
FARM MANAGEMENT PRACTICES AS AN AID TO PASTURE IMPROVEMENT ON STEEP GREYWACKE HILL COUNTRY

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The Soil Bureau tells me that there are at least eight million acres of greywacke derived soils in New Zealand. The greywacke clay hills form one of the oldest and largest soil groups in the country. In the Raglan County alone they account for about 91,000 acres or a sixth of the county area. As an Advisory Officer appointed in that district I soon became acquainted with the typical thin, dark grey topsoil formed over a weathered, sticky yellow subsoil. Well watered, but hard baked in summer, greasy in winter, these hills, with their characteristics of steepness, low natural fertility, and steady reversion to second growth, had proved the most difficult class of land to handle, and as such they offered a real challenge to the property owner and to myself as the new adviser.

History

Armed with the knowledge that phosphate and molybdenum were the answer, I set about my initial visits, and it was from the practical farmers who had learned the hard way that I started to build a picture of the problems and history of the country. Originally in a mixed broadleaf-podocarp forest that had thrived under 4 to 5 ft of annual rainfall, it had accumulated enough fertility for good pasture to be established on the bush burns, and the burning was generally successful because of the dry summers. But the idyllic prospect of green hills dissected by reliable streams was soon shattered, for, once the original fertility was exhausted, the owners had to face up to a **continual** reversion to both bracken and hard fern and to manuka, gorse, blackberry, and broom. Subdivision, scrub cutting, and the use of **wethers** and big unprofitable cattle were barely able to counter this reversion, and it was the acceptance of topdressing that finally gave the owners the opportunity to make progress. The application of fertiliser by hand on these steep hills was a real man's job and the very thought of the effort and time required tended to restrict the quantity applied. **Hired labour** was apt to dump it by the bagful into blackberry bushes.

Then with the pioneering of aerial topdressing after the Second World War this physical barrier was overcome, giving the hill country man the chance to reverse completely the deterioration

that has since taken place on even the best of the bush burns, and to build a pasture that will fulfil indefinitely the promise that the bush burn held out.

The Farm

Store sheep farming is the prevailing land use. Properties fall within 600 to 1,000 acres, with the original subdivision based on the idea of 300 acres quickly won from the bush to support two sheep to the acre and some dairy cows among the stumps and logs. Subsequently more bush areas were cleared, but with falling stock numbers and lack of revenue the job was never finished, leaving the steeper and back areas, usually about a quarter of the farm, in their virgin state. In Raglan the greywacke hills have a mantle of light silt loam soils of volcanic origin, persisting on the ridge crests and lower slopes, but on the steep sidlings washed away, to expose the hard weathered greywacke faces. These small areas of volcanic soils, from 10 to 20 per cent of a property, proved invaluable to the pioneer. On them we find the homestead and buildings, the few acres of forage crops, and the improved pasture species sown after cultivation. Here too are the hay paddocks that not only help winter the young cattle, but also provide one of the weapons against the greywacke reversion. And here, last but not least, we find the airstrips.

Fertiliser Responses

During the last 10 years, the well-sited airstrip has become the heart of the farm from which is pumped first phosphate, then molybdcic phosphate, and next perhaps lime. It is well known that these clay hills are rather sour, but in the past their very steepness has ruled out the use of lime. The aeroplane that has boosted the carrying capacity and hence the farm revenue is the sole means of **commercialising** the field trials in the district that have been demonstrating a marked response to lime. With no precedent to work from, the economics of liming appear to hinge on the cost of application, and local air spreaders are at present investigating this.

My own observation is that by sticking to $2\frac{1}{2}$ oz of molybdenum every three years one can obtain a very marked improvement in the sward for as low as 1s. an acre annually. So from the cost factor alone this should be the way to go. But once molybdenum has been used several times, and say a ton of phosphate in the aggregate per acre, then the carrying capacity should have risen to about three ewes and it could be worth while reducing the topdressing thereafter to three-quarters of the farm with 10 cwt

of lime to the remaining quarter in rotation. Neither potash nor any of the trace elements other than molybdenum is at present limiting production on these steep greywacke soils.

Stocking Rates

When this land class was originally subdivided into large blocks, few could have anticipated the potential and the quandary that many owners now face as their flock numbers increase. More ewes and another house versus more cattle and a lower net income. At present on the average one-and-a-half ewe country, that is one-and-a-half ewes wintered to the acre of grass, plus most of the ewe hoggets and a cattle beast to every four or five acres, these properties have an obvious potential of two ewes, and an ultimate potential of three ewes no longer seems as fantastic as it must have only 15 years ago when Sir Bruce Levy put it forward. At one-and-a-half ewes the production of the sheep, although not high, is in keeping with the nature of the land being handled, and an average lambing of 85 per cent with a total wool clip per ewe of about 15 lb (obtained by dividing the total year's clip by the ewes previously wintered), would be a fair indication of how the average established man is doing. On badly reverted properties the stock must be worked harder than one would desire as a good shepherd, and lambing percentages as low as 70 per cent and a wool clip down to 13 lb a ewe are found.

This country is well watered, but the sporadic late summer droughts have made the older settler hesitant about stocking up with cattle. Lately the growing appreciation of the value of well-sited small haybarns out the back has tended to offset this problem. Increased topdressing and fencing have resulted in the breeding cow taking over the role of second growth control, and, with prices favouring the younger cattle, big steers are no longer retained. The cattle stocking rate that is proving most successful is that of one beast wintered to every four to five acres of grass. On the dirty properties the breeding cows are predominant, with one cow carried to every eight to 10 acres and with the annual crop of surplus calves quit in their first autumn. As the country improves the cow ratio widens to about 1 to 20 acres, usually a 1 bull-40 cow herd, and all the calves are carried through their first winter, with the surplus sold in the spring. This can be a lucrative practice, but only when the calves can be wintered well. Although cattle have been very profitable over the last few years, it is the Romney breeding ewe numbers that in the long term provide the income, and it is these sheep that have made spectacular gains over the last 15 years (Raglan County sheep numbers have doubled in this period).



Once the original fertility was exhausted, the owners had to face up to a continual reversion to both bracken and hard fern and to manuka, gorse, blackberry and broom.

Planning Development

To anyone concerned with the improvement of this country the question of finance is invariably the crux of the problem. Tough propositions such as these are the cheapest on the market and attract the young, keen, land-hungry purchaser with limited financial backing. Attracted by the apparent potential of a run-down ewe to the acre block, he considers he has a bargain when he compares the £10 to £12 a ewe for land and buildings with the £15 a ewe being asked for easier three ewe country. However, the bargain loses much of its gloss when, at a more detailed inspection, he climbs from the few good house paddocks through pastures that are deteriorating into browntop, sweet vernal, danthonia, and annual clovers. The further back he goes the more prominent becomes the aggressive second growth. Stock that have worked harder to find their rations than their sleek suburban counterparts looked a little scruffy by comparison, and the semi-derelict fences propped up by bracken fern give little promise of containing them. Somewhat disillusioned and faced with a multitude of urgent jobs, the new owner must now give serious thought to the most economical policy to follow.

It is at this stage that the Advisory Officer with his district knowledge can be of real value.

Correct stocking rates and likely performances can be related to the probable costs to ensure that the development programme will be feasible. Just how important this is can best be illustrated by a study of the Government Statistician's annual survey of a selection of average New Zealand sheep farms, which shows that the gross income is likely to be in the vicinity of £5 a ewe. This is to be expected from established farms that appear to form the basis of the survey, but from a study of the incomes of the harder struggling hill properties a gross return of £3 10s. a ewe from sheep and wool sales and £1 a ewe from cattle sales would give an upper limit of £4 10s. a ewe. Of further interest in the survey we find that after meeting running expenses-I mean fixed charges and the ~~maintenance~~ charges added together-a sheep farmer retains about 45 per cent of his gross income. This is again optimistic for my invariably highly committed man, who probably does well to retain 40 per cent. From a quick calculation based on these figures one can arrive at the point I am trying to make. With a run-down ewe to the acre block carrying about 850 ewes a gross income of £3,500 will leave approximately £1,400 to meet his personal drawings, taxes, life insurances, and mortgage principal repayments. You may well ask how he can make a "go" of it, when one considers that the total value of the unit as a going concern is about £15,000 and the new owner is probably paying interest and principal on £10,000 of this. Quite frankly in many cases he cannot make a "go" of it, or at best he faces a long struggle, often assisted by the Marginal Lands Board. However, where commitments are not too severe a tightened belt and a systematic approach can pay off, and I will outline how.

The key to successful development from revenue is to concentrate one's resources on improvements that will yield the quickest returns with the intention that the first profit will finance the long-term improvements. On greywacke hill country the emphasis must therefore be two pronged, fertiliser and fencing, with these two in turn making room for the third prong, increased stocking and production.

Fencing

Fencing is cardinal. One must ensure that the stage where one gets on top of the bracken fern and scrub weeds finds one with sufficient paddocks to take full advantage of this initial breakthrough. For with plenty of paddocks, the emphasis can then be changed from heavy set stocking to beat the second growth, and to rotational grazing to beat the hard fern, bidibidi, and moss. Sir Bruce Levy has been quoted as saying that your largest paddock should be no greater than 10 per cent of the property. More

recently Whatawhata Hill Country Research Station has suggested about 20 paddocks as being desirable for efficient rotational grazing. Very few farmers on this class of land have achieved either figure, but the advent of the sheep electric fence means that anyone can. I would suggest that electric fences should be erected along bulldozed lines, with permanent angles and strainers ready to receive a normal fence in due course. Current trials with electric, Hunter chain, netting, and normal seven-wire fences 'have shown them all to be effective, and the emphasis should be on the fence itself, not on the type of fence.

In planning subdivision on this class of country there are several good rules. Get an aerial map, think it out, bulldoze your line down the ridges wide enough for a Landrover track, and separate the shady and sunny faces if you can. Bracken fern and gorse restrict the size of **paddock**, because later you may require 20 sheep to the acre in November to control the young regrowth.

Allocating the Topdressing

Fences without fertiliser are monuments in the wilderness! Although I am delighted to see the aeroplane over the hills, the more properties I visit the more concerned I become at the general lack of planning that only too often leads to waste of fertiliser. Two years ago at this conference C. P. Tebb suggested that annual topdressing is essential on the hills, but intimated that a formula would be desirable whereby it is converted to a fixed overhead.

In endorsing Mr Tebb's remarks I would like to offer a simple approach, based on some theories originally put forward by Mr Miller, our Farm Economist, and subsequently received enthusiastically by my farmers. From a study of the topdressing records of hill properties it became apparent that by allocating an expenditure of from 10s. to 12s. a ewe in money, or approximately 1 ton per 30 ewes as a quantity, the ewe flock could be steadily increased by the 7 or 8 **per** cent possible from an 85 per cent lambing. At that rate the flock would double in 10 years. Expenditure in excess of this amount should be regarded as a capital expenditure, like the new fence with which it will be competing for a share of the revenue. This systematic allocation avoids the embarrassment first of feed surpluses and second of having to buy capital stock from already committed funds, or third of borrowing on **short-term** and adding to the interest burden.

On the high-rainfall greywacke hills the normal maintenance topdressing appears to be not more than 2 cwt of phosphate annually plus molybdenum at not more than 2½ oz every three

years. At an average carrying capacity of one-and-a-half ewes per acre, 2 cwt would cost a pound a ewe. So it is obvious that until the carrying capacity reaches three ewes per acre, a proper maintenance dressing over the whole farm cannot be afforded. But if you know that you can afford to spend 10s. a ewe, then the quantity you buy is determined automatically by the size of the flock and increases as the flock increases.

In working towards maximum carrying capacity, clovers are the key to the best value for your topdressing. Where they are dense enough, the paddock warrants the annual maintenance dressing; where they are absent or sparse, an all out effort to build up their population is imperative before considering maintenance topdressing. An occasional light dusting of poor grass may improve its palatability, but experience has shown the absolute necessity to consolidate block by block. Once the best paddocks have received their maintenance dressing out of the fertiliser quota, the surplus can be used to develop one new block a year in the expectation that the increased ewe carrying capacity will provide the extra fertiliser now required for its maintenance, along with the other good paddocks, as one tackles the next block.

Pasture Improvement

The block-by-block development programme, although many years have passed since it was first recommended, has been recently and appropriately dubbed the "blitz technique". One selects first a run-down block that is clear of major scrub weeds, that has been well fenced, and that is not too large to permit a heavy dressing of phosphate from the year's quota. At least double the maintenance dressing is desirable. Over the summer the hard fern patches can be burnt and sown with a pasture mixture and then the ewe flock can be used to clean the block right out by early April in readiness for the heavy fertiliser dressing accompanied by oversowing with certified clover seed. The clovers to be **oversown** should be determined by a prior examination of the sward. In the Raglan hills *Lotus* species are present as volunteers and the inclusion of $\frac{1}{4}$ lb of expensive ***Lotus major*** seed is considered only where it is missing on shady blocks. The standard recommendation is to use 1 lb each of Mt. Barker and Tallarook subterranean clovers, with 1 lb of white clover per acre for both sunny and shady faces, at a cost of about 15s. an acre. To make the most of this light seeding certain management factors are important. Firstly, oversowing should preferably be delayed until the first good autumn rains close the cricket cracks; and secondly, straight after the seeding the ewes should go back to thoroughly trample

the ground. The value of this practice can be simply demonstrated by raking an **oversown** face and observing the good strike that follows; but in addition the trampling checks paspalum and other low fertility grasses and encourages the volunteer ryegrass. Once the ewes are off, only cattle should be put on over the winter and early spring to treat the establishing clovers with deference. Hay feeding on the poorer faces will further help with paddock improvement. If the faces are predominantly sunny, the small pinky white subterranean clover flowers in early October will indicate the time to close the block for about six weeks to let the subterranean clover set seed.

Young cattle can be judiciously used to tear out the bidibidi lifted by the vigorous growth and the paddock will be ready for early weaned lambs. In stronger paddocks and where shady faces are predominant, white clover can be favoured by delaying closing until mid-December. This works in well with the saving of mature leafy feed for **hoggets** worried by ill thrift, although before turning on sheep I would let the cattle get a stomach full of clover **seed-heads** then put them out on a poor block.

The following autumn this first block joins those getting a maintenance dressing of phosphate and the next block gets the blitz.

Second Growth Control

By systematic rejuvenation of the run-out blocks one will gradually move on to the second growth blocks, but one's income will have steadily increased with the ewe numbers to a stage where these more costly areas can be tackled with confidence. The policy followed will be determined by the major scrub weed. If it is manuka, cutting in summer and burning once the red tinge is evident are required, whereas dense gorse and bracken fern will readily take a fire standing. Burning should be followed with an autumn pasture seeding, of predominantly perennial **ryegrass** and crested dogstail, with some **browntop** for very hard ridges and a big proportion of clover seed. Once again liberal topdressing is essential and trampling desirable. Grazing should be delayed until the grass leaves can be plucked without disturbing the roots and then cattle should be preferred. With gorse and bracken heavy sheep numbers will ultimately be required. The aim with gorse should be to have a thick, vigorous pasture established by late spring to suppress the gorse seedlings and support the concentration of sheep. With bracken especially it is good policy to run the ewes and lambs on the block before early weaning in November, after which the ewes can be returned and crushed on when the emerging fronds are most vigorous and palatable. The

ewes should never be off the bracken for longer than three days during this period, and as some 20 sheep to the acre are often required at this its most vulnerable stage, the size of the block must suit the size of the flock.

Gorse cannot be eliminated by this treatment; persistent plants have to be spot sprayed with 2,4,5-T as a follow-up to the burning and grazing. Similarly with blackberry; and this has removed the excuse for the large mobs of uncontrolled goats that still roam the hills. Only when the last of the reverted blocks is back in production can we have another look at the standing' bush, but the aggressive wasps therein and the present cost of bush felling and fencing have so far stopped me from having too close a look, and I am content to, leave it to posterity.

Roading

Of recent years the all-important horse and dog have been joined by the Landrover and crawler tractor on the hills. The bulldozing of tracks by crawler tractor has enabled the Landrover to penetrate to many previously inaccessible corners with fencing materials and spray plant to the mutual benefit of the property and the owner and the delight of the dogs. But roading on this greywacke country, that already bears scars from slip erosion, should be restricted to essential routes, as even the most carefully battered banks take many years to settle and cover.

Summary

Less than five years ago I had never been in the Raglan, County, nor had I more than the vaguest idea of how greywacke differed from any other hills. Coming as I did with no preconceived ideas I have written this paper entirely on my experiences as an Advisory Officer, applying the techniques for which I have to thank many of you people taking part in this conference.

That the greywacke hills can be improved from their present one-and-a-half ewes to three ewes is being capably demonstrated by many farmers in my own Raglan district. How they can do this from revenue is what I have really learnt and told you. With their very thin layer of topsoil I doubt whether these hills are physically capable of exceeding three-ewe country. In working towards a three-ewe carrying capacity the greywacke hill man is extremely vulnerable to market prices and cannot afford to make mistakes. To the young man contemplating the development of this country I would suggest that unless he has a substantial credit with his bank and above average ability as a stock and pasture man, then he should leave it alone. If he does take it on, he should get his principles right, then stick to a planned systematic development programme, consolidating each block as he goes.

DISCUSSION

- Q. (H. Thorpe): Would more cattle be desirable on tough hill country?
- A. Sheep are most profitable therefore we go for sheep where capital is limited, Cattle are probably better for weed control. If you can get good profits out of cattle then use them.
- Q. (W. Jacques): What success have you had in feeding seeded clover through cattle on to unimproved blocks? In one experiment we had no benefit from this method of seeding until phosphate was applied. Would it not be better to sow phosphate and clover together than use this nursery field system?
- A. I agree. I got this idea from North Auckland. It is understood that seed passed through sheep is damaged but cattle can be used successfully for this method of distributing clover.
- Comment (E. Madden): In some cases failure from oversowing has been due to bird and slug damage. If clover seed is carried out and deposited in animal droppings it will have protection and fertility. In a trial on a very low fertility soil the results were poor, but on higher fertility soils this system would work. A reduction in sheep numbers and increase in cattle sometimes results in higher wool weights per head and better control. Would more cattle result in improved pastures and heavier fleeces in Raglan?
- A. The main difficulty in this area is lack of finance, Sheep can control fern, and as sheep are most profitable we prefer to use as many as possible.
- Q. (J. Graham): There was mention of lime and molybdenum. Has lime at low rates been used? In my area we have had spectacular results from lime at 2 cwt with molybdic super. Would the initial use of lime be beneficial?
- A. Finance is a problem in the initial stages. We use a heavier rate after production and income has been raised with Mo. super.
- Comment: (J. Bell): Trials in North Auckland showed that Mo. super gives results equal to lime and super. Usually Mo. super which is cheap gives very good results which provide more cash for lime.
- Q. (J. Tripp): What does Mr Currie mean by his 15 lb wool per ewe? It was noted that browntop has been sown; is there no better grass than this?
- A. This figure of wool per ewe is a rule of thumb method of assessing stocking rate, etc. It is obtained by dividing the total weight of the wool clip by the number of ewes wintered. Browntop is used only on the very poor ridges where topsoil is very thin as it is the only grass that will effectively achieve some cover.
- Q. (P. D. Sears): What are your experiences with the fencing of shady and sunny faces?
- A. Such fencing is desirable for weed control; it allows stock to be concentrated on the dirty areas on the shady faces.
- Q. (C. E. Ballinger): What does it cost to apply lime to this country?
- A. The application of lime is expensive. At £7 per ton, the recommended 10 cwt costs £3 10s. Lime is not applied until about one ton of phosphate and three applications of Mo super have been made, and carrying capacity is approaching three ewes per acre.
- Q. (R. W. Moody) : Is grass grub a problem in this area?
- A. No.
- Q. (J. Graham) : Is porina a problem?
- A. No, army worm and crickets are the pests which cause trouble.