

WAIKATO PASTURES.H. E. Annett, Matangi.

It would be difficult to find anywhere else in the world.-an area more favoured by nature for pasture development than the Waikato. The rainfall averaging round about 40 inches or a little more is ample and fairly well distributed, A drought of a few weeks' duration is usual in the summer, but if this extends beyond a period of 4 to 5 weeks the lighter soils dry out so rapidly that the pastures turn completely brown. There are certainly frequent heavy frosts in winter but with proper management it is possible to keep grass growing through most of the winter, Southerly and South Westerly winds are frequently severe in the winter and provision of shelter on all farms is essential. Hitherto the Waikato has been practically free from nature's major calamities such as floods, really bad droughts, and earthquakes., Certainly the area has recently suffered, but not alone, from a great calamity in the form of so-called Facial Eczema, but it may be we should not blame nature but our farm management methods for this trouble and possibly others.

In one matter chance seems to have come to the aid of pasture establishment in the Waikato, The early settlers obtained their ryegrass seed with which they sowed down the area from Poverty Bay, and this explains at least partly why the pastures of the Waikato are superior to those of Taranaki. Through the system once in vogue the pastures were allowed to get out of hand in the autumn and went into the winter with rough feed on them, This consisted of cocksfoot brown top, and on the wetter lands much fog.. with at the same time an increase in tall fescue which had been sown on some areas in the early days. Where, however, the right type of ryegrass had been sown it has been possible to re-establish the pastures as rye-white clover by control of the roughage with stock and the use of the mower combined with efficient topdressing. Most of my own farm has been brought- into good ryegrass by these methods without the use of the plough, An inspection of the area on which animal droppings and urine have fallen will give a good indication regarding the possibilities of bringing back a pasture without resowing, since rye, if present, will show up on these areas.

It is necessary in talking of Waikato pastures to refer briefly to the type of soils. Fortunately our knowledge of soil types is being rapidly extended by the Soil Surveys at present in progress. Most of the Waikato soils are sandy to, silty loams with some clay loam with a fair amount of peaty soils. Messrs. Grange and Taylor classified the Waikato soils tentatively into -

- (1) Soils of the rolling hills formed from subaerial volcanic ash - the Hamilton clay loam.
- (2) Soils of the Waikato fan -
 - (a) Water sorted rhyolite ash - Horotiu sandy loam and sand; Te Kowhai sands and loams,
 - (b) Swamp vegetation - Rukuhia and other peats,
 - (c) Water sorted Hamilton ash - Rotokauri clay loam.

(3) Soils of Waikato Terraces -

(a) Water sorted rhyolite ash - Waikato sands.

Taylor's remarks concerning the relation of farm practice to soil type given in the report on Soil Surveys for 1933/34 are given below in a condensed form. The Hamilton clay is a heavy, well-drained, warm soil little affected by frost. It provides a large amount of early spring and late autumn feed, but dries out in the summer or early autumn months. Most farmers on it make ample provision for supplementary feed for use in summer as well as winter. The soil is difficult to cultivate in wet weather. It grows good root crops and many stands of lucerne are situated on it.

The Horotiu soils are light and well drained. The pastures come away well in spring but parch badly in dry weather. Ensilage and hay are made from surplus summer growth. Weeds grow so freely that some farmers avoid cropping on this soil. It grows lucerne well but many prefer to sow lucerne in the early autumn on this soil rather than in November. Mr. Taylor adds that this soil type is free from mud in the winter months and is therefore suitable for winter dairying. My own farm is largely on this soil type and my milking shed and surroundings are on this type entirely and there is a beautiful collection of mud around the shed in winter, though of course not so much as there would be on heavier soil.

The Te Kowhai soils need drainage and are largely drained by open drains. The pastures do not dry out in summer. Excellent crops of swedes are grown on this soil.

Mr. Taylor refers to the Rukuhia peats as usually being poorly farmed where they are farmed at all. They are badly frosted and give little winter growth.

To Mr. Taylor's remarks I should like to add my own. My own farm consists largely of light land of the Horotiu sandy loam type with a fair proportion of wetter land of the Te Kowhai loam series. As Mr. Taylor states, such a farm has good advantages. One can keep stock off the wetter areas in winter and so prevent them from pugging. Owing to the high moisture content of the Te Kowhai soil and since water holds heat longer than soil this soil type remains 'warm longer into the winter, and having given grazing in the summer time carried, on long after the lighter Horotiu soils have stopped giving growth. For this reason on my own farm I do not topdress the Te Kowhai soil in the autumn as it gives feed anyway and moreover one cannot stock such wet land in winter. Therefore this soil type receives its manure in August and gives feed quite early in the spring because it has never really got as cold as the Horotiu soil. On the other hand, the Horotiu soil on my farm gets its topdressing in autumn,

Where one desires to establish paspalum on a Waikato farm, soil types comes into the question. Paspalum needs moist land and though it remains green during drought on light soil it gives no feed worth considering. It is therefore on the Te Kowhai rather than on the Horotiu soil type that paspalum should be encouraged. This grass is, of course, naturally suited to the swampy soils. Another point I feel I ought to refer to is the need where ensilage is made on light soils such as the Horotiu soil to make it early and by this I mean as early in October as possible.

The reason for this, apart from the quality of the ensilage made, is that the paddocks which have been cut will then have good growth on them again by mid-summer, which will be valuable if a drought occurs. If ensilage is cut too late on such light soils there will be little aftermath in hot dry summer weather. There is reason to believe that where paddocks go into late summer with this good growth on them that they will be of great value in controlling possible outbreaks of facial eczema,

There are large areas of peat land in the Waikato and in many cases some good farms have been developed on this soil type. In general, however, the peats, particularly the deeper peats, should be left alone. Farming on unconsolidated peat is full of trials. Over-draining results in obtaining soil which will not wet from the surface. As the soil sinks, generally unevenly, further, stumping and resowing to grass becomes necessary. Fires on peat country in the past have resulted in large losses, the pastures themselves as well as the houses being burnt out. What consolidation can do for peat, however, can be well seen at Ruakura, where it is difficult to realise the transformation which has taken place from poor peat to high-class pasture over a considerable portion of the farm.

Before leaving this question of soils it is only necessary for me to add that in the main the soils are light. Growth conditions in early summer are so wonderful that few crops can compete with the phenomenal weed growth and this is one reason why cropping is unpopular on Waikato dairy farms. Grass is almost entirely autumn sown and thereby avoids much of the competition from weeds.

Recent Changes in Waikato Pastures.

As has been said above, a considerable area of the Waikato was sown down with ryegrass of Poverty Bay origin and this has saved Mr. Bruce Levy a good deal of work. But 10 to 12 years ago there was little real pasture management. There was a fair amount of cropping, the stock carried per acre was lower than today, and farms were taken into the winter with plenty of rough feed all over. There was very little winter milking and cows did not calve till the end of August and well into September. Little attention was given to the matter of actually growing grass in winter. Then came the campaign for the so-called new system of intensive grassland farming. This gave a great impetus to the introduction of a better system of managing our grassland. Here one ought to pay tribute to the enthusiasm of Mr. C. E. Cuming, whose able editorship of the "Dairyfarmer" did so much for grassland farming in N.Z. generally. We were very fortunate too that our workers in N.Z. had already appreciated the value of strain within the species, and the work at Lincoln under Professor Hilgendorf and of Mr. Bruce Levy paved the way for the establishment in N.Z. of what is today one of the most progressive bands of grassland workers in the world. The provision of certified strains of pasture plants came at just the time they were needed. Soon a great change in pasture management methods in the Waikato came about. The pastures became better cared for, the question of manuring received more intelligent consideration, and growth was obtained later into the autumn and earlier in the spring. As a result, cows are now calved down much earlier - usually in July - and the milking season has been considerably lengthened. At the same time a larger number of stock are being carried per acre. Ensilage making became far more common. The rapid developments in grassland

farming could not have been possible had it not been for the fact that our farmers were very receptive of new ideas, It would be well for us to look back over the last 10 years and consider our position. Undoubtedly production has increased enormously and a few farmers have produced 300 lbs, of fat per acre and quite a number over 200 lbs, There seems, however, to be an impression that stock troubles have increased, and 'in certain respects I think there is evidence that this is so, Before intensive grassland farming became the vogue the stock were fed in the winter on roots and hay and were milked for a shorter season and probably per head got more food than they do today. With the increased stocking now practised animal management has become more difficult, Insufficient supplies of hay and ensilage are frequently made and much of it of very poor quality, and the animals are frequently on too low a plane of nutrition in the winter, Anyway over-stocking has become much more common and there has been too a wrong application of the principles of rotational grazing. As of ten practised, it should more properly be called rotational starvation for animals are kept on a paddock for some days at the end of which time they are not getting enough to eat and in a hungry starved condition go on to a fresh paddock with ample feed, and so a succession of periods of gorging and starvation go on. Far more attention should be given to the provision of a regular and sufficient ration from day to day and to nutrition of animals in the winter and during dry spells in summer. The recent work at Massey College shortly to be published in full indicates that cows on a low plane of nutrition produce milk abnormally low in solids, not fat, the loss being due largely to casein deficiency. This is an indication that there is interference with protein metabolism in the animal which may have serious consequences.

It is of interest in this connection to refer to English work by Dr, Crowther, who showed feeding is not so important just after calving when the milk secretion rises for physiological reasons and if feed is short the animal will draw on its skeleton and lose weight. He points out that in order to allow for this loss the animals should be fed fairly well but not too well in winter. One can readily imagine that after a series of winters of under-feeding the skeletons of animals may be so weakened that disease takes heavy toll,

Pasture Mixtures.

It is usual on dairying pastures to sow at least 35 and up to 40 and more pounds of seed per acre. It is advisable to sow 25 lbs. of certified ryegrass, Some farmers use as little of this seed as 10 to 12 lbs., but this is a great mistake. It is important to get a vigorous sward to smother out weeds, A usual mixture is as follows:-

Certified Perennial Rye,	20 to 25 lbs.
Certified Akaroa Cocksfoot,	8 to 10 lbs.
Timothy,	3 to 4 lbs.
Certified N.Z. White Clover	1 to 2 lbs.
Red Clover	3 lbs.

Crested dogstail at 3 lbs. per acre is also frequently added, Where it is desired to encourage paspalum 6 lbs. per acre can be substituted for cocksfoot in the above mixture, but the mixture must then be sown in the late spring or early summer as it takes many years to become

established in the Waikato by autumn sowing. It is probably far better to sow paspalum alone in early summer and then to disc in the late summer and sow the rest of the mixture in autumn.

P a s t u r e Re-establishment

In breaking in raw country roots play a great part but where land has been in grass and it is wished to renew it the grass can be ploughed and resown within a few weeks. Actually in the present year we finished ploughing up a grass paddock on 18th February, disced twice harrowed and rolled, and sowed it down in grass again by 9th March, rolling again after sowing. In spite of drought conditions we got excellent results. On the 6-acre area 46 to 50 milking cows received 2 hours a day grazing for 29 days between 19th June and 31st July. Thereafter it was grazed by dry and young stock for a week, again topdressed and shut up.

The Weed Problem.

Time will not admit 'more than a passing reference to this subject. Ragwort has rapidly increased in recent years. Six years ago ragwort was quite rare on most farms in my own area but it is probably not too much to say that a careful search would show the presence of at least an odd ragwort plant on almost any paddock in the Waikato. The light soils are ideal for the growth of weeds and Californian thistle is a real menace, especially on land freshly sown to grass. *Poa pratensis* is a common constituent of pastures but as fertility increases begins to disappear. Buttercups in some seasons and on the wetter soils overrun the pastures. They are encouraged by the stocking of wet land in winter but early mowing keeps them in check. On the question of weed control no more will be said except to point out that where sheep are run on the dairy farm they do a lot in checking weed growth and, further, that early cutting for ensilage before the seeds of weeds have set plays a big part in weed control. The best way to get a clean farm is to build up a good sward by proper fertilisation and management and then there is far less room for weeds to grow.

Manuring.

Time will allow only a brief discussion of this matter. Superphosphate has been the mainstay of fertilisation in the Waikato and by its use the production and carrying capacity of our pastures have rapidly increased. Three hundredweight per acre is a usual topdressing and it is mostly applied in the autumn. Some farmers apply a second dressing in the early spring. Personally my practice is to topdress with super at 3 cwt, per acre a year. The lighter soils receive the dressing in autumn and the wetter soils in August as already explained. I have never felt it economic to topdress in the summer for the reason that if we do not get rain we get no result, and if we do get rain we get good growth on the residues of manuring earlier in the **mar.**

Controversy has centred around the use of lime and potash. Grazing records on my own farm show that after the first three years both lime and potash increased the carrying capacity by from 25 to 100%. Where the carrying capacity is so high as it is in the Waikato it seems at least good insurance to apply lime and potash. In regard to lime I feel convinced that it should be more widely used,

We have light soils and a high rainfall and any lime present gets rapidly leached out, Professor Robinson, one of our best soil workers, in his new little book "Letters on Soil," states that 25 years ago perhaps 10% of the soils of Wales were deficient in lime but today over 50% of Welsh soils are sadly in need of lime,, He states that the position in England is probably about the same and that the problem is one of national importance, Lime is cheap in New Zealand. Soil survey work shows that pH value of the Te Kowhai silt loam of which my farm is partly composed to be 5.30, nearly as acid as peats. This particular type of soil is also low in available potash (0.13%) and potash response is therefore not to be wondered at, What is remarkable, however, is that on this particular soil type the available iron content is of the same order as is found in bush sick soils, Recent work on cobalt shows that the Hamilton clay loam is rich in this element, whereas the Te Kowhai loam has a cobalt content as low as that of some bush sick soils, It certainly seems a wise practice in the Waikato to feed licks containing Whangarei limonite or cobalt on soils of the Te Kowhai series.

The Waikato experiences much trouble with grass staggers and milk fever in cows, and perhaps further study of mineral deficiencies may throw some light on troubles such as these,

I cannot leave the subject of manuring without referring briefly to the **use** of sulphate of ammonia on grass. There still seems an impression that the use of this causes clover suppression and is deleterious in some other way. Manuring, however, has little effect on the composition of the sward -- the main factor being the influence of the grazing animal, I now have paddocks which have received sulphate of ammonia for 11 years running, They have too much clover, if anything, but have magnificent swards and for winter feed we are very dependent on them for our winter mlikers. Needless to say, ample lime and phosphate, and frequently potash, are applied to all paddocks receiving sulphate of ammonia,

Provision for Winter and Summer Feed.

Hay and ensilage are made on the majority of Waikato farms. Owing to the increased carrying capacity many farms do not make all the reserves of hay and ensilage they should, Both hay and ensilage are far too often made too late with consequent loss of quality, a further drawback being that little aftermath comes away in a dry season if the fields are cut late,

Ensilage made from short grass is a valuable food for milking cows in the dry symmer period, but quite commonly the feeding of it is left till the cows' production has declined too far, Ensilage should be fed as soon as the grass begins to dry up, We have used both molasses and whey for sprinkling over the ensilage during the filling of the pit or trench with excellent results though whey seemed to give the best results and of course cost nothing but cartage.

For winter feed we used to grow Italian rye but this means further ploughing for permanent grass and we now aim at putting in 6 acres of new permanent grass each year though when we have turned over 3 or 4 more paddocks it may be that it will no longer be economical to break up pasture. There is certainly an advantage in ploughing up pastures in that this is the only way in which it is possible to get animal droppings really mixed in the soil,

Harrowing.

Some appear to hold that harrowing is unnecessary. My experience is all in favour of harrowing. Apart from spreading droppings there have been occasions in the winter where the use of a penetrating harrow has given an effect similar to the use of nitrogenous manure. It seems possible that on sunny days in winter aeration might favour nitrification. Any trials with harrows must be done on plots heavily stocked with cattle and on pastures which are kept under the usual conditions of farming.

Irrigation.

Since my first arrival in the Waikato it has been my firm opinion that there are great possibilities for irrigation on Waikato pastures. One farmer (Mr. Peacocke) has had the enterprise to really tackle this problem and his experiences could be of very great value to others. Without irrigation he certainly would not have been able to maintain the winter milk production so necessary for his operations. Many farms border on rivers and over large areas in the Waikato there is a large underground water supply. The most troublesome time for the Waikato farmer is the dry summer period and if he were able to irrigate only 10% of his area he would be free from drought troubles and would also be able to carry more stock because there would be less need to make so much ensilage. It is not often realised that where irrigation is practised in the water meadows of the South of England the purpose is to obtain early spring growth because the watering of the paddocks in winter keeps the soil warmer and hence spring growth starts much earlier on the water meadows. In certain seasons this fact might be of value in New Zealand. One possible advantage of irrigation might be that we could maintain steady growth on a portion of the farm throughout the summer and there would thus be less danger of a sudden flush of feed causing such troubles as facial eczema, and possibly staggers and bloat. In the work on facial eczema a bore is being put down at Ruakura and on Mr. Gore's farm where we have experimental work. Apart from the value of this irrigation work in the control of facial eczema it seems to me that very valuable data on irrigation on Waikato farms will be obtained.

In conclusion, one might add that only a small proportion of Waikato pastures are up to a high standard, and even in good areas poor pastures are far too common. With the new strains of grasses and clovers available, production could largely be increased. The better the pastures, however, the greater the need for careful management or deterioration will soon set in. Paspalum in particular needs careful control by the mower to prevent it seeding as in the seed stage it is particularly harmful to stock,

Prairie grass seems to warrant investigation as strains of it stand grazing well and it grows well in the winter,

Finally, there is urgent need for improvement in the quality of the hay and ensilage which is made.

DISCUSSION.

E.B. Levy:

Dr. Annett has dealt very comprehensively with pastures of the Waikato. He has referred quite enthusiastically to the team of research workers which we have in New Zealand. We, of course, as research workers include Dr. Annett in that team. He is one of the most practical farming experimenters that we have in New Zealand, I now throw the paper open for discussion,

R. McGillivray:

In connection with prairie grass I am quite certain that a very intensive investigation should be carried on with prairie grass.

J.M. Smith:

Firstly I would like to congratulate the way that Dr. Annett has carried out his farm practice in conjunction with the soil survey. The other point of interest is the very complex grass seed mixture sown in "his pasture,

H.E. Annett:

With regard to prairie grass I am very pleased to hear remarks regarding that grass. I had two patches of trees under which prairie grass was growing and I noticed that when those trees were cut down the prairie grass has spread over the paddocks. On the other hand I have a patch of land where I fenced off land with some pampas plants. It came away very rapidly in prairie grass and has been throwing most marvellous grazing. I did not know it was a very complicated mixture, I thought it was what Mr. Bruce Levy would recommend - plenty of certified ryegrass,

J.W. Woodcock:

I would like to join in congratulating Dr. Annett on his very interesting survey in pastures. I do not intend to enter into a discussion of harrowing at the present time I have always respected Dr. Annett's methods. In regard to lime which Dr. Annett mentions causes an increase in grassing of 25-100%. I would like to know whether the Dr. applies lime at sowing down of his pastures because we have found that on this farm - Ruakura - that lime apparently causes better results on new pastures than it does on the old pastures and I would like to know whether the Dr. believes in giving large dressings of lime in the early stages or whether he believes in an annual dressing,

H.E. Annett:

I would normally sow down the pasture, in my opinion, with superphosphate and lime. This year my pasture was sown without lime as I could not get the lime. Normally speaking I would like to sow a pasture with 5 cwt. lime and 3 cwt. of superphosphate in the autumn. I would topdress the pasture again in the spring this year. I use superphosphate and potash in the spring. General practice regarding lime is 8 to 10 cwt.

J.E. Bell:

Could Dr. Annett tell me what difference there is with silage made with whey and molasses?

H. E. Annett:

Whey has made far superior silage than molasses. You get a greener type of silage possibly

because of the lower fermentation. You do not get loss of green colouring matter,

F.R. Callaghan:

In Dr. Annett's method of pasture establishment little time elapses between ploughing and sowing; this is in marked contrast to the long fallow recommended by Messrs. Glanville and Dalgliesh. If a longer fallow was given would the pasture establishment be better?

H.E. Annett:

I do not think we could get any better establishment by ploughing up earlier and giving the land a summer fallow, I do not think it would be an advantage; the pasture would be no better than if we just ploughed up in February and sow in March.

P.W. Smallfield:

Mr. Chairman, I would like to join in with other speakers in congratulating Dr. Annett on his paper, I would like to mention prairie grass. I certainly believe that some work should be done on better strains of prairie grass. Dr. Hill spent a lot of time on prairie grass and he brought out a strain of prairie grass that was superior to the usual prairie grass-, This prairie grass sown at Ruakura remained in the fields for a considerable time, I would like to ask Mr. Levy if he is working on the strain of prairie grass that Dr. Hill selected at Mounahaki.

E.B. Levy:

We are doing a certain amount of work with regard to prairie grass, I am very glad to have the point brought up. With regard to Dr. Hill's strain we have unfortunately been unable to get hold of any material of that strain, If anybody here, including you Mr. Smallfield, could get us supplies of seed of Dr. Hill's strain, from the farm, or anywhere else, we would be very glad to get hold of it. It was a good strain and especially from the point of view of smut.