A Multi-disciplinary Approach to a Sheep Thrift Problem

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Summary

An ill thrift problem appeared in lambs on a farm which had been border-dyked and converted to flood irrigation as part of the Morven-Glenavy Irrigation Scheme. This was investigated by local veterinarians, local farm advisory officers and veterinarians and scientists from the Ministry of Agriculture and Fisheries. Diagnoses of internal parasitism, cobalt deficiency and ovine white liver disease were made.

A copper trial and pasture fungicide treatment trial run in the following season gave no positive results but helped indicate that rapid re-infestation with internal parasites was occurring.

Ewe thift problems became apparent during the later winter-spring period. Parasitism and unknown types of hepatopathy caused this.

The 3 main factors involved in the ill thrift are management/nutrition, parasitism and cobalt deficiency. The problem exists to varying degrees on most farms in the irrigation scheme.

Discussion groups highlighted the importance of adequate parasite control and recommended that an in-depth study of the parasitism, its epidemiology and effects be made. They suggested that the farm and district ill thrift problem should be properly defined, including the use of material from meat works. Intensive investigations of ill thrift problems should be done as they occur.

Criticism was levelled at the lack of relevant farm management data for the new situation.

Preface

It is very difficult to produce a comprehensible written paper from a series of talks which unfolded a story of ill thrift followed by recommendations from discussion groups and panel discussion! This paper has been prepared by one of the authors (R.C.G.) from all the material presented. No apologies are given for errors and bias!

Introduction to the Morven-Glenavy Irrigation Scheme

Location

The Morven Glenavy Irrigation Scheme is located on the Canterbury coast immediately north of the Waitaki river which divides Canterbury from Otago.

Area

The scheme is approximately 12,500 ha (hectare) and is adjacent to the much older Redcliff Irrigation Scheme which is about 2000 ha.

Soil

The soil, being alluvial varies considerably across this plain. 2000 ha adjacent to State Highway 1 near Morven is heavy land used principally for cropping and overhead spray irrigation.

The remaining 10,500 ha are variable light stoney soils which are suitable for both dryland and irrigated pastoral farming.

History

In 1960 the first serious moves were made to gain approval and support to divert a little of the Waitaki River into the Plains. The principal men involved were R. Richards, farmer and J. Symons, Farm Advisory Officer, Department of Agriculture.

In 1969 the first sod was moved in development and the scheme was opened in 1973. On-farm irrigation development by the farmer then started.

Up to this date the dryland farm management was a rigid affair controlled by the climate. The low moisture holding capacity of these thin soils meant that dry to drought conditions started about early November only a month after the spring flush of feed. Autumn growth was a doubtful affair and winter feed was provided by hay and turnips. The unpredictability of this situation, the high cost of winter feed and the drought years of the late sixties left permanent scars on every farmers' bank balance.

Farms range from 200 to 400 ha. The average carrying capacity was 7 stock units/ha mostly on an old ewe-fat lamb policy. Even those that pushed their stocking rate to 8 stock units/ha farmed using an extensive grazing management with large paddocks and relatively little requirement for stock health remedies.

Development

The initial development years saw a 30% change of ownership. However, boosted by good product prices in 1972/73 and development loans from the Rural Bank and Finance Corporation, 2000 ha was border-dyked by June 1974 which rose to 3200 ha by June 1976 and now (June 1978) stands at 4400 ha on top of which there is

1000 ha of spray irrigation on heavy land

Land preparation is done with scrapers and big road graders Land that can vary by a metre in height is pushed by these machines into an acceptable even fall divided by levees and a headrace constructed along the top boundary.

Border-dyke development is dictated by the lie of the land and rarely are dryland fences in the correct place. Even farm boundaries have been adjusted to achieve our goal of total land development on the scheme.

If contract labour for land preparation itself is not counted it takes up to 30 man hours to develop each ha of land. This includes cultivation before and after land preparation, sowing pasture, fencing, reticulation of stock water and installing the in-race structure to control irrigation water such as dams and sills. The development cost, including land preparation but excluding labour is over $500/ha.

Irrigation Farming

Irrigation development is time consuming and expensive. In return the farmer gets a completely different pattern of grass growth. Annual production is some three times that of the dryland. This feed is grown over the spring, summer and autumn months. Year to year variation in the rate of grass growth is much lower than dryland farming so irrigation feed supply is much more reliable.

These changes in feed supply allow more stock to be carried (say 15 stock units/ha) and a different stock policy can be adopted (mixed age ewes-breed replacement hoggets) The change from a low stocking rate — old ewe-fat lamb policy to a higher stocking rate — mixed age ewe-breed replacement hoggets policy is quite dramatic by itself. Add to this the fact that the successful irrigation system is one which minimises the use of fodder crops and conserved feeds. Therefore grazing management skills must be changed to manipulate feed growth so that feed supply matches the demands for the animals.

The current requirement is the operation of a lot of small paddocks with mob stocking especially in the summer and winter months.

To further add to many farmers' management problems rearing hoggets is a new business. These men have been skilled at fattening lambs on a dryland farming system but to do this at higher stocking rates under irrigation and also to rear good hoggets which will turn into respectable two-tooths requires different skills in grazing management and sheep husbandry.

Cobalt

In 1957 the district experienced a very growthy season. Grass grew at an extraordinary rate through not only the spring months but well into the summer months The result was rank pastures, which the dryland stock numbers could not cope with further, resulting in lamb ill thrift leading to death Several on farm trials were set up which administered cobalt to one group and left another as controls. It is reported that on three farms these trials were only continued for 10 days The response was so dramatic that the controls had to be treated to prevent further deaths.

In 1975 these conditions and lamb ill thrift were repeated on one property, the difference being that irrigation created this grass growth The property was fully developed for irrigation in the previous season. The trial started in mid February and went through until May with weekly drenches of 30mg cobalt sulphate. The Coopworth lambs started at 22kg and although they showed typical symptoms of cobalt deficiency particularly ill thrift and anaemia the responses to cobalt drenching were small. The total gain for the control mob was 6.5kg while the drenched group gained 7.3kg.

The Problem Appears

On January 23 1976, one of the more progressive farmers in the scheme consulted his veterinarian about an ill thrift problem which was just becoming apparent in his lambs.

The property consisted of about 400ha in three blocks, a home block with a heavier soil type used for cropping and grazing and two lighter blocks both of which were extensively border-dyked for irrigation during 1973/74. Approximately 120 ha was flood irrigated at that stage.

The problem was confined to a mob of 900 fattening lambs grazing over five irrigated paddocks of ryegrass clover pasture They had been weaned in mid December, drenched with anthelmintic and selenium and shifted to this block.

The season had been an unusual one for South Canterbury with warm humid showery days rather than typically clear dry January weather. Consequently it had been a growthy season and pasture in these paddocks had got away. It was long and rank and not very suitable lamb feed In spite of mobbing up of the lambs they were not able to keep up with the grass growth and were forced to graze rank feed. A thrift problem was first noticed in these lambs in mid January when they were drenched. They did not pick up after anthelmintic treatment

The Problem — Lamb Ill Thrift

By January 23 1976 about half the mob of 900 was affected, 220 of them severely, being very thin, weak and depressed 12 had died up till that date.

Two wethers were autopsied. Both were well grown but emaciated. Both had urinary calculi obstructing the urethra.

The veterinarian recognised the seriousness of the situation, its implications and that management factors were probably involved. The local Farm Advisory Officer was consulted and together they visited the farm. After a farm walk they decided that affected lambs together with appropriate pasture samples should be submitted for laboratory examination

Four live lambs thought to be representative of the problem were submitted to the Invermay Animal Health Laboratory

The body condition of all four lambs was very light with individual body weight of 7 8, 10, 10, 13.2 kgs Their wool was very dry and lacked lustre There were scabby *Dermatophilus*-like lesions on the backs of the ears, a sero-mucous discharge from the eyes and crusty accumulations at the medial canthus of the eyes Two of the wethers had pizzle rot.

Laboratory examination revealed the following.

1. Morbid anatomy: carcasses small and emaciated, excess serous peritoneal and pericardial fluid, livers tended to be pale and friable, soft bones.
2. Haematology: all showed evidence of anaemia (two severe). (See Table 1)
3. Parasitology: high worm burdens present in all four. (See Table 2)
4. Trace Elements: normal copper, low vitamin B_{12}. (See Table 3)
5. Histopathology: lesions of parasitism in the gastro-intestinal tract, white liver disease in all livers.
6. Summary: parasitism, cobalt deficiency, white liver disease. (See Table for details of biochemistry.)

By the time laboratory results were available about thirty lambs had died. The situation had not improved and there was little that could be done immediately to alleviate the problem.

The following recommendations were made —

1. The clinically affected lambs be separated from the normal lambs.
2. Increased frequency of anthelmintic treatment.
3. Reduce the stocking rate and change pastures more frequently.

Results of pasture analyses are given by Cornforth in this seminar. In summary phosphorus, zinc, sulphur, nitrogen and copper were low in one or more samples.

It appeared that copper deficiency might be a contributing factor because both pasture and liver assays for copper were low. A small copper response trial was set up and run during March and April but there was no difference between the treated and control groups.

In the main mob stock health had improved and the outbreak appeared to be over by the end of February. About forty lambs were lost. Those remaining recovered slowly, were fattened and sent for slaughter.

While this story is limited to one farm, the problem was widespread over the area of irrigation. In all, local veterinarians investigated ill thrift problems on nine farms in the area. White liver disease was found on two other irrigated properties. Low liver vitamin B_{12} levels were found in these sheep.

A compounding problem for the diagnosis and treatment of this condition was the delay in the results of the vitamin B_{12} analyses from Wallaceville. These were not received until June 1976.

Fungicide Trial

Ovine white liver disease was thought to be caused by a fungal toxin produced by fungi growing on pasture or pasture litter. This hypothesis was tested by a fungicide trial which was run on the affected farm from December 1976 to March 1977. It was organised by veterinarians from the Invermay Animal Health Laboratory, scientists from the Invermay Agricultural Research Station and veterinarians and farm advisory officers from Waimate.

Two paddocks were split into 6 blocks. Three replicates received no treatment and three were sprayed with 'Benlate' fungicide. Six mobs of 46 lambs were run on control or treated paddocks only. Every three weeks these pasture measurements were taken:—

dry matter production
dry matter consumption
nutrient value
spore count

The following lamb treatments were done at the same time:—

weight (for growth rate)
serum collected from marked lambs for liver enzymes
all lambs given anthelmintic
autopsies on one lamb from each group

There was no difference in lamb growth and health between groups. Likewise, there was no difference in herbage growth and composition. The lamb worm burden was similar in each group, tended to be high at times and fluctuated (see Table 4). This was in spite of 3 weekly drenching. Fungal spores typical of *Pithomyces chartorum* were found on pastures in the December period at 40,000 spores, reducing regularly down to zero by March

The only conclusion that could be drawn from the trial was that parasite control should be intensified with drenching at intervals of less than three weeks.

Ewe Thrift Problem

In the winter of 1977 ewe thrift problems became apparent on some farms in the area. Towards the end of August the farm where the lamb thrift problem had occurred reported problems of thrift in its ewe flock. This was the first winter that an all grass wintering regime was used from May onwards.

1800 Romney and Romney Cross Border Leicester mixed age ewes were rotated around 8 paddocks (2 dry land and 6 irrigated). They were fed hay on the fourth to seventh days of rotation. From the end of July they had been getting ours hours a day greed feed then on a run-off where they were fed hay.

The problem first appeared at the end of July and about 12 ewes died during the period to August 12. The rest were drenched with an anthelmintic and deaths ceased for a short period (the ewes had been pretup drenched in mid March). Lice were present. The bottom quarter of the flock continued to slip throughout August and a further 7 died by August 30. A feed check had occurred about the end of July.

Three dead ewes and two moribund ewes were autopsied. A range of pathology was found including severe pneumonia in a barren ewe, fatty livers, pleural adhesions and pneumonia. Laboratory examinations confirmed that parasite burdens were medium to high. There was also liver pathology of varying degrees present. The type of pathology suggested that some type of acute hepatotoxic condition was present. However, it was different from white liver disease as seen in the lambs the previous summer. Trace element levels were all within the normal ranges.

The poorer ewes were drafted off the ewe flock and given preferential treatment up to and during lambing. Recommendations for further drenching and cobalt treatment were made but not carried out.

Although there was evidence of disease it was concluded that the main problem was managerial.

Several other properties in the area had ewe thrift problems during the same period. Most of them were associated with high worm burdens and lesions in the gastro-intestinal tract typical of parasitism. The district lambing percentage has dropped considerably (from 110% to less than 85%), since irrigation. Ewe body weight has slipped, particularly in the last autumn. Some farms have ewes under 44kg live weight.

Lamb Growth Rates, 1977/78

During this season ewe lamb growth rates were followed from weaning through to the winter Pasture mineral content was also monitored. On six farms each month —

1. identified lambs were weighed
2. 20 faecal samples were collected from the mob for worm egg counts
3. samples of the pasture that the lambs were to graze on were collected and sent for analysis.

The aim of the investigation was to see —

how fast the lambs grew
if internal parasites were associated with lower growth rates
if the pasture mineral status kept in the normal range.

There has been a correlation between growth rates and worm burdens as indicated by faecal egg counts The 2 farms that had the best growth rates were those that reduced the worm burden either by very frequent drenching (every fortnight) or by drenching every month and ensuring that lambs were put on to clean pastures.

On other farms some drops in growth rates could be explained by high faecal egg counts

Pasture Analysis

It has been suggested that flood irrigation washes many minerals out of the soil or else it upsets the fine balance of the major and minor elements in the feed.

These are very plausable suggestions and many fertilisers, drenches and licks have been sold to restore "just the right balance".

In 1977/78 season samples of grass were taken monthly from six farms in the Morven-Glenavy area 0.5kg fresh weight samples were taken by walking diagonally across a paddock plucking grass by hand every 10 metres

The results received back to date indicate that no element is abnormally high or low (Butler and Baily, 1973; Cornforth and Sinclair, *per. comm*)

Sodium deficiencies have been seen regularly in lucerne. Occasional samples have shown low copper levels but this has never been associated with high molybdenum levels. A very few samples have shown phosphate or zinc deficiencies.

Pasture cobalt levels have been in the "low normal" range on 5 of the 6 farms. The 6th farm has been topdressed with cobaltized superphosphate annually

Conclusions

The continuing nature of the problems of sheep thrift and production indicates their complexity. A careful study of the information obtained from affected farms over the past few years indicates that there are 3 main problem areas

1 Management — the changes in farming methods necessary with the advent of irrigation have been greater than has been generally appreciated.

2 Internal parasites — while it was apparent in the first ill thrift investigation that parasites were playing an important role in the ill thrift it was only when the fungicide trial was run that the extent and rapidity of reinfestation was demonstrated. This together with the results obtained by the few farmers who drench very frequently (every 2 weeks) indicates the "new life" given to parasites by regular irrigation

3. Cobalt deficiency — the soils were intially marginally cobalt deficient. The increased plant growth obtained with irrigation on these soils has probably potentiated this deficiency, enabling it to be expressed as an animal health problem.

The extent and degree of cobalt deficiency in the area has yet to be determined. However the general recommendation is to topdress successive thirds of the farm with cobaltised superphosphate annually.

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References

Butler, G W , Baily R W eds *"Chemistry & Biochemistry of Herbage "* (1973) Academic Press, London

Table 1. Haematology and Serum Chemistry Results of 4 Lambs Examined in January, 1976

Lamb	1	2	3	4	Normal Range*
Haemaglobin (g/dl)	6 2	8 6	7 3	10 5	8 — 14
PCV (l/l)	21	25	25	36	0 22 — 0 40
MCHC (g/dl)	29	34	29	29	29 — 35
					60 — 80
White cells (x 10⁹/l)	6 21	4 95	17 5	25 850	4 0 — 10 0
Neutrophils (x 10⁹/l)	3 41	2 48	11 55	18 35	0 4 — 5 0
Lymphocytes (x 10⁹/l)	2 67	2 25	5 78	7 50	1 6 — 7 5
Monocytes (x 10⁹/l)	0 06	0 25	0 18		0 — 0 6
Eosinophils (x 10⁹/l)	0 06				0 — 1 0
Plasma zinc (mg/l)	1 6	1 1	1 3	2 2	0 78 — 1 17
Plasma phosphate (mg/l)	60 3	64 7	43 7	32 5	40 — 70
Serum magnesium (mg/l)	14 8	22 0	15 7	12 9	12 — 28
Serum calcium (mg/l)	70 1	96 3	76 2	80 1	80 — 120

* Specimens for Laboratory Examination" (1975) Ministry of Agriculture and Fisheries

Table 2. Parasitology Results of 4 Lambs Examined in January, 1976

Lamb	1	2	3	4	Pathogenic Burden*
Abomasum					
Ostertagia	8,400	8,100	6,600	5,200	5,000
Small Intestine					
Nematodirus	4,500	200	800	700	2,000
Trichostrongylus	200				5,000
Trichuris			3	9	5,000

* "Specimens for Laboratory Examination" (1975) Ministry of Agriculture and Fisheries

Table 3. Liver Analysis Results from 4 Lambs Examined in January, 1976

Lamb	1	2	3	4	Normal Levels*
Copper mg/kg		36 2	15 1	21 2	6
Vitamin B_{12} mg/kg	0 05	0 05	0 05	0 05	0 2

* "Specimens for Laboratory Examination" (1975) Ministry of Agriculture and Fisheries

Table 4. Parasitology Results from the Morven Fungicide Trial, 1976-77

	21 December		11 January		1 February		22 February		15th March		
	Average	Highest Count	Average	Highest Count	Average	Highest Count	Highest Average	Count	Average	Highest Count	Pathogenic Burden*
Number examined	6		6		6		6				
Abomasum											
Ostertagia	16	100	1,940	3,200	1,700	2,900	370	900	1,200	3,200	5,000
Trichostrongylus	200	800	50	200			70	200	310	900	5,000
Intestine											
Nematodirus	900	2,800	6,950	16,500	2,900	5,400	1,250	4,500	510	2,100	2,000
Trichostrongylus			200	400			100	500	610	900	5,000
Trichuris	27	99	31	73	9	44	11	40	3	12	500
Oesophogostomum							1	4	7	21	5,000

* "Specimens for Laboratory Examination" (1975) Ministry of Agriculture and Fisheries