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# A Comparison of Hogget Thrift On Perennial Ryegrass and White Clover

By

D. P. SINCLAIR, E. A. CLARKE and D. B. FILMER.

## INTRODUCTION.

**I**LL thrift is a descriptive term applied to a condition where weaned lambs or hoggets fail to grow in the midst of plentiful pasture growth during the autumn and early winter months in the absence of any positive cause such as Haemonchosis or known trace element deficiency. It need not necessarily be associated with mortality although it frequently is. Therefore, we think it is safe to regard the poor lamb growth which will be referred to in this paper as being one and the same with the hogget ill thrift described in the previous paper by E. A. C. and D. B. F.

Now the fact that weaned lambs or hoggets at Manutuke do well on white clover dominant pasture and at the same time do poorly on perennial ryegrass dominant pasture has been observed for some years. A summary of the available data we had on this subject was used to illustrate a paper on lamb fattening given at the N.Z. Grasslands Conference in 1954 (Simpson and Sinclair). However, those results were incidental. They were drawn from sundry pasture feeding trials concerned with facial eczema and were not designed to compare lamb growth on the two pastures as such.

In view of the dominant role played by perennial ryegrass in our system of grassland farming under which hogget ill thrift is a widespread problem we thought it desirable to obtain more detailed and critical information concerning the widely different rates of lamb growth which had been observed on these two common pasture species by comparing them under as similar, and as favourable conditions as possible during the ill thrift season from February to June.

Therefore, in 1954 and 1955, further trials were conducted in which growth rates of lambs on the two pastures were studied in relation to climatic conditions, parasitic infestation and dry matter intake and digestibility. Two consecutive trials were carried out each year, the first during February and March and the second during April and May. The following descriptions of pasture and animal management and experimental procedure apply to all four trials unless otherwise stated.

## TECHNIQUES OF PASTURE AND ANIMAL MANAGEMENT.

### 1. TYPE OF PASTURE.

Reasonably pure stands of both perennial ryegrass and white clover were available for the trials and an endeavour was made to keep them in good order throughout.

Perennial ryegrass was obtained from an old permanent pasture which during the last 10 years has produced approximately 12,000lb. DM per acre per annum. Under close sub-division and heavy sheep grazing it has become almost pure ryegrass with a bottom of wild white clover. The age of the pasture and the origin of the seed are not known but almost certainly the ryegrass is an early Poverty Bay strain. The white clover with it is a very poor type indeed. It does not grow above 1in. in height and yields only a minor proportion of total DM production.

White clover was specially grown for the purpose and was encouraged to become completely dominant. Earlier it was found that a mixture of H1 and White Clover tended to become clover dominant if the H1 was not permitted to come again from fallen seed in the second year so the technique used is to sow 25lb. H1 with 2lb. pedigree white clover, keep it well grazed during the winter and spring and then treat it more leniently from early December onwards, allowing the clover to come away. The H1 dies out during the hot summer weather and if the sward is not opened up during the autumn it does not regrow, leaving a completely white clover dominant pasture for the next two years. This technique is bad pasture management and a waste of good H1 ryegrass but it is effective, and I do not think white clover could be grown without the accompanying grass to suppress weed competition.

## **2. RATE OF STOCKING AND PASTURE MANAGEMENT.**

Both pastures were set stocked in the first trial with ten lambs per acre and in the second trial with seven to eight lambs per acre. Perennial ryegrass was not controlled by this rate during periods of flush autumn growth and where necessary one 18 months old steer per acre was added to keep the feed in check. Throughout the trials it was kept at around the 4in. stage and was at no time overgrazed.

In a period of summer drought before and during the early part of the first 1954 trial, spray irrigation was used to keep the perennial ryegrass from drying off completely. Sufficient water was given to keep the grass alive and green but not to produce flush growth conditions.

A dense deep sward of white clover was kept for the trials by grazing it only lightly with weaned down cross lambs during December and January. Thereafter it stood up well to set stocking with ten lambs per acre even during the dry February of 1954. Towards the end of the second trials it became short in patches but otherwise was maintained at a length of 6in. or more at the rates of stocking used.

## **3. GROWTH SIZE AND TYPE OF ANIMAL.**

With the exception of the second 1954 trial groups of 20 lambs were used. In the former case group size was reduced to 16 lambs as only two acres of white clover were available.

The groups were selected on a liveweight basis from a line of hill country store Romney lambs using the technique of restricted randomisation. Average initial liveweight varied between 60 and 70lb. so in each case the lambs were in good store condition.

## **EXPERIMENTAL PROCEDURE.**

The lambs were weighed at 2-3 weekly intervals during the course of the trials, care being taken to weigh directly off feed on each occasion. At the conclusion of the trials all lambs were killed at the local Freezing Works, where individual carcass weights and grades were obtained.

To measure the effect of Nematode parasites faecal samples for egg counts were taken on weighing days in the 1954 trials and total worm counts were done on ten lambs in each group following slaughter.

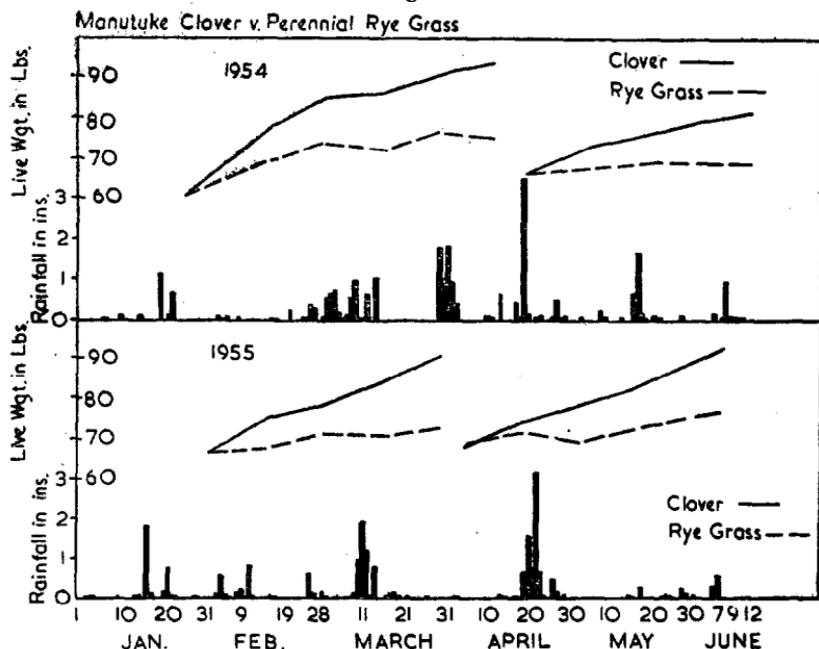
No drenching was included in the experimental design of the trials but on 3rd March, 1955, when other evidence suggested that Haemonchosis might become a complicating factor, all lambs were drenched with 25g phenothiazine.

To determine relative intake and digestibilities of the two pastures, approximately 500lb. total dry weight of each was mown and dried at intervals during February and March, 1955. Continuous pasture

growth occurred during this period and both samples when cut were in a fresh green state and free from dead unpalatable material.

In May, 1955, the bulked dry samples were fed ad lib to groups of five 60lb. hoggets in pens at Ruakura for a period of three weeks. The hoggets were weighed before and after the feeding period. Daily feed intakes were recorded and digestibilities were obtained by the usual technique of collecting faecal output. Individual daily intakes of digestible dry matter were then calculated.

Fig. 1.



## RESULTS AND DISCUSSION.

Growth curves of lambs in the field trials are shown in Fig. 1 in association with histograms of daily rainfall during the periods concerned. It will be seen that growth of lambs on white clover was consistently good and not apparently associated with rainfall except possibly for the first two weeks of March, 1954. During that period frequent rainfall and warm, humid conditions produced the most spectacular flush of growth ever recorded at Manutuke. A figure of approximately 100lb. DM per acre per day was recorded from the perennial ryegrass pastures. Although no measurements of clover growth are available, it is reasonable to assume that periods of warm autumn rain would produce more vigorous and succulent growth and thus there would appear to be no correlation between lamb growth curves and maturity of white clover.

In contrast, growth of lambs on perennial ryegrass was inconsistent and generally poor. After a period of variable initial increase body weights fluctuated up and down but little further gain was made. Actual losses of bodyweight appear to be associated with the period of heavier rainfall which suggests a direct relationship between ill thrift and maturity of the ryegrass.

Although no mortality whatsoever occurred during these trials, we believe that this cessation of growth without any spectacular initial decline is the onset of typical hogget ill thrift.

To illustrate actual differences in meat production from the two pastures, growth rates converted to the conventional lb. liveweight gain per day, average dressed carcass weights and percentage of 2nd grade carcasses are shown in Table 1.

**TABLE 1**

|                | White Clover     |                 |           | Perennial Ryegrass |                 |           |
|----------------|------------------|-----------------|-----------|--------------------|-----------------|-----------|
|                | Gain per day lb. | Carcass Wt. lb. | Seconds % | Gain per day lb.   | Wt. lb. Carcass | Seconds % |
| 1st trial 1954 | 0.43             | 43.3            | 0         | 0.19               | 33.2            | 60        |
| 2nd trial 1954 | 0.28             | 37.7            | 0         | 0.04               | 30.9            | 44        |
| 1st trial 1955 | 0.42             | 40.5            | 0         | 0.11               | 31.4            | 73        |
| 2nd trial 1955 | 0.39             | 41.4            | 0         | 0.12               | 31.1            | 70        |

These figures again illustrate the great value of white clover in the Gisborne area.

In three of the four trials weight gains were approximately 3lb. per week. In its local application this means that a medium store lamb of 60lb. liveweight will fatten to a 36lb. carcass in about seven weeks. Thus it is possible to fatten three or even four consecutive drafts of lambs on a good stand of white clover. The emphasis at Manutuke has been on fattening store lambs for export, but it is obvious that, if desired, excellent hoggets could be reared on white clover.

The results from the ryegrass demonstrate how difficult it is to fatten lambs or rear hoggets on that type of feed even under the most favourable conditions.

These results in terms of liveweight gain have not been subjected to statistical analysis. It is fairly safe to say that a difference of 5lb. weight gain between groups of 20 lambs with a restricted initial weight range would be significant at the 1% level in a simple test. As the differences in these trials range from 15-19lb. they were obviously real ones and far beyond any realm of chance.

Now to consider the effect of nematode parasites we will refer to the 1954 egg count levels shown in Table 2.

**TABLE 2 — MEAN EGGS PER GRAM**

**Trial I (1954)**

|              | 2.2.54 | 15.2.54 | 1.3.54 | 15.3.54 | 29.3.54 | 13.4.54 |
|--------------|--------|---------|--------|---------|---------|---------|
| White clover | 318    | 577     | 603    | 148     | 580     | 2598    |
| Ryegrass     | 380    | 175     | 237    | 131     | 1020    | 3261    |

**Trial II (1954)**

|              |  |         |        |         |
|--------------|--|---------|--------|---------|
|              |  | 26.4.54 | 4.5.54 | 24.5.54 |
| White clover |  | 3556    | 2449   | 1617    |
| Ryegrass     |  | 2796    | 1984   | 902     |

Here it is obvious that there was no difference between groups and no correlation between egg count and weight gain of lambs. Counts in both groups reached a peak at the conclusion of the first trial, started off at a similar level at the beginning of the second trial and then declined rapidly with the onset of winter. Growth of the lambs in both groups was slowest as the egg counts declined.

Total worm counts are shown in Figs. 2 and 3.

Fig. 2.

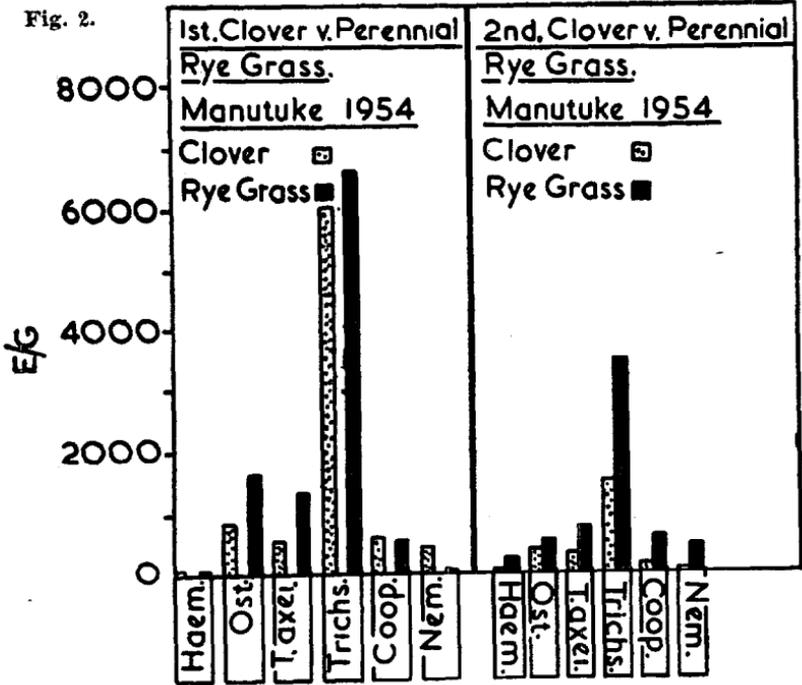
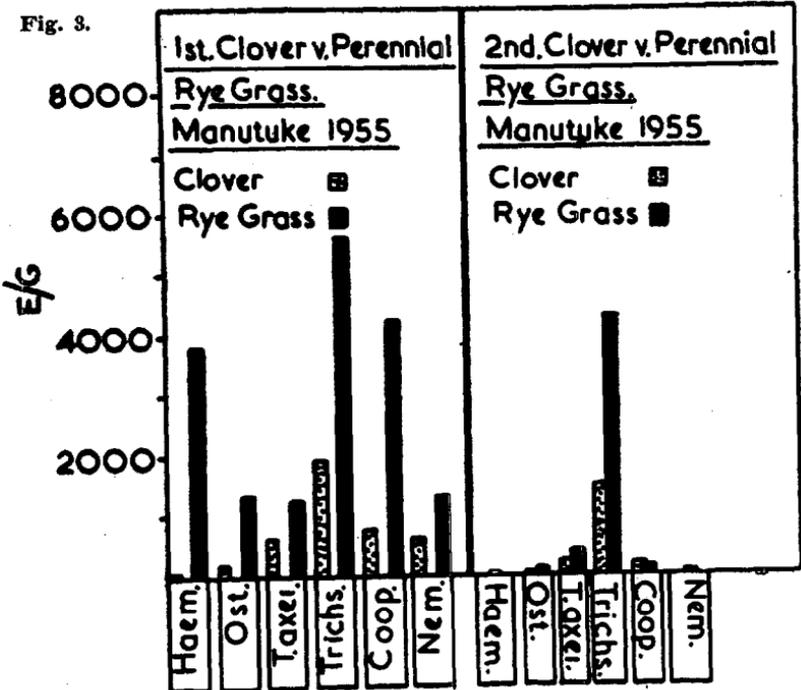


Fig. 3.



In 1954 figures for both groups are similar. One high count of *Trichostrongylus* caused a slightly higher average figure in the second trial, but in general they were in line with previous egg counts and require no further comment. The same, however, cannot be said for the 1955 figures. In this year we decided that egg counts were not likely to yield any further useful information and none were carried out. This was unfortunate, and a good example of how not to leap to conclusions, as obviously worm counts, especially those of *H. contortus* were significantly higher in the ryegrass group of the first trial. Without egg counts we have no information as to when this difference developed, but as all lambs were drenched with 25g phenothiazine on 3rd March, 1955, we suspect that it was of recent origin before slaughter.

In the second trial, the overall worm count difference between groups was greatly reduced and yet growth curves of the groups were almost an exact replica of those in the first trial. It is this repeatability of relative growth rate irrespective of variation in total worm count that leads us to believe that nematode parasites are incidental. The poorer ryegrass lambs may at times have had higher counts but these we suspect were more the result of poor growth than the cause of it.

Finally, there are digestibilities and DM intakes of the two feeds to be considered. The results of the three weeks' pen feeding trial with the dried samples of the two pastures are as follows:—

**Perennial Ryegrass:** Digestibility 63%; average daily intake of DDM, 400g; weight gain 2½lb.

**White clover:** Digestibility 73%; average daily intake of DDM, 800g; weight gain 12½lb.

Thus, while perennial ryegrass lambs consumed barely enough dry matter to do more than maintain body weight, clover lambs consumed twice as much and gained at the rate of 4lb. per week. Although more divergent, the relative growth rates were very similar to those observed in the field.

By modern British feeding standards, the ratio of maintenance to production requirements in terms of S.E. for a 60lb. lamb are 2:3 for a 2lb. weight increase per week and 1:2 for a 4lb. increase. From this it would seem that the difference in growth between perennial ryegrass and white clover lambs both in the pen and in the field is adequately explained in terms of relative intake of DDM.

## CONCLUSION.

In conclusion, these trials offer confirmation, if any were needed, that lambs and hoggets at Manutuke do consistently well on white clover, while becoming unthrifty on perennial ryegrass. This difference occurred at any time from the beginning of February until the middle of June but was greatest during periods of autumn rain when pasture growth was vigorous. It was not related to nematode parasite infestation but was simply the result of a very much higher dry matter intake and digestibility of white clover.

Thus while these trials do not elucidate the problem of ill-thrift they strongly suggest that perennial ryegrass itself can be responsible owing to an inadequate DDM intake of the animals which are grazed upon it. Whether this inadequate intake is due directly to unpalatability or to other unknown nutritional factors which lead to loss of appetite is open to question.

## REFERENCE:

Simpson, J. E. V. & Sinclair, D. P. (1954): Proc. N. Z. Grasslands Association: 101.

## Discussion

Mr. YEOMAN: What result would you expect from using Yorkshire Fog instead of ryegrass?

Mr. CLARKE: On the hogget block at Ruakura where fog is a dominant species, ill-thrift occurs annually. It is also widespread over the Waikato, particularly on peat soil and ill-thrift occurs commonly over these areas. We have no information on the incidence of ill-thrift on single species swards except what has been given in these papers.

Mr. BONNER: It was mentioned that hoggets drenched with phenothiazine still carry a heavy burden of immature worms. In the early days of the trials with phenothiazine, it was considered that worm eggs were rendered infertile. Would you care to comment?

Miss FILMER: Eggs are rendered infertile by phenothiazine. However, P.T.Z. is not 100 per cent efficient against parasites as yet and some fertile eggs may be deposited on the pastures between drenchings. Hoggets may thus become infected between drenchings and harbour immature parasites.

Mr. LYNCH: Did the pastures consist of ryegrass alone? Must white clover be completely pure to be effective?

Mr. SINCLAIR: The ryegrass pastures contained a bottom of wild white clover but otherwise were pure ryegrass. Yes, the purer the white clover is the better the growth rate of lambs.

Mr. BUTLER: With reference to the second paper, did the animals have access to a stock lick during the trial?

Mr. SINCLAIR: No licks or supplements of any kind were given.

Mr. SMITH: If the ryegrass was so unpalatable that the lambs did not eat it, what steps were taken to control it?

Mr. SINCLAIR: It was found necessary to add cattle to keep the growth of ryegrass in check.

Dr. CARTER: Does the malady affect other stock?

Mr. CLARKE: We have observed in two-tooth wethers and in ewes a check in live weight curves commencing at the same time as in hoggets running with them. In the case of older sheep, although usually the same loss in live weight occurs, it does not cause any noticeable ill-effects and is of shorter duration.

Mr. BUTLER: Were the thyroid glands examined for any evidence of goitre?

Mr. SINCLAIR: The lambs were not specifically examined for goitre but in the general handling of the animals no enlarged thyroids were ever observed.

Mr. GRANT: What effect does high stocking rate have on pasture palatability?

Mr. CLARKE: We have no data on this. Our observation, however, is that ill-thrift occurs most frequently and most severely at high rates of stocking which possibly reduces the scope for selective grazing.

Mr. PERCIVAL: The differences in digestibility between the perennial ryegrass and white clover could explain the differences in the growth rate of the hoggets. Have any trials been carried out using ryegrass and clover of the same digestibility?

Mr. CLARKE: The difference in digestibility in one trial was 10 per cent. This is not sufficient to account for the difference in intake and liveweight gain but does contribute to the difference found. It is hoped to closely investigate this aspect in future trials.

Professor McLEAN: Has any attempt been made to find out whether the reduced food intake is due to the animal or the pasture?

Mr. SINCLAIR: No, but the results of the pen feeding trial indicate that it was due to the pasture.

Mr. WILLIAMS: At Ruakura we have been comparing the rumen contents of thrifty and unthrifty hoggets and have found that unthriftness is associated with a very low protein level. From faecal nitrogen we have estimated the protein content of the pastures being grazed by the unthrifty hoggets to be about 22 per cent so they were not suffering from any shortage of protein. Low protein of the rumen content is probably due to low conversion to microbial protein and we believe this to indicate that the amino acid content of the feed is very different from that found in normal pasture.

Dr. SEARS: I was interested in the composition of the pure ryegrass swards. How were they kept pure and was nitrogen applied artificially throughout?

Mr. SINCLAIR: Heavy grazing at other times of the year kept the pastures as dominant perennial ryegrass. The bottom of wild white clover evidently supplied sufficient nitrogen. No artificial nitrogen was applied.

Dr. FILMER: I think we can heartily congratulate the speakers on having brought this problem into something like focus. There have been lots of ideas about it for many years and now, for the first time, we have some facts about the conditions under which hogget ill-thrift does and does not occur. It would appear that in the autumn some pastures do produce hogget ill-thrift and experiments have confirmed that dairy and mature white clover pastures do not. The place of pasture has, I think, at least been clarified and it would seem to me that we can conclude that there is something abnormal about certain pastures growing in the autumn which is responsible for hogget ill-thrift. The hypothesis has been advanced that it is unpalatable. That has to be proved. Reduction in intake could be merely a question of something happening to the animal or it may be related to unpalatability. To prove this hypothesis two things will have to be done. Unthriftness will have to be produced by reducing intake of pasture on which hoggets thrive and hoggets will have to be made to thrive by increasing the intake of pasture on which they become unthrifty.

Colonel DURRANT: Is it intended to duplicate these trials on other places to see if the same results are obtained?

Mr. CLARKE: At this stage at any rate it is not intended to duplicate such trials. We are hoping that with refined techniques it will be possible to efficiently survey the problem on a broad basis in the future. There is every reason to believe that what we are studying is the same problem which occurs widely in hoggets over the North Island at least. It is certainly the same problem as in Poverty Bay and as has been investigated at Wallaceville.

Mr. McFARLANE: Are there any other ways of fattening store lambs apart from white clover?

Mr. CLARKE: Yes. Many crops are used, particularly rape in Hawke's Bay. We have fattened lambs in the autumn-early winter on long pasture on both sheep and dairy farms.

Mr. McFARLANE: Has Mr. Clarke any suggestions for the preparation of hoggets for the winter, or for preparation of hill country for wintering hoggets?

Mr. CLARKE: It is prior to winter that the precautions against ill-thrift must be taken. Once past the shortest day trouble is seldom experienced. All the possible ways of wintering hoggets cannot be dealt with here but it is our experience that they do well on almost any feed after the ill-thrift period has been passed, and grow according to the quality and quantity of feed available.