THE STOCK PARASITE POSITION IN RELATION TO GRASSLAND.

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1. INTRODUCTION:

No clearer demonstration could be desired of the vital relationship obtaining between the condition of grasslands and the prevalence of internal parasites in sheep, than this last year's widespread losses of hoggets from worms. Consideration of the high standard of efficiency attained at the present time in pasture improvement and in methods of supplying supplementary feed, only makes clearer the necessity for learning more of the relation of the parasite to permanent pasture, if this deterioration due to parasites is to be prevented. And whilst an effective method of medicinal treatment is still in most cases admittedly lacking, it is obvious that proper management of the pasture is also required before the problem can be solved.

It is only too clear that the economic loss to the country due to hogget mortality would reach a very high figure could it be accurately expressed in £.s.d. In England, from the same cause, losses in one district amongst 43 farmers amounted, during the winter of 1933-34, to £10,341, an average of £240 each. Nor is mortality the only form of economic loss; one must further take into consideration loss of condition and failure to grow and fatten, of sheep with a low grade infestation of parasites.

In the present paper it is my desire to discuss primarily the enormous part which is played by nutrition in control of parasitic disease, and to emphasize the fact that a high standard of pasture management is no less essential than is intensive pasture improvement.

Throughout, references will, of necessity, be made to individual parasites; and of these in particular to the small intestinal and small stomach worms which are chiefly responsible for losses amongst hoggets. Mention will also be made of the large stomach or barber's pole worm - a notorious blood sucker affecting all classes of sheep.

It should be noted at this point that knowledge of the existing parasitic diseases in New Zealand itself, is very slight in proportion to the whole volume of knowledge available on the subject. For this reason many of the views here expressed are derived from observation of English and Australian conditions; nevertheless, with some slight degree of modification they will no doubt be found to fit in with conditions in New Zealand also. It is hoped that investigational work now in progress will presently provide ample information specific to the country.

2. IMPORTANCE OF NUTRITION AND PASTURE MANAGEMENT IN THE CONTROL OF PARASITIC DISEASES:

Nutrition:

The influence of proper feeding is a primary factor in controlling parasitic diseases. There should be nothing new in this statement, because early this century Gilruth, the then Chief Veterinary officer of the Department of Agriculture, and his
colleagues, stressed the importance of an adequate supply of feed in controlling losses due to "parasitic gastritis" as he termed the disease responsible for losses amongst hoggets. To-day this same advice holds true because the severity of the disease amongst hoggets is definitely influenced by the nutritional state of the young growing animal and an available supply of feed all the year round would prevent lambs suffering any check until they were twelve months old, after which time they become relatively immune to the effects of the parasites. The importance of nutrition is again seen in the case of older sheep which have developed a resistance to the effects of the large stomach worm, because this immunity may be broken down if the sheep are exposed to under-nutrition, which results during a period of drought. Besides building up a powerful resistance, a plentiful supply of feed lessens the daily grazing period of the sheep and so decreases the risk of infection.

Until other effective means of controlling internal parasites are available, therefore, improved nutrition offers the only solution, and it is to pasture improvement and improved methods of supplementary feeding that we must look in future in order to stop the present deterioration due to increased parasitism, caused by under-nutrition, and to allow for greater production than ever before. However, where the rate of infection is high, as in the case of sheep grazing on heavily contaminated pastures, adequate feeding alone may not be a sufficient safeguard against the development of disease because a thorough knowledge of proper pasture management is essential.

(b) Pasture Management:

Although farmers scattered throughout the Dominion have pinned their faith on pasture improvement, as the solution to their problem, it has resulted in heavy losses and has so tended to become discredited in the minds of certain graziers. The trouble is invariably due to lack of proper knowledge in regard to the management of sown pastures and it is frequently believed that overstocking cannot occur on the latter, but unfortunately it can occur just as readily on improved as on unimproved natural areas.

Where one sheep is carried per acre, the chances of a single parasite being ingested by a sheep is unity, but where two sheep per acre are carried the chances are doubled and also the number of parasites contaminating the pasture is doubled. So that the chances of a sheep picking up parasites varies as the square of the concentration of the sheep.

The aim should always be to expose the sheep to the least possible risk of infection and this can be done by avoiding long periods of stocking, that is, rotating the sheep, and avoiding the necessity for close grazing which leads to a maximum intake of parasites due to the fact that, in any one paddock, the mass of the infection lies under the protection of the lowest leaves of the plant near the ground.

Other factors influence pasture management and these will be discussed fully below.

3. FACTORS TENDING TO INCREASE THE RISK OF PARASITIC INFESTATION:

(a) Oversocking:

Sown pastures are capable of being stocked at the rate of ten or more sheep to the acre, without being overstocked. However, if the sheep are not rotated or the numbers reduced and this heavy stocking is persisted with, it will not be long before the more palatable species of plants are eaten out with the results that the
sheep are soon exposed to under-nutrition. Given unfavourable seasonal conditions, grave overstocking may result and as a consequence of this lack of sufficient feed the resistance of the sheep becomes lowered. In addition, heavy contamination of the ground results and the sheep becomes exposed to a heavy rate of infestation. Both factors combined, result in definite clinical signs of parasitism being shown and unless something is done in the way of removing the sheep or reducing the numbers, mortality will result. Where overstocking occurs on improved pastures the risk of sheep becoming infected is greater than on natural pastures, due to the increased rate of stocking, which is at times out of all proportion to the available feed.

(b) Close Grazing:-

This is closely related to overstocking, and as mentioned earlier, it leads to a maximum intake of infective parasites. Sheep being selective feeders tend to nibble certain plants very close to the ground and for this reason long periods of stocking should be avoided and cattle used to clean up the roughage.

c) Effect of Certain Climatic Conditions:-

Dull warm weather with intermittent showers, in contrast to bright sunny weather, is ideal from the point of view of the parasite itself, and it is during such weather that sheep are exposed to the greatest risk of infection. However, other seasonal influences play their part in influencing the survival and longevity of the parasite on pasture. These will be discussed under separate headings as follows:-

(i) Drought: This has always been considered one of the most lethal natural factors in controlling parasitic diseases. The life cycle of the large stomach worm, for example, is such that the female parasite in the stomach of the sheep lays eggs, (at an extremely rapid rate, a single female being capable of laying 5-10,000 eggs per day and a sheep showing clinical evidence of the disease may harbour 2-10,000 parasites of which half would be females) which are voided with the droppings and provided satisfactory moisture conditions are available they become embryonated, hatch in 24 hours and liberate a small immature parasite or larva, which after undergoing two molts reaches the infective stage, at which stage as the name indicates, it is ready to infect a sheep. The time taken to reach the infective stage is five days under artificial conditions but under field conditions where temperatures vary, six or more days would probably be required. The life cycle may be illustrated diagrammatically as follows:-

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*Sheep* → Pasture → *Sheep* → *Sheep*

Adult female parasite (hatches parasite in 24 hours) → Infective stage (reached on infective stage).

Drought affects the large stomach worm adversely in that it destroys all stages of the parasite in a few weeks and so it is no source of danger during prolonged dry weather. However, in the case of the small intestinal worm, with its high pathogenicity for young sheep, the eggs will develop to the stage where a young viable parasite moves within the shell but will not develop further and hatch until adequate moisture is provided. In this stage it can remain alive for 15 months and therefore, although development is inhibited during drought, the storing up of "potential" infection occurs and this will lead, with the advent of prolonged rain, to a mass hatching resulting in rapid infestation of the sheep and with an already lowered resistance it may succumb to the effects of the
parasites. This was found to be a primary factor in the winter outbreaks of "parasitic gas tritis" in England in 1933-34, which resulted in heavy losses economically.

Light rain during periods of drought will often help to wipe out an infection already present due to the fact that the mass of already embryonated eggs hatch and the pre-infection stages are over taken with dryness, before they can reach the infective stage which is further resistant to desiccation.

(ii) Cold: If the distribution of the large stomach worm and the small intestinal parasite in Australia were marked on a rainfall map, it would be seen that the former is distributed in the summer rainfall areas (chiefly central and northern New South Wales and southern Queensland) and the latter is distributed in the winter rainfall areas although it does extend up into the summer areas. It indicates that the large stomach worm is a summer parasite, depending on a summer rainfall for its existence and showing its effects in late summer and autumn, whereas the small intestinal parasite tends to be a winter parasite being distributed over the southern and colder states such as Tasmania and Victoria, where the stomach worm is practically non-existent. This latter parasite furthermore does not extend into areas having a rainfall less than 20 inches unless in exceptionally wet seasons and it develops best at temperatures from 75-85°F. Losses in the case of the small intestinal worm have been recorded in areas having rainfall as low as 16-18 inches annually and for this reason is probably the most widely spread parasite in Australia.

In all probability a similar distribution in respect of rainfall and temperature exists here in New Zealand of which we are not yet aware. The spread of the large stomach worm is limited by temperature particularly and requires a summer rainfall—it is definitely not a winter parasite. On the other hand the small intestinal parasite and its close relation the small stomach worm, are both capable of developing during the winter and will extend into areas with very low temperatures; just exactly what part heavy frosts play on the development of this parasite is not exactly known.

(iii) Wet Seasons: The superabundance of herbage which follows a wet season favours the development of the parasites on pasture in that it protects them from the drying rays of the sun, whereas short pasture leads to their destruction because air currents and the heat of the sun soon dries up the droppings in which they would develop were an adequate supply of moisture available.

(d) The Nature of the Herbage:-

In England, Taylor has expressed the view that clover pastures are a greater source of infection than grass pastures because the structure of a clover plant is such that parasites can climb up the simple leaf stalk and reach the trifoliate leaf without being short-circuited in any way, whereas the blade and sheath of a shoot of grass tends to divert the ascending parasites to the underside of the lower leaves, which are usually avoided by the grazing sheep.

(e) Ploughing, Topdressing, and Burning of Paddocks:-

The view held that ploughing a paddock will destroy the infective parasites it harbours is entirely incorrect in the light of recent knowledge. It has been shown that after being turned in by six inches of soil they can regain the surface and remain alive for ten months or more, the loose soil of a ploughed paddock being more favourable than the hard surface of a permanent pasture where
they are exposed to rapid alternation of moist and dry conditions.

No actual experimental work has been carried out which shows the effect of liming and topdressing on the survival of parasites but the application of one ton of salt per acre to a pasture had no effect in reducing the soil infestation;

Although burning is not a practice to be recommended, if carried out with due respect to the seeding of grasses so as to prevent deterioration, it will destroy an infestation present. Paddocks left unstocked following a burn will prove invaluable for use by lambs and young sheep.

4. THE PART PLAYED BY MEDICINAL TREATMENT:

From time immemorial veterinarians have administered medicines in the treatment of disease and more recently they have advocated the ‘use of drenches in the control of parasitic diseases. However, without detracting too much from the efficacy of this measure, it is only of secondary importance in any scheme of control to protect hoggets from the ill-effects of the small intestinal worm. Although the blues tone and nicotine mixture is widespread in its use, its efficiency is low against the latter parasite and should be considered only a supplementary measure, to adequate nutrition. Also, the nicotine fraction makes the mixture a dangerous one where weak sheep are concerned. In addition, for satisfactory results, treatment should be commenced at weaning time and repeated every three weeks until the following spring.

The large stomach worm differs from the small intestinal parasite in that it is less refractory to the action of anthelmintics and can be effectively removed by drugs such as carbon tetrachloride, bluestone, and nicotine, and least of all tetrachlorethylene. Consequently medicinal treatment against this latter parasite should be considered, of primary importance.

Heavy expenditure by graziers on the purchase of drenches, often gives them a false sense of security, in that they rely—almost solely on the efficiency of the drench to control the parasites—with the result that hoggets die because the treatment does not remove the heavy rate of infection to which they are often exposed or compensate for the under-nourishment which lowers their resistance to the invading parasites.

5. PREVENTION OF PARASITIC DISEASES:

Already the importance of adequate nutrition and proper pasture management has been stressed as two important fundamentals in lowering mortality from internal parasites. Therefore, in this last section it is proposed to discuss some of the nutritional measures which can be adopted and to point out by what means the risk of parasitic infestation may be minimised.

(a) Pasture Improvement:

The advantages of pasture improvement far outweigh the disadvantages, and it is a very vital factor in controlling the effects of parasitism and in increasing production. It has offered the only solution in certain areas—ok New South Wales—where sheep-breeding has been considered impossible due to the effects of worms in young sheep. At times instead of increasing the carrying capacity gradually, pastures are merely because they are improved, are subjected to such stocking that they are completely eaten out and yet graziers appear resentful if it is suggested that sheep carried on such pastures are definitely under-nourished. Consequently for optimum benefits to be derived, both in respect of nutrition and Control of
internal parasites, a system of rotation, which makes it possible to
practise intensive stocking for a short period and then spell to
allow regeneration of the pasture, is ideal.

Resorting to sown pastures as a means of overcoming the
effects of parasitism, often results in one or two improved grass
paddocks becoming "hospital" paddocks, which are danger areas for
young sheep. For example, it is often the practice to have one or
two paddocks which are a good source of available feed and are
capable of heavy stocking. These are kept usually fairly continuously
stocked by sheep which are in an unsatisfactory condition—most
frequently as a result of parasitic infestation. As a result, they
become fairly heavily contaminated, and when ewes and lambs or
weaned ewes, already showing the effects of parasitic infestation, are
"put" into the paddock at a high rate of stocking, in the hope that the
extra feed will overcome the effects of the worms; instead of "picking
up" they die because the extra feed does not compensate for the mass
infestation, they receive. However, should the change over be made
during a dry spell the results would be beneficial due to the fact,
as previously pointed out, that dryness inhibits the development of
the parasite to a stage when it is a dangerous menace to the sheep.

Need for greater knowledge:—"It is necessary for sheep-
owners to realise that the greater the restriction of a grazing area
and the less selective feeding compulsory for the sheep, together
with an increased rate of stocking, the greater is the care and
intelligence required in the management of both pasture and sheep"—
such is the opinion of Dr. Clunies Ross, the leading authority on
parasitic diseases in Australia and now-appointed to the International,
Wool Secretariat in London.

Graziers differ in their opinions of the value of turnips
as a source of feed for hoggets. Some will state that losses did
not commence until the hoggets were "put on to turnips," others cannot
speak too highly of the excellent results they have obtained. For
my part I have had little experience of this method of farming and
cannot discuss the question very thoroughly, but results obtained in
England with sheep pastured on arable land may give some indication of
the possible cause of losses. It has been shown that two types
of losses occur on arable land. The first, or least important, is
due to sheep becoming infected from a heavy residual infection which
has survived in the soil from the previous season, and the second is
due to "auto-infection" where sheep infect the soil from their own
droppings and become re-infected. Although the first type of loss
can only be overcome by selecting new areas for ploughing, the second
can be overcome by allowing the sheep to graze only small areas at a
time, occupying one area no longer than a week and definitely not
allowing them to wander back over the already grazed portion.

(c) Handfeeding—"It is necessary for sheep-
owners to understand that the plane of nutrition plays such an important
part as it does in helping hoggets to resist the effects of the small
intestinal and stomach worms, feeding should be commenced early.
If hoggets are allowed to grow to the stage where they are definitely
weakened by the effects of the parasites which they harbour, hand
feeding will not prevent losses. Gradual loss of condition is the
first clinical sign of parasitic infestation and if pastures are
becoming bare, supplementary feeding should be commenced. Weak lambs
are preferably drafted off and kept separate from the more thrifty
ones and if the necessity arises, they can be put into bare yards with
a few old ewes and fed on dry feed, which, unfortunately, they often
refuse to eat. Where lambs have actually begun to die greater
difficulty will be experienced in checking further losses, especially
when there is an element of fear in the sheep. It is important that
sheep should be put into a situation in which they are not dependent
on handfeeding and may work for their feed. Shearing in August and
September can reduce the feeding requirements for lambs to the
extent of about one-third. Handfeeding lambs is expensive and so
should not be used unless it is absolutely necessary.
where lambs take time to become accustomed to artificial methods of feeding.

(d) Rotation of Stock:

The rotation of cattle, over twelve months of age, with sheep is very valuable, in that more suitable feed is provided for the latter as the coarse roughage, which tends to become dominant, is removed, allowing the more palatable grasses to survive. Horses actually do damage to a pasture, being selective feeders and for preference should not be rotated with sheep. Cattle further reduce the degree of infestation on the ground and are not a source of re-infestation, except in fluke areas.

(e) Danger Areas:

During dry spells, creek banks and river beds are often a source of heavy infestation because sheep tend to concentrate on these areas, which usually have a greater shoot, and so heavily contaminate the ground. Low-lying areas receiving drainage from hilly country provide green feed on which the whole of a flock may concentrate and provide very heavy contamination.

CONCLUSION:

Throughout this paper grasslands and grassland management has been kept well in the foreground and no attempt has been made to discuss other aspects of the stock parasite problem, such as symptoms, diagnosis and treatment. It is hoped that too such importance has not been placed on the question of nutrition, to the detriment of other aspects of control, such as medicinal treatment and methods of prophylaxis. Whereas the small intestinal and small and large stomach worms are responsible for the major proportion of losses from parasitic diseases, other parasites are at times responsible for mortalities and in these cases the skill of the veterinarian should be sought.

One cannot stress too strongly the close cooperation which should exist between the fields and Veterinary Divisions of any institution in order that sufficient light could be thrown on a problem which is of such economic importance to the country and to the individual.
DISCUSSION.

Dr. Hopkirk, Wellington, stressed the importance of nutrition in control of parasites and pointed out that the previous season had been an abnormal one in that although in many parts feed was available, it was of a soft, mushy type and unsuitable for sheep, in that there was not sufficient roughage for them to be able to chew their cud.

He further pointed out that sheep coming from hilly country where they are exposed to little or no infestation of parasites, on to plain country, have no immunity to parasites and frequently succumb to the heavy infestations to which they are exposed on improved country.

Mr. Dobson, Timaru, was pleased to hear how much the nutrition had been stressed and said that he himself had a good deal of experience of parasite trouble in Canterbury. From his experience, sheep weaned on to stubble paddocks frequently did better than those put on to rape. He wanted to know whether there was any explanation for this observation. He stressed, the fact that prevention was better than cure.

Mr. Smeaton pointed out that prior to weaning a farmer was advised by a local veterinarian to put his lambs suffering from parasites on to bare paddocks and dry feed. He did this, but the death rate practically doubled and he was at a loss to know what to do. In describing this incidence he was wondering whether the speaker could give him any explanation of the fact.

Mr. Stringer, Oamaru, stated that a North Otago farmer had some 300 hoggets of which 16 died, all being ewe lambs. He tried various drenches but they had no effect. He said that on post-mortem these lambs the wind-pipe was blocked by masses of long, white worms, and wished to know if these were Lungworms.

Dr. Hopkirk in briefly replying to questions which had been asked him pointed out that lambs should be weaned on to green grass paddocks which have been rested and could later be put on to rape. He further pointed out that in his opinion the excess of white clover in Canterbury was one of the attributing causes of the heavy infestation of parasites in lambs. In answer to one question, he pointed out that putting bluestone in drinking water was quite ineffective in controlling parasites.

He further stated that there was no difference in the resistance of ewe or wether lambs to the effects of parasitic infestation. However, whereas wether lambs can be fattened and sold in January or February, ewe lambs are carried over through the winter and succumb to parasitic infestation in late Autumn and early Winter.

Mr. Cole explained that there should be no difference in weaning lambs on to rape or stubble paddocks, provided both had been stocked previously with sheep. The effect of ploughing does not completely destroy all parasites present in the soil, but from experience, sheep weaned on to ploughed paddocks are exposed to less infestation than those weaned on to permanent pasture kept continually stocked with sheep.

It is very difficult to discuss the relative value of this procedure, without actually knowing the history of the paddocks concerned.

In reply to Mr. Smeaton the speaker pointed out that when lambs were allowed to get into very weak condition, frequently loss of appetite resulted and although hand fed, they
showed no inclination to eat. Where losses are experienced every year, lambs should be hand fed to a small extent before weaning so that should the necessity arise later, they do not take two or three days to become accustomed to dry feed.

Furthermore, bluestone and nicotine is the only drench with any efficiency against the parasites responsible for hogget mortality.

In regard to Mr. Stringer's remarks, although Lungworms are present in large numbers, frequently in lambs, it is usually found that these lambs have in addition a heavy infestation of the Black Scour parasite. While there is no medicinal treatment for Lungworms, treatment of sheep with bluestone and nicotine will remove a large percentage of the Black Scour parasites, increasing the resistance of the individual sheep and allowing it to throw off the infestation with Lungworms.