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Tuakura in this coming season we wanted to use in the team five yearling sons of proven sires. They have been selected in the way Mr. Ward has illustrated. To show that such cattle do exist today as a result of the efforts of Mr. Ward's team I may say that we were able to purchase one bull, a proved sire, with 33 daughters averaging 407 lb. butterfat. This bull was out of an "L.M.R." cow by a proven sire out of an "L.M.R." cow, and that cow was herself out of an "L.M.R." cow also by a proven sire. In that little bull there are three successive generations of Lifetime Merit cows on the female side - and two of those cows are still alive. The great-grandmother, at the age of 15, is this year producing 500 lb. butterfat. Five such bulls have been obtained, not without difficulty, I may say, but I am telling this merely to illustrate the fact that they do exist and that Mr. Ward is not talking about something completely Utopian at present.

DR. FILLER: We have had an excellent paper to start our conference, and if we keep up to that standard we will be breaking records this year. I express appreciation to Mr. Ward not only for his paper but also for the work his team is doing and the wonderful lead it gives us in attacking disease problems. Figures like those he has given show where the sore places are and what to go out after. They have been challenged from time to time, but Mr. Ward has checked them so thoroughly that when he gives figures they can be accepted as correct. He has thrown out a challenge to the veterinary profession this morning in no uncertain terms, and we have to take that up. These figures will continue to be collected and I take it that as our Veterinary Clubs become more numerous and we have more veterinarians in the dairying districts, we will see the culling rate coming down and the lifetime of the cow going up by the two years Mr. Ward has suggested. We want similar data in the sheep industry, and I suggest to those engaged in it that they consider if it is not well worth while spending money in getting similar data so that they, too, will know the weak points in their industry, where it can be strengthened, and where help is most needed from veterinarians and others.

#### ECONOMIC IMPORTANCE OF SHEEP DISEASES IN NEW ZEALAND

by  
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STOCK DIVISION.

Some people say figures cannot lie. Others say figures can be made to fit any argument.

In attempting to reduce sheep losses due to disease to a matter of pounds, shillings and pence, or to cold figures, one is largely obliged to rely on guesswork. Two sources of information were open to me. Mr. Paton of the Statistical Section of the Department of Agriculture has kindly supplied me with figures, based on the sheep returns and slaughtering figures, from which it appears that there is a discrepancy each year between the number of sheep which should be present (potential flock) indicated by lambs tailed, plus sheep shorn, plus sheep and lambs slaughtered up to the 30th April, and the number actually shown in sheep returns at the 30th April, of approximately 2½ million, which represents mortalities.

An alternative estimate has been made from figures supplied by the District Superintendents of the Live-Stock Division in the four districts as to mortalities from certain specific diseases. During 1938-39 an extensive survey was made of the disease position. In the Wellington district the method adopted was to take a number of representative farms in each county area, obtain from the farmer as accurate as possible a figure for losses due to the various diseases, and with the figure for his total

flock and the county total to arrive at some approximate idea of the total wastage. On this basis the total annual loss in sheep is somewhat like a million less than Mr. Paton's figures show. At the end of this paper is an attempt to summarise losses as calculated on the second method. I do not pretend to defend or justify either estimate. The percentages suggested for various disease losses may be too low; there may be other sources of leakage; the discrepancies in sheep returns may possibly be capable of other explanation.

I am satisfied, however, that the loss is not less than one and a half million - about 5 per cent.

The incidence of the different diseases varies with the following partly-related factors: Class of country; type of sheep carried; type of farming; density of stock per acre; nature of season; rainfall; width of gap between maximum and minimum food-supply in each year; labour available for routine shepherding work.

Certain types of disease loss are heavier on better country, or at least on this country greater precautions and better farming are called for to avoid them. On good country, stocking per acre is heavier, parasitic contamination of pasture greater, breeding ewes tend to get fatter in the summer, and have less call on them to take plenty of exercise.

It is proposed now to discuss briefly the following disease losses. Deaths in lambs at birth and prior to tailing: No figure is available for this, but an estimate of 5 per cent. of all lambs born is not unreasonable, made up of stillborn lambs, those dying through difficult parturition, mismothering, climatic conditions, early cases of arthritis, pulpy kidney, etc. Experience shows that careful shepherding will reduce these losses. Where the shepherd can get round twice a day, instead of only once, many lambs can be saved. Better nutrition of the ewe prior to lambing reduces the number of stillborn lambs. (Incidentally no account has been taken here of loss due to barren ewes.) Injury to ewes' teats during shearing may account for a percentage of lambs failing to get milk.

Loss between docking and 30th April (sheep returns): The chief causes are:-

Enterotoxemia (Fulpy Kidney): This is a bacterial disease. The multiplication of the organism in the intestine, with the formation of toxin, is favoured by full feeding of the lamb. It is commoner in good seasons, when the ewes have abundance of milk-producing food, and will occur more often in single lambs than in twins. While regarded in New Zealand as a disease of the young lamb, cases occurring chiefly in lambs between 3 and 6 weeks old, it may occur in weaned lambs on rape, and sometimes in older sheep. Control is by vaccination of the pregnant ewe, where a high annual incidence may be expected, or by management, to slightly check milk production. It is probably commoner in some of the good Central Otago country, and incidence in unvaccinated flocks is 2-4 per cent. Approximately 1½ million c.cs. of vaccine was distributed in Otago-Southland in 1940-41 season, exclusive of proprietary vaccines.

Arthritis: Most cases are believed to be bacterial in origin. The incidence may be quite high in certain flocks, but the majority recover either completely or sufficiently to allow of their being fattened. There is some loss on works' returns due to a percentage being rejected for export. There is delay in fattening, indicated by the increase in incidence of arthritis in the lambs coming to the works towards the end of the season. Rejections for export amount to under .3 per cent. There is a belief that the use of the Burdizzo or similar bloodless castrator lessens the incidence.

Blood-poisoning following Docking: A group of infections due usually to malignant oedema, or blackleg organisms, either of which produce rapidly-fatal disease, more rarely to tetanus, occasionally to organisms causing spinal abscess, and paralysis. There is considerable controversy amongst sheepmen as to the respective values of different methods of docking, by the use of the knife, or the hot iron, and of bloodless castrators as against older methods. While cleanliness and care at time of operation are important, the avoidance of old yards and provision of clean ground for lambs immediately afterwards, appear to be the chief factors in control. Ewer found that blackleg infection might follow either the knife or the bloodless castrator method of operation; also that healing following the hot iron is slower.

Parasitic Diseases: Internal parasites are a minor cause of mortalities before weaning, but may be important as a cause of delayed fattening. Drenching of young lambs is frequently practised. After weaning the following diseases become important:-

Parasitic Gastro-enteritis of Lambs and Hoggets: This is due to one or several varieties of nematode worms present in the stomach and intestines, causing interference with digestive functions, anaemia and loss of condition. Mortality may be high. Most lambs carry a few of these worms without harm to health. An increase in the worm population to a stage when disease is set up may be expected on infected pastures which are heavily stocked without occasional spells to allow a big percentage of the infective larvae on the ground to die out, and in wet seasons when the moisture and increased soil cover favour the development and survival of the larvae. Dry seasons in general reduce the incidence. The general mortality rate is estimated in Otago at  $\frac{3}{4}$  to  $1\frac{1}{2}$  per cent; highest on improved high rainfall areas; unknown on hill-country runs. Canterbury - 5-10 per cent.; on some of the good country, 1-2 per cent. on higher country. Wellington, most serious in better-class country in Hawke's Bay, where about 3 per cent. of hoggets may die, in the Manawatu, Wairarapa and in Tanganui areas. Auckland varies between 1-2 per cent. An estimate of  $2\frac{1}{2}$  per cent. mortality for the Dominion has been taken.

Delayed fattening of many lambs which survive infestation must cause considerable economic loss.

The expenditure on vermicides, while no doubt a legitimate insurance, is likewise a charge against the industry due to disease. Under exceptional circumstances, considerable mortalities may occur in mature sheep. Control of disease due to internal parasites should be based on improved nutrition, proper rotation of grazing, and where possible alternate grazing with cattle. Under present conditions, however, routine drenching with efficient vermicides is an indispensable substitute for the perfect application of these measures.

Mortality in Breeding Ewes: A small but important group of troubles associated with pregnancy and parturition:-

Pregnancy Toxemia (ante-partum paralysis - sleepy sickness): A disease of management, though the factors are not always under the farmer's control. It appears to be due to a clogging of the liver by fat drawn from the body stores in the absence of sufficient ingested food, particularly carbohydrates. Though the pathology may be in dispute the circumstances under which it occurs are well-known - any sudden check in nutrition, due to over-stocking, holding a few days too long in a bare paddock, frosty spells, cutting back the grass, or wet weather leading to trampling of feed. Ewes which have become fat in the autumn are more liable than those which were poorer at that stage. On good Waikato fat lamb country East Coast ewes which have been on the property 18 months are always more subject to this complaint than those arriving just the previous autumn. Ewes carrying twins

are likewise more susceptible. Control measures, are to avoid unduly high condition in the autumn, maintain a steady food-supply, particularly in the final month of pregnancy, avoid sudden checks, and ensure a certain amount of regular exercise.

In a survey of 460 farms covering Patea, Rangitikei, and Horowhenua counties, good country carrying approximately 2½ million ewes, the death rate was estimated at 1.07 per cent; in seven counties of Southern Hawke's Bay, rather lighter and more hilly country, at .5 per cent. Mortalities may reach 5 per cent., or higher. An estimate of 17 per cent. is made for the Dominion.

Prolapse of the Vagina: (bearing trouble): This condition occurs within the two or three weeks prior to lambing (exceptional cases at various times after lambing), and appears to be associated with high condition, lack of exercise, conformation of ewe, twin lambs, but more particularly related to nature of feed, being more common following a mild autumn and winter, where there is a considerable amount of rough feed about. It does not appear to be so troublesome where cattle are carried in good proportion to sheep. It is by no means confined to the heavier flat country, but may be quite serious on undulating, moderately-hilly areas. In the above-quoted two areas mortality was in adverse ratio to pregnancy toxemia, being .72 per cent. in western areas and 2 per cent. in Southern Hawke's Bay.

Many treated cases recover, but mortalities of up to 4 or 5 per cent. are quite common. Control measures are not always effective, but should include proper control of rough feed by cattle, maintaining ewe in good active condition, without allowing a type of bulky food which will mechanically distend the paunch, and proper exercise. Attempts to drastically reduce the food-supply at this stage are quite likely to result in an outbreak of pregnancy toxemia.

Milk-fever, or acute hypocalcemia, occurs in certain districts and in certain seasons. It may be confused with pregnancy toxemia, since cases are seen just before lambing, but conditions of occurrence are slightly different, as usually the green-feed is coming away.

Failure to lamb, or infections such as blackleg or malignant oedema, following lambing, account for a considerable proportion of deaths. Blackleg can apparently be effectively prevented by vaccination.

#### Mortalities Common to all Sheep:

Apart from the above-mentioned causes, there is a fairly extensive list of fatal conditions, which can only be mentioned here, that may lead to heavy mortalities in individual flocks. Some are peculiar to certain localities or seasons. They include: Fly strike; infection by blackleg or malignant oedema, following dipping or shearing; losses following shearing from climatic causes; parasites in mature sheep; black disease in Hawke's Bay; ragwort and other poisonings; cobalt and copper deficiency; enzootic jaundice; snow losses in Otago and Canterbury.

Facial Eczema in certain seasons, such as 1938 when the losses ran to hundreds of thousands, may be a major disaster. In ordinary years the loss is insignificant. It is confined to the North Island, though a type of photosensitisation does occur in the South.

One or two other conditions, very seldom fatal but of considerable economic importance because of loss of condition and of time and labour consumed in their control, must be mentioned. Foot-rot is the chief of these. The incidence may vary from 20 to nearly 100 per cent. in bad flocks. Due to a specific infection, it can be eliminated by strict control methods, but in many cases it is merely kept in check, which requires regular inspec-

tion of the feet of the flock and regular treatment of all affected.

Contagious Ecthyma, or sore mouth, of lambs may give fattening lambs a serious check, and may affect older sheep. It is effectively controlled by vaccination.

Contagious Ophthalmia may be troublesome.

Caseous Lymphadenitis, primarily due to round infection by a specific organism, with chronic lesions in certain lymphatic glands, is a disease which apparently gives the farmer little concern, but becomes more important in meat inspection, as all carcasses showing lesions must be rejected for export. More common in the South Island, where in certain flocks it may affect up to 20 per cent. of older sheep, it is quite widely distributed. Incidence as found at freezing works is in the North Island, .33 of ewes, in the South Island, 5.7 of ewes and 1.3 of lambs.

Losses due to Condemnations at Freezing Works: This must be mentioned, but in comparison with the previous causes, is a very minor factor. During a twelve-month period, of 3,730,902 sheep killed, 54,916 were condemned, including 31,534 for emaciation - mainly old ewes sent in for boiling-down in South Island works, 3,659 for pleurisy, and 1,024 for lymphadenitis. Of 10,510,440 lambs, 4,265 were condemned, including 973 for pleurisy and 31 for lymphadenitis.

Comparison with other Countries: Little information as to the total cost of disease is available. In Great Britain the National Veterinary Association, after a survey covering 1,000 farms, estimated the loss from sheep disease due to the 10 principal diseases at just on one million pounds, the main items being parasitic gastro-enteritis, £300,000, and pulpy kidney disease. Sheep population was about 26 million, and it must be remembered that value per head is considerably higher than in New Zealand. In South Africa, with sheep population of 40 million, it was estimated that fly-strike alone cost the industry £1½ million.

#### Summary of Estimate of Losses and Monetary Significance.

(Based on 1939 sheep returns, showing 16,948,979 lambs tailed, breeding ewes, 19,960,299; total sheep, 31,897,091).

Estimated loss of lambs prior to 30th April,		
500,000 at 10/-	...	£250,000
Hogget mortality:		
3% of 6,190,000 = 185,700 @ 15/-	..	139,000
Ewe mortality:		
3% of 19,960,000 = 598,800 @ 30/-	.	898,200
Other mortalities:		
1½% of all sheep = 478,850 @ 20/-	.	478,850
TOTAL, excluding lambs before 30th April	1,263,350	£1,766,050

#### DISCUSSION ON MR. MARSHALL'S PAPER:

After congratulating the author of the paper, Mr. Armstrong mentioned that ewe mortalities had been given as 3% and the value of ewes at 30/-. As most of that 3% would be ewes with young lambs, the figure of 30/- could probably be doubled. Unborn lambs were also a loss. Had Mr. Marshall included this in the 30/-?

MR. MARSHALL: I quite agree with that. Mine was a very conservative estimate. I wanted to feel that I was not exaggerating in any way. The figure is probably higher; it could not be

put down as lower. There was no consideration given to the loss of the lambs.

DR. McMAHON: I want to stress the point that Mr. Marshall is also conservative in quoting only the actual deaths of sheep. When we have figures to cover the loss of production from various causes with sheep still remaining alive they will be even more startling than those for the losses through death itself. In the case of wool we have made an attempt to get some sort of approach to that in our wool survey work. In a total of something like 150,000 fleeces examined to date, we might find nearly half showing some sign of break, or, as described by the wool men, slightly tender, though not all of it is loss. We found that fleeces graded as sound weighed 10% heavier than fleeces reported as tender or worse. The total loss in actual wool production from that cause in our samples was something like 4%. That is a very considerable figure, but it is made greater by the fact that the affected fleeces are worth less to the manufacturer. He pays less for wool which is tender. We have made a rough calculation - it is tempting to make the calculations, the astronomical ones that occur in an industry producing in large volume - and we consider that the cost to the industry from breaks is something like £1,000,000 or £1,500,000 annually. We find that it is connected up fairly closely with pregnancy toxæmia, a qualitative thing that goes with quantitative sheep losses from that disease. I think that the break situation may be tied up in some way with sub-clinical cases of pregnancy toxæmia. I think the loss in the products of sheep which did not actually die is probably even more important than the loss from those which cease to live.

DR. CUNNINGHAM: I would like to add my congratulations to Mr. Marshall on his paper. He has brought out an important point that should be noted by the Society - that a number of diseases in sheep are controllable and have been controlled. Mr. Marshall has mentioned that some causing important losses are due to mismanagement or failure in management. He mentioned pregnancy toxæmia, which may be the fault of the farmer or due to circumstances not under his control. He also mentioned the big saving that may be made by proper shepherding and proper treatment of lambing ewes. A very considerable part of the losses that he has mentioned can be attributed to failure in that direction. The control of parasites is another thing of which the Society should take notice, and it should approach the control of sheep diseases from the management point of view and from the standpoint of existing knowledge.

Observing that foot-rot is probably one of the worst things the farmer has to contend with, Mr. Duncan asked whether Mr. Marshall, in the course of his survey, had come across anybody who had succeeded in eliminating it.

MR. MARSHALL: The survey was more on mortality, though figures on the incidence of foot-rot were collected. I do not know of any record of it being non-existent in any areas. The information regarding foot-rot was pretty scanty.

MR. CRAWFORD: Has Mr. Marshall any idea of the loss sterility causes in sheep in New Zealand? Were any of the still-born lambs known to be premature? In Poverty Bay there have been complaints of abortion.

MR. MARSHALL: I am afraid I have no accurate figure on the percentage of sterility in two-tooth ewes. It seems to vary from year to year. I would be only guessing if I stated a figure at all. In answer to the second part of the question, I would say that in some instances there are a certain number of premature stillborn lambs. What the percentage is I cannot say.

MR. HOWELL: In his paper Mr. Marshall gave losses due to parasitic troubles, and I take it that that is internal parasitic

troubles, in hoggets and lambs. The Canterbury figures - from 5 to 10% - are extremely high. Are they taken over the whole of Canterbury, including the hill country, or just on the arable lands where, of course, the farming is more intensive? If not, the losses are tremendously higher in Canterbury than anywhere else in the Dominion. Mr. Marshall also mentioned, as a control measure, that management had quite a lot to do in the controlling of parasitic trouble in hoggets and lambs. I was under the impression that the Canterbury farmers are fairly good managers, but, if that is an example, it does not look too good. Probably some explanation to the Canterbury farmers on methods of management would do a lot of good.

MR. MARSHALL: I think that the 5 to 10% I mentioned was actually on the good, heavy and intensively stocked country in the vicinity of Christchurch. I do not think that we attempted to give the incidence for the whole of Canterbury, except that on the higher country it is between 1 and 2%. I would not be prepared to work it out over a fair average of the sheep population of Canterbury. It is accepted that management does play a big part in the control of parasites, but I safeguarded myself by saying that some of the factors included in management are not always under the farmers' control. Climatic conditions may upset a management programme. A wet season may favour parasitic development and make unsuitable the food which would normally be suitable for the sheep. Where controls could be made it has been shown that when one group of sheep is fed slightly better than another - both being subject to the same exposure to infection - the better fed group is far less susceptible to parasites, so nutrition does play a big part in controlling them. The spelling of pastures for as short a time as three weeks results in the death of a large number of larvae that would otherwise be picked up by the lambs.

In reply to Mr. Goodall on a question concerning hydatids, Mr. Marshall said the complaint was not in the carcase but in the liver. It ran to a very high percentage. In some instances, well over 50% of livers were affected. Under present circumstances loss due to hydatids on the liver did not directly affect the farmer. He was paid the same whether hydatids was present or not.

DR. FILMER: Mr. Marshall has given us ample evidence that there are very heavy losses in the sheep industry and that the need for veterinary assistance there is probably just as great as in the dairy industry. Unfortunately, that has not been properly recognized yet in New Zealand. However, it is good to report that in Poverty Bay they have recognized it by employing a veterinarian. One would like to see other districts follow their example. In Australia, sheep graziers have been more ready to recognize the necessity for veterinary assistance than have the dairy farmers. Here the position is different and the graziers have been left in the background a little. I would emphasise the point that Mr. Marshall has given us ample evidence that we do need some organization that will collect data concerning losses in sheep. When Mr. Goddes was in New Zealand last year, he discussed with a prominent farmer the good work that Mr. Ward's team is doing for the dairy industry. The farmer said, "It costs a lot". "What does it cost?" asked Mr. Goddes. On being told the figure, his reply was, "That is sheer profiteering by the dairy industry". I pass that on to the sheep industry.