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The sheep measles control programme

Co-operative approach to control of a difficult disease

By J. White, Veterinary Surgeon
Department of Agriculture, Albany

In the first seven months of 1968 Australia exported to the United States 17,747 tons of boned mutton; of this 2,198 tons, or 12.4 per cent, was condemned on arrival in that country. This loss was valued at U.S. $1,538,600. Within this total, Western Australia exported 962 tons to suffer the condemnation of 212 tons, or 22 per cent.

The main cause of rejection was the presence of *Cysticercus ovis* cysts, the intermediate stage of the tapeworm *Taenia ovis*, of which the definitive host is the dog. The *C. ovis* cysts are usually fibrosed and calcified when found in meat.

The heavy rejections of 1968 gave rise to anxiety within the meat trade as to the future of sheep meat exports unless marked improvement could be achieved. The situation became critical in May 1970, when the U.S. banned all imports of Australian sheep meat, one of the main reasons for the decision being *C. ovis* cysts. In the parlance of meat hygiene these are classified as "pathological lesions".

The farm dog—key to the control of sheep measles

The inspection of carcases, which had been intensified earlier, was augmented by a substantial increase in inspectors on the mutton chains in meatworks killing sheep for export.

The U.S. exacts the highest standard of hygiene in the processing of the meat it imports, but it also pays the best prices. In this way it tends to set the pattern of world prices. Today, many countries, including those of the E.E.C. and the Middle East, are adopting similar standards for the meat they import.
The extra inspection of this meat by Australian Department of Agriculture and boning room staff, plus insurance costs to cover the risk of rejection, all add to the cost of processing this meat.

At the time of the U.S. ban the basic life cycle of *T. ovis* was well known, but more information was needed on many details important for any control scheme to be successful in preventing sheep acquiring cysts.

THE PROGRAMME

In 1969 the Western Australian Department of Agriculture decided to study the epidemiology of this disease. This was assisted by a grant from the Australian Meat Research Committee.

A veterinary surgeon was appointed in October, 1969, to carry out this study. He was based in Albany where first-hand knowledge could be obtained at Thomas Borthwick and Sons' meatworks. His instruction was to trace back to the farm of origin each line of sheep with an incidence of *C. ovis* of 3 per cent or over, and to investigate conditions on the farm which might favour the presence of *C. ovis* in the sheep.

Each farm within a selected area was visited to gather information about the size of the farm, soil type, rainfall, the stock carried, the number of dogs, how they were fed and what control was exercised over their movements. Further questions related to the presence of stray dogs and foxes, the feeding of offal and whether the dogs were treated regularly for tapeworms.

During the interview the opportunity was taken to explain to the farmer and his family the importance of *C. ovis* to the meat industry, and the life cycles of *C. ovis* and hydatids.

It became clear that few farmers had any knowledge of *C. ovis* although some, mainly from the Eastern States, knew of hydatids. Wives who had been nurses were also aware of hydatids.

With the owners' permission, the dogs were purged with arecoline and tapeworms recovered were sent to the Animal Health Laboratory for identification.

The life histories of adult sheep found to be infected at the abattoirs proved so variable that it was impossible to determine when they had become infected. It was therefore decided to concentrate investigation on lambs, which normally do not leave the farm until sold for slaughter.

The co-operation of the Australian Department of Agriculture and Messrs Thomas Borthwick and Sons was invited to record the prevalence of *C. ovis* in both lambs and sheep, with the name and address of the owners. This assistance was willingly given and continues to this day.

The objectives were to provide information as to the presence of *C. ovis* in the Albany area and to secure background data against which any future control scheme could be measured.

Mt Manypeaks scheme

It was also considered desirable to study a district with a large number of lamb producers in order to understand more fully the many inter-related factors which might influence the spread of infection. This included factors such as the siting of one farm house and yards relative to those of the neighbour and the importance of roads or bush as a barrier to the spread of infection.

The 32 farms selected formed a block surrounding the Manypeaks townsite, with a road as boundary for most of the area. All but two of the farms were engaged in lamb production, while 11 had dogs infected with *Taenia ovis*.

This seemed an excellent opportunity to institute a small control scheme which would further our knowledge on epidemiology and which, if successful, would provide good extension material for future control schemes. It would also help to show whether control on a co-operative basis was possible.

The veterinary officer visited all farms within the area and the previous procedure was repeated. The treatment with arecoline was repeated in three months and all farmers were issued with arecoline to treat their dogs every two months.

The farmers were told what tapeworms were found and how many of their lambs at slaughter had cysts. The time spent on farms waiting for dogs to purge was used to discuss with farmers all the details of the scheme. This helped to cement a good working relationship with the farmer and aroused in many an interest at being involved in a scheme.
which was unique in Australia at that time.

Throughout this period emphasis was laid on dog feeding and the need to prevent infections of the dog by making it impossible for it to obtain raw meat or offal. It was difficult to convince farmers that treatment alone would always leave loopholes for a breakdown.

This was not unexpected. The modern Australian community at large rates hygiene a poor second to drugs.

Abattoir results for Manypeaks

By September 1970, figures became available for the last five months' killings of the 1969 crop of lambs. The figure of 6.9 per cent of lambs infected with *C. ovis* was high.

As will be seen in the Table there was considerable improvement in the two succeeding years, to be followed by a setback in 1972 but with a good average in the 1973 lambs.

### *C. ovis* infection of lambs—Mt. Manypeaks trial.

<table>
<thead>
<tr>
<th>Year of birth</th>
<th>Total examined</th>
<th>Total infected</th>
<th>% infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>2 188</td>
<td>153</td>
<td>6.99</td>
</tr>
<tr>
<td>1970</td>
<td>9 628</td>
<td>274</td>
<td>2.84</td>
</tr>
<tr>
<td>1971</td>
<td>8 549</td>
<td>41</td>
<td>0.48</td>
</tr>
<tr>
<td>1972</td>
<td>2 906</td>
<td>51</td>
<td>1.75</td>
</tr>
<tr>
<td>1973</td>
<td>5 274</td>
<td>17</td>
<td>0.32</td>
</tr>
<tr>
<td>1974</td>
<td>7 535</td>
<td>16</td>
<td>0.21</td>
</tr>
</tbody>
</table>

The lapse in 1972 showed how easily control can break down. The worst incident was almost certainly due to one farm's adoption of a stray dog, although it was not possible to prove this because the dog had been treated by the time the infection in the lambs was discovered. In another case, the farmer had agisted lambs to an outside property where no precautions were being observed.

Among the 1970 results were those from the two farms which in 1969 showed heavy infection but were now free of infection. This was the first indication that eggs do not survive for long on the pasture. On other farms, levels of infection had been markedly reduced.

These findings suggested the main source of infection was the farm dog, in which it should be possible to control *T. ovis*. They also suggested that dead sheep in the paddocks did not constitute the menace previously believed, since few of the farmers had changed their method of carcass disposal.

Towards the end of 1971 all the dogs at Manypeaks were again purged with arecoline and on this occasion only one *T. ovis* was found, in a young puppy acquired from outside the area.

Still later, in 1973, the only tape-worms found in a further purge were one *Taenia hydatigena*, the adult stage of the bladder worm and two *Taenia pisiformis*, the cystic stage of which is found in rabbits.

### The operation expanded

In view of the Manypeaks results it was decided early in 1971 to expand the operation to an area of 100 km east to west and 50 km north to south, but retaining Manypeaks as an experimental unit.

A stock inspector was appointed to work steadily through the area interviewing every dog owner and seeking co-operation. This interview closely followed the lines of the previous ones. A modified questionnaire was used and the farmer was instructed on dog feeding and offal disposal.

Searching for cysts in an Albany meatworks. Co-operation of the meatworks and the Australian Department of Agriculture allowed the prevalence of cysts to be recorded

At this time bunamidine, a more efficient taeniacide than arecoline, was adopted for treatment of dogs. All owners throughout the area, including Manypeaks, were provided with enough tablets to treat their dogs every second month.

By mid-1972 the whole of the new area had been covered by personal interview.

### Abattoir survey

While this field work was being undertaken information was being collected in the abattoir to determine how many cysts escaped detection in the course of routine inspection.

In a survey involving 100 000 carcasses which had passed normal inspection 10 cysts per 100 carcasses were found during boning and checking of the meat. In 8 000 carcasses which had been rejected because *C. ovis* had been detected, 24 cysts per 100 carcasses were found during boning. Carcasses which had passed inspection and which were further examined by thin slicing of the meat revealed up to 20 per cent with cysts.

It became clear that any manual examination method sufficiently thorough to detect all cysts would render the meat unsaleable, as well as being uneconomic because of the labour involved. In adult sheep almost all cysts detected were dead. However, in a sample of 600 cyst-
infected lamb hearts, 30 apparently viable cysts were found.

Another important finding from the abattoir studies was the very heavy infections of *Cysticercus tenuicollis*, or bladder worm, which were found in all classes of sheep. They were most noticeable in lambs of four to five months. These are the cystic stage of the tapeworm *Taenia hydatigena* which is a frequent parasite of the dog and can only be acquired by eating raw offal containing *C. tenuicollis* cysts.

**Offal disposal problem**
The frequency of infection in the sheep made it clear that dogs everywhere had access to raw offal arising from the home killing of sheep. Enquiry on farms confirmed that offal disposal was very haphazard, allowing ample opportunity for the farmer’s own dog, or outside dogs, to eat it. Raw offal may carry cysts of *C. ovis* and hydatid as well as *C. tenuicollis* so it was important that methods of disposal should be improved.

Safe offal disposal is a difficult problem. Offal pits are useful in some areas but too often are not suitable because of rocky subsoil or a high winter watertable. Incinerators are satisfactory and can be used for most of the year if fitted with spark arrestors, but many farmers consider them too expensive.

Investigations showed a cheap and satisfactory method of disposal is to place the offal in a heavy duty polythene bag such as an old fertiliser bag, tie the neck and hang it out of the reach of dogs for two weeks.

**THREE SHIRE CONTROL PROGRAMME**
In the autumn of 1972, officers of the Department of Agriculture and the Shire Clerks of Albany, Denmark and Plantagenet Shires discussed the possibility of linking the sheep measles programme with the annual registration of dogs. At that time few dogs were registered. The need for sheep measles control was explained to shire councils, which agreed to co-operate by enforcing registration.

This gave an accurate assessment of the dog population and made possible the distribution, at the time of registration, of literature explaining the programme and of drugs for the treatment of the dog to cover a period of one year. The drugs were issued free to the farmer, their cost being shared equally by the Shires and the Department.

In practice it was found essential for the Shire to make this work the responsibility of one person and to provide a vehicle to visit farms where no dog had been registered.

As a result of the co-operative venture, in 1972-73 2,000 dogs were registered against a previous figure of about 100.

In 1974, State finances were under pressure and the Shires found it difficult to finance this work; in consequence registrations have fallen off considerably.

**Extension campaign**
Extension was mainly undertaken by Department of Agriculture officers and a variety of media were used including television, commercial radio (including paid advertisements), the local and national press as well as the farming press. The media gave excellent co-operation in the campaign.

Every opportunity was taken to address field days, farmers groups, Apex meetings and to hold demonstrations at meat works.

A collection of coloured slides was prepared showing the various cysticerci found in sheep, the problem in the abattoir and the means of control. A written script accompanied the slides so that a layman could show them at meetings in country halls. To simplify the demonstrator’s task a folder posing various questions commonly asked at meetings was prepared with the requisite answers.

Another device was a series of four cartoons depicting the adventures of the dog “Ambrose”, each carrying a message on the control of *C. ovis*. These were exhibited in stores, hotels and even a doctor’s surgery, which was rated the best site in a subsequent survey. All these were used to supplement the many personal interviews.

A warning service was instituted in which every farmer sending infected sheep into the Albany abattoir was sent a letter informing him that his sheep were infected and outlining the methods of control he should employ. The letter was repeated in slightly different form a year later.

The effectiveness of the programme was to be monitored by
From the farmer’s point of view, three main points arise:

- He must be convinced that control is possible provided he and his neighbours observe the rules.
- He must be told of the disease conditions found in his sheep whenever trace back is possible.
- There must be a financial incentive, in the form of a bonus or deterrent, to justify the extra labour and expense in applying control measures.

**RESEARCH**

While research was not a major aim in the programme, collaborative work with research workers at the University of Melbourne Veterinary School commenced in 1974 at Mt Barker was highly satisfactory because of the unique knowledge of flock cyst history in the Albany district. The work involved study of:

- use of a vaccine to protect lambs against infection,
- susceptibility of previously infected lambs when re-challenged compared with non-infected lambs,
- whether *T. ovis* eggs spread from heavily infected pasture to adjacent pastures without the aid of man or animals, and
- how long *T. ovis* eggs on pastures remain infective.

The trial showed that the vaccine significantly decreased the infection acquired by lambs when challenged. Previous natural infection also decreased the infection acquired, while previously non-infected unvaccinated lambs were very susceptible. Eggs did spread more than 50 metres and did not appear to be infective for more than seven weeks in spring-early summer.

Further trials are planned but at this stage a vaccine does not appear to be a potentially practical means of controlling the disease.

**The fox**

At the beginning of the Manypeaks trial there was still some doubt as to the significance of the fox as a host of *T. ovis*.

Early work in N.S.W. on a small sample of foxes had suggested that they were often infected and might well play an important role in the infection of sheep. This view was held despite the fact that *C. ovis* was common in sheep in Tasmania and New Zealand, where there are no foxes.

Recent investigations in N.S.W. and Victoria in which over 2,000 foxes were examined, and no tapeworms were found, as well as local experience in W.A. that lamb cyst infection is related to dog tapeworm infestation, have now made it clear that the fox is not involved.

**A reward?**

At present the reward to the farmer who does take care to produce sheep and lambs free of infection is more moral than real. Human nature being what it is, some financial incentive appears to be essential if real progress is to be made.

The results of these investigations, trials and research indicate that the control of sheep measles is well within our capacity if farmers and other dog owners feed their dogs only on food which is safe, and prevent dogs having access to raw meat and offal.

**ACKNOWLEDGMENTS**

Thanks are made to the Australian Meat Research Committee, Australian Department of Agriculture, Messrs Thomas Borthwick and Sons, Public Health Departments at Midland and Robbs Jetty abattoirs, to Geoffrey de Chanet, Robert Townsend, Bruce Boddington and particularly to the farmers of Manypeaks for their help in this work. Councillors and officers of the Shires of Albany, Denmark and Plantagenet made possible the unique “Three Shire” control programme.

The *C. ovis* project was initiated by Dr M. R. Gardiner, Chief of the Department of Agriculture's Animal Division.