The southern salmonella survey – 2015/16

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Introduction

The first reported case of enteric Salmonellosis in sheep in New Zealand was in 1949. Salmonella serovar typhimurium was isolated for the first time in 1958, from a scouring ewe (Salisbury 1958). Currently, 127 different serovars have been identified in New Zealand (Clark et al. 2002). The most important to farmers pre-1996, were S. Hindmarsh (mostly in sheep) and S. Typhimurium (more commonly in cattle). These serovars normally cause enteric disease; and the occasional abortion. A new serovar, S. Brandenburg, emerged in 1996. This caused severe abortion storms and many ewe deaths in Canterbury, Southland and Otago.

During the years 1998 to 2007 there were very few, if any, S. Hindmarsh cases reported in sheep flocks. However, since 2008, there has been a consistent annual increase in cases associated with S. Hindmarsh; a large proportion of which are from Otago and Southland. The same trend has not been observed in the east coast of the North Island. This may be due to declining ewe numbers since the 2007 Hawkes Bay drought, and reduced periods of ‘risky’ mob stocking (R.Hilson, pers comm). In the Wairarapa, cases still occur from December to July; however it is suspected that many are not reported (S. Bruere, pers comm).

In November 2015, in collaboration with five veterinary clinics in Southland and South Otago, a short survey was sent via post (1400) or email (380) to farmers. The survey asked about ewe numbers, vaccination practices, other farm management factors, and whether any outbreaks of Salmonellosis had occurred in the prior season.

Response rate

A disappointingly low number (167) of useable surveys were returned. Due to the poor return rate, no formal statistical analysis was performed; rather summary data and my observations are presented. It was expected that the majority of respondents would be farmers with a recent farm history of disease, and/or an existing vaccination programme. As shown in Figure 1, this was not the case. This indicates a significant general interest in the disease.

Basic farm information

**Ewe numbers**: A total of 278,994 ewes: 60% (169,137) mixed age (MA), 27% (74,270) two-teeths (2T). The age of 13% was not specified, these were recorded as a simple total.

**Lambing dates**: The distribution of lambing dates was typical of the Otago/Southland area (Figure 2). In most cases, farmers try to match lambing date with grass supply, as harsh winters and springs can often mean little or no pasture growth until late September.

**Breed of ewes**: Romney and Romney Cross breeds dominated the sample (Figure 3).

**Scanning percentage**: The mean scanning percentage was 178% and ranged from 134% to 210% (n=49). As triplets were not always identified, the potential lamb crop would be underestimated.
**Vaccination:** Mob usage of sheep performance vaccines (Toxoplasma, Campylobacter and Salmonella) was collected. The results were considered typical. Most farmers use Toxovax® in their prior to mating in either maiden hoggets or two-tooths (Figure 5).

There was a large variation in Campylobacter vaccination programmes between farms (Figure 6).

Most (80%) farmers do not currently vaccinate against Salmonella (Figure 7). Sixty (60%) however, had historically, vaccinated their two-tooth ewe mobs, but not given an annual booster. Usage has drastically declined over the last 15 years. Timing of vaccination also varied greatly between farms.

![Figure 1. Total number of valid surveys, including those that either use Salvexin+B (red) and/or recorded Salmonellosis](image1)

![Figure 2. Reported start of lambing](image2)

**Salmonellosis outbreaks**

Fifty seven (57) suspected outbreaks of Salmonellosis (24 enteric and 33 reproductive) were reported. Most reported occurred in the 2015/16 season as requested, however some farmers reported outbreaks from the previous season (2014/2015). Some reported both enteric and reproductive disease in the same season.

Most (46/57) outbreaks were farmer diagnosed, with only three enteric and eight reproductive outbreaks being confirmed by post mortem and culture. While both diseases demonstrate classic symptoms, farmers will misdiagnose, over diagnose and miss cases. This potential misclassification must be considered in the interpretation of
these data. Outbreaks appeared geographically clustered. Positive explanations include common risk factors raised awareness.

![Breed of ewes](image)

**Figure 3.** Breed of ewes

The first of the 33 reported abortion outbreaks occurred on 15 July, the last on 1 October. This is similar to previous years (John Gill, pers comm), and reflects that abortions normally occur during the last six weeks of pregnancy. There was however no correlation observed between calendar date and abortion.

The duration of individual outbreaks, calculated from the first reported abortion to the last, ranged from 9 to 62 days. Most outbreaks were between 14 to 28 days.

The daily abortion incidence ranged from 1 to 10 per day.

**Salmonella Brandenburg outbreaks**

![Flock scanning percentage](image)

**Figure 4.** Flock scanning percentage

![Toxovax usage](image)

**Figure 5.** Toxovax usage
S. Brandenburg: Ewes abortion and mortality

There was large between farm variability. The proportion of a flock (not mob, as this data was not available) reported to abort ranged from 1 to 10% with a mean of 3.3% (Figure 9).

The proportion of ewe deaths attributed to S. Brandenburg within a flock averaged 2.1% and ranged from 0 to 7% (Figure 9). Four cases farms were excluded as flock size was not reported. Of the ewes that abort in an outbreak, on average 59% die, but mortality ranged from zero to almost 100%.

Overall a total of 2,136 ewes aborted of which 64% (1,364) died. The number of lambs lost was estimated at 3,204.

This illustrates the considerable loss associated with this disease. The total cost of major outbreaks was estimated to range from $18,000 to $33,000 (Table 1). Clark et al. (2014) discussed the ‘Cost of Ovine Salmonellosis’. The paper estimated the cost to the Otago/Southland region of S. Brandenburg abortions alone was around $4.6 million per year.

Of major concern, from a disease surveillance and management was in failure of farmers to notify veterinary clinics of outbreaks.

**Figure 6.** Campyvax 4 usage

**Figure 7.** Salvexin+B usage
Figure 8. Location of *Salmonella* outbreak reported with location able to be identified

![Image](image_url)

Figure 9. Within flock incidence of disease and deaths due to *S. Brandenburg*

![Image](image_url)

Figure 10. Total number of ewes that aborted or died. Farms 1, 5, 15, 24 & 26 had some history of vaccination

![Image](image_url)

<table>
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<th>Farm ID #</th>
<th>Total MA ewes</th>
<th>Total 2T ewes</th>
<th>Vacc</th>
<th>Total sick/aborted</th>
<th>Total died</th>
<th>Expected Lambing %</th>
<th>Value of dead lambs*</th>
<th>Value of dead ewes*</th>
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*Based on ewes valued at $200, lambs valued $85

Table 1. Costs of a severe outbreak
Risk factors
Subjectively, no association was seen between disease and break feeding, back fencing, feeding crops, or feeding balage/hay.

Of the farmers who had abortions, only 4/33 said their neighbours had also suffered abortions in their flock. Many commented that it had been a very tough, wet, cold winter and ewes were in relatively poor condition. Most respondents also reported that spreading out ewes at the time of abortions helped slow the outbreak. No farmers chose to vaccinate in the face of the outbreak. Note, vaccinating in the face of a Salmonella abortion outbreak is not a label recommendation, due to the stress and inappetence associated with yarding, and late pregnancy use of a Gram negative vaccine.

The protective effect of vaccination was impossible to assess due to the low sample size. Of the 33 case farms, five had a history of vaccine use. Three of which only vaccinated the two-tooths.

Enteric salmonella outbreaks
Twenty four outbreaks of enteric Salmonella were reported, on 20 farms. Two outbreaks were in two-tooth ewes only, 11 were in MA ewes only, and the remaining 11 were in both age groups, usually with one age group following on from the other.

On five farms there were two distinct outbreaks. These outbreaks have been recorded separately. In Figures 12 and 13, these are labelled 1 and 13, 2 and 14, 3 and 15, 4 and 16; and 7 and 17. Given the epidemiology of Salmonella, these outbreaks are probably linked.

Outbreaks occurred between December and June, with an autumn peak (Figure 11), the duration of outbreaks ranged from five to 39 days and averaged 18 days. Only one of the farms with enteric Salmonellosis had previously used Salvexin+B – in the two-tooths only.

S. Hindmarsh morbidity/mortality – incidence in flocks
The reported mean incidence of flock enteric disease was 2% (range <1 to 6%). Mean mortality was 1.5% (range 0 to 4.5%, Figure 12). The within-flock incidence of enteric Salmonellosis was therefore lower than S. Brandenburg. In total farmers classed 1,326 ewes as sick, of those 78% (1,033 died). The average farm-level mortality was 79% (range 40 to 100%, Figure 13). This is a higher mortality rate than in abortion cases.

Vaccination in the face of an outbreak
Thirteen farmers (65%) vaccinated with Salvexin+B in the face of an outbreak. The average time elapsed between the start of the outbreak to vaccination was nine days (range 2 to 18 days). This may reflect the time from the vet being called to the results being returned to the farmer.

Farmer’s comments about the effectiveness of vaccination varied, with some saying it ‘stopped it immediately’ and others saying it ‘took a week to make any difference’. However, in general the comments were positive.

In most cases farmers did not give a booster vaccination to the affected ewes, meaning that in subsequent seasons a full vaccination course may be required for protection.
Six farmers did contact their vet to discuss their losses, and most of this group went on to vaccinate in the face of the outbreak without laboratory confirmation.

The challenge for vets working with these farmers is to explain the effect that this ‘sensitiser’ shot has and the need for a booster and then a follow up annual booster!

![Figure 11. S. Hindmarsh start date of outbreak, by month](image)

![Figure 12. Within flock incidence of disease and deaths due to enteric Salmonellosis](image)

**Human health risk**

Table 2 presents ESR data on reported human *Salmonella* cases from 2008–2015. There are a number of cases of *S. Brandenburg* in humans. While not shown, most cases are in the Otago/Southland region. The incidence peaks in August, September and October, when over half the annual cases occur.

Between 1984 and 1997 there were very few cases of *S. Brandenburg* in humans (Smart 1999) but this changed dramatically in 1999, with the diagnosis of around 170 cases. All cases were suspected to have work-related (i.e. farmers or abattoir staff) exposure.
Comments

It is suggested by many veterinarians experienced in both enteric and abortive *Salmonella* outbreaks that the increased number of cases of this more ‘traditional’ Salmonellosis is an indicator that overall sheep population protection is waning. Especially in the lower South Island, flocks are now vulnerable to both forms of disease – enteric Salmonellosis (*S. Hindmarsh*) between late summer and late winter, and abortion losses (*S. Brandenburg*) during late pregnancy. It is thought the majority of properties which had *S. Hindmarsh* in the autumn did not have any abortions in the spring; however this majority had vaccinated with Salvexin+B as a result of the previous outbreaks in the autumn.

Since 1998, laboratory diagnosed cases of *S. Brandenburg* peaked in 2000 and again in 2005/06. This cyclical pattern is typical of a disease like *S. Brandenburg* as it is endemic in the sheep population.

Since the peak of 2005/06 we appear to be ‘at the bottom of the trough’ again. However, *S. Brandenburg* has not gone away, and there is no cause for complacency. Salvexin+B, the vaccine used to protect ewes against abortions and deaths in late pregnancy from *S. Brandenburg*, also protects against the *Salmonella* species that cause the enteric form of the disease. However, vaccine usage has steadily declined over the last 10 years. This decline, coupled with the reduced recent exposure to the disease and culling of previously exposed sheep, and the introduction of naïve replacements, means the overall sheep population immunity to all *Salmonella* organisms will be low.
Vaccination strategies

Vaccination strategies differ depending on which form of disease is of most concern. There is a lot of further work that needs to be completed to refine and improve our knowledge. However, current best-practice recommendations are outlined below:

**Enteric disease:** Vaccination from weaning onwards. Replacements or sheep not previously vaccinated need a Salvexin+B sensitiser and booster four to six weeks apart. An annual booster is recommended but not always given, and this booster should occur a few weeks before the ‘risk period’ of disease. Vaccination in the face of disease can give some protection providing it is early in the outbreak and risk factors are taken into account, e.g. reduction in stocking density. The difficulty arises when the risk period for *S. Hindmarsh* seems to now be from January to September!

**Brandenburg disease:** Vaccination in early pregnancy prior to the risk of disease. Sheep not previously vaccinated require a sensitiser and booster and an annual booster is recommended (as per the Salvexin+B label). Vaccination in the face of disease is problematic and the stress of yarding for vaccination may result in a rapid escalation of disease. The decision to vaccinate must be on an individual farm basis and must take all risk factors into account.

**Rams** should not be forgotten. Enteric disease often occurs at the time of mating. Transmission is faecal-oral, observation of rams leaves one in no doubt they are at great risk. The minor risk of a slight temperature spike after vaccination is likely to be less than the risk of a sick or dead ram. It is very difficult for rams to get any ewes pregnant when they are sick, or dead!

As discussed elsewhere (Clarke *et al.* 1999), vaccination against *S. Brandenburg* may be a factor in the reduction in enteric Salmonellosis reported in Otago and Southland from the late 1990s onward.

Further work is needed to investigate this fully, and it appears a farmer survey is not specific enough to gain this information.
References

For formatting purposes, all original long URLs have been condensed using the bit.ly format.

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