

Update on anthelmintic resistance



Phil McKenna, from Gribbles Veterinary in Palmerston North, reports.

THIS REPORT IS a continuation of regular updates to keep the veterinary profession informed about any changes in the prevalence of anthelmintic resistance in New Zealand sheep. It is based on an examination and analysis of case submissions to Gribbles Veterinary laboratories for fully differentiated faecal egg count reduction tests (FECRTs) from the period January 2016 to July 2017.

Only those cases that specified the identities of the anthelmintics under test and involved ≥ 10 animals per treatment group with arithmetic mean pre-treatment strongylid (excluding *Nematodirus*) faecal egg counts (FECs) of at least 150 eggs per gram (epg) of faeces, were included. The occurrence of *Nematodirus* infection was established by the presence of their eggs. The occurrences and identities of worm genera other than *Nematodirus* were determined by examination of third-stage larvae recovered from pooled larval cultures, although no effort was made to differentiate between the infective larvae of *Oesophagostomum* and *Chabertia*. Pooled larval cultures were undertaken on all pre-treatment faecal samples and on those groups of post-treatment samples in which any positive FECs were recorded. These pooled samples were incubated at 27°C for seven days before larval recovery and identification. The percentage generic composition of the cultures, as determined from a random examination of 100 larvae (or all when fewer than these were recovered), was then used to calculate the group mean FECs and FECRs for the individual nematode genera represented in each case. For each individual parasite

FIGURE 1: Frequency of anthelmintic resistance according to drench type

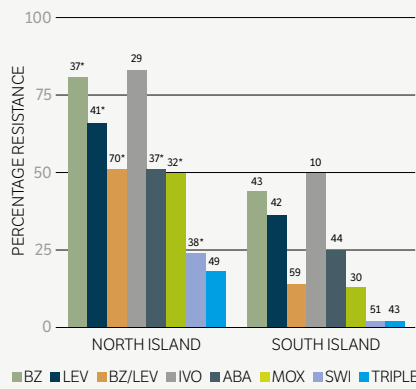
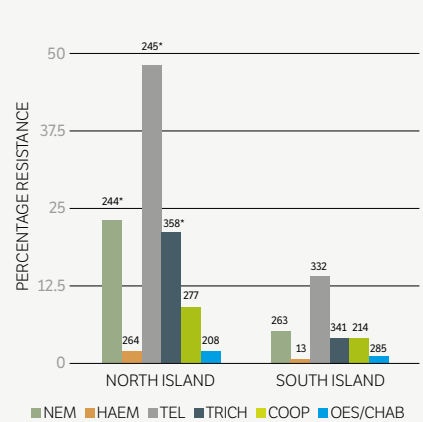


FIGURE 2: Frequency of anthelmintic resistance according to parasite genus



FIGURES 1 AND 2: Prevalence of resistance to anthelmintics recorded in sheep FECRTs submitted to Gribbles Veterinary laboratories during 2016-17. Numbers at the top of columns represent number of valid tests carried out with each anthelmintic or parasite genus whereas the presence of an asterisk indicates a statistically significant difference in the prevalence of resistance between the two islands ($p < 0.05$, Yate's corrected Chi square test). BZ = benzimidazole, LEV = levamisole, BZ/LEV = benzimidazole-levamisole combination, IVO = ivermectin, ABA = abamectin, MOX = moxidectin, SWI = levamisole-abamectin combination, TRIPLE = benzimidazole-levamisole-abamectin combination. NEM = *Nematodirus*, HAEM = *Haemonchus*, TEL = *Teladorsagia*, TRICH = *Trichostrongylus*, COOP = *Cooperia*, OES/CHAB = *Oesophagostomum/Chabertia*.

genus (including *Nematodirus*), an arithmetic mean pre-treatment FEC qualifying criterion of at least 50 epg was applied, with resistant genera being identified as those where anthelmintic treatment failed to reduce their pre-treatment egg counts by at least 95%.

The results of these analyses, which were based on a total of 77 case

submissions from the North Island and 64 from the South Island involving the testing of between one and eight anthelmintics on each occasion, are presented in Table 1. The numbers and geographical divisions of these cases were similar to those recorded in the 2014-15 update (McKenna 2016), as were the general patterns of anthelmintic resistance they revealed. Thus, as in the

TABLE 1: The prevalence of anthelmintic resistance identified in sheep nematodes by fully differentiated faecal egg count reduction tests (FECRTs) undertaken on case submissions to Gribbles Veterinary laboratories during 2016-17 (n = 141).

PREVALENCE OF RESISTANCE ^a											
Parasite	Single active anthelmintics						Combination anthelmintics				
	BZ	LEV	IVO	ABA	MOX	MONE	BZ/LEV	LEV/ABA	DERQ/ABA	BZ/LEV/ABA	ANY DRENCH
<i>Nematodirus</i>	32/57 (56%)	12/59 (20%)	1/26 (4%)	0/62 (0%)	3/48 (6%)	0/19 (0%)	19/90 (21%)	0/63 (0%)	0/19 (0%)	1/64 (2%)	68/507 (13%)
<i>Haemonchus</i>	5/32 (16%)	0/32 (0%)	0/23 (0%)	0/27 (0%)	0/21 (0%)	0/11 (0%)	0/54 (0%)	0/30 (0%)	0/10 (0%)	0/37 (0%)	5/277 (2%)
<i>Teladorsagia</i>	32/68 (47%)	36/72 (50%)	23/29 (79%)	23/69 (33%)	11/50 (22%)	0/16 (0%)	24/107 (22%)	8/75 (11%)	1/15 (7%)	7/76 (9%)	165/577 (29%)
<i>Trichostrongylus</i>	17/80 (21%)	15/82 (18%)	12/38 (32%)	5/81 (6%)	9/62 (15%)	0/22 (0%)	20/129 (16%)	4/89 (5%)	2/24 (8%)	3/92 (3%)	87/699 (12%)
<i>Cooperia</i>	7/52 (14%)	1/55 (2%)	8/28 (29%)	9/59 (15%)	8/48 (17%)	0/10 (0%)	0/92 (0%)	0/64 (0%)	1/15 (7%)	0/68 (0%)	34/491 (7%)
<i>Oes/Chab</i>	2/58 (3%)	0/57 (0%)	1/24 (4%)	2/59 (3%)	0/48 (0%)	0/17 (0%)	1/86 (1%)	0/61 (0%)	1/20 (5%)	0/63 (0%)	7/493 (1%)
Any parasite^b	49/80 (61%)	42/83 (51%)	29/39 (74%)	30/81 (37%)	20/62 (32%)	0/23 (0%)	44/129 (34%)	10/89 (11%)	3/24 (13%)	10/92 (11%)	237/702 (34%)

^aShown as a percentage (rounded) of the number of tests where each particular parasite was adequately represented for testing purposes. ^bAny one or more of the above genera. BZ = benzimidazole, LEV = levamisole, IVO = ivermectin, ABA = abamectin, MOX = moxidectin, MONE = monepantel, BZ/LEV = benzimidazole-levamisole combination, LEV/ABA = levamisole-abamectin combination, DERQ/ABA = derquantel-abamectin combination, BZ/LEV/ABA = benzimidazole-levamisole-abamectin combination (Triple), *Oes/Chab* = *Oesophagostomum/Chabertia*.

previous survey most such resistance involved mainly the benzimidazole (BZ), levamisole (LEV) or ivermectin (IVO) anthelmintics and, to a somewhat lesser extent, abamectin (ABA), moxidectin (MOX) and BZ/LEV combinations. The overall occurrence of resistance to the former three anthelmintics (as illustrated by the last row of data in Table 1), was also reflected in a relatively high level of multiple resistances to them. Hence, simultaneous resistance to both individually administered BZ and LEV anthelmintics was recorded in 37% (27/73) of cases while the concurrent presence of individual resistances to BZ, LEV and IVO was detected in 36% (11/31) of cases.

There were no statistically significant differences relating either to the frequency of occurrence of these multiple resistances or in the prevalence of resistance to any drench recorded in the current and previous surveys (McKenna, 2016). In contrast, and as first described in the latter report, there was clear evidence of a continuation of significantly higher levels of anthelmintic resistance in

the North than the South Island (Figures 1-2).

Of particular interest was the recording of three cases of apparent resistance to derquantel/abamectin combinations (DERQ/ABA) for the first time. Two of these were from the South Island and appeared to involve resistance in both *Trichostrongylus* and *Oesophagostomum/Chabertia* in one instance, and in *Teladorsagia* (= *Ostertagia*) and *Cooperia* in the other. The remaining case, from the North Island, showed a reduced efficacy solely against *Trichostrongylus*. The validities of these apparent DERQ/ABA resistances, particularly those from the South Island, are, however, questionable. Following treatment with DERQ/ABA, FECRTs for the four South Island parasite genera were only 92.2%, 93.2%, 93.2% and 87.8%, respectively, and all were essentially susceptible to ABA administered on its own (FECRTs ranging from 94.9% to 99.9%).

The North Island case, although also demonstrating a similarly limited reduction

in DERQ/ABA efficacy (92.5%) against *Trichostrongylus*, showed a relatively substantial level of resistance (53.3% FECRT) to treatment with ABA alone.

Resistance to DERQ/ABA has only previously been reported in Australia, where it was found to be associated with minor reductions in efficacy against *Haemonchus* (Lamb et al., 2017; Sales and Love, 2016). Whether the marginal reduction in drench efficacy to just below the <95% FECRT threshold observed in the current survey may also be suggestive of a similar emerging DERQ/ABA resistance, at least in *Trichostrongylus* here, remains to be seen. [Ⓞ]

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