NSW DPI SHARING INFORMATION ON ENDOPARASTES OF FARM ANIMALS

turning the worm

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IN THIS ISSUE

FROM THE EDITOR

Welcome to this issue of TTW.

The main purpose of this informal newsletter is to share information with those interested in the management of endoparasites of farmed animals, including sheep, goats and cattle.

In line with current conventions, acknowledge authors and include details of this newsletter (title, issue, editor).

DRENCH DECISION AIDS

(Stephen Love. WormMail 201008051430)

When to treat sheep for worms is a common question.

Various decision aids have been used over the years. For example,a traditional approach has been to simply combine drenching with other management events, including joining (tupping or mating in other countries), off-shears, pre-lambing, at lamb marking, and at weaning.

In the pastoral areas such as the western division of NSW, where sheep are less frequently mustered, sheep may be drenched when they are mustered for other reasons.

In the *Haemonchus* - endemic areas of northern NSW and SE Qld (higher rainfall areas, eg > 700 mm, with summer rainfall dominance), drenching of young sheep in summer was largely a monthly affair prior to the 1982 release of the long-acting anthelmintic, closantel.

As well as considering the calendar (for management events and the seasonality of different types of worms), producers and advisers consider indications of worm burdens (typically worm egg counts (WECs)), the condition of sheep, the age and class of sheep, and their nutritional status.

As an aid in making decisions, skilled producers and advisers have always considered a number of factors, as outlined above. Drench decision aids merely facilitate this process and can take the form of charts, graphs and tables, or interactive computer programs or websites.

Following is a bird's eye view of various decision aids.

THE BRAIN

The brain has been a popular decision aid among hominins over the 2 million years or so of its development. However, despite their name, *Homo sapiens* have sometimes been less than wise in the use of this decision aid.

Seriously though, as intimated above, skilled operators use a combination of logic and intuition, weighing up various factors when deciding whether to drench or not. In essence, this is what all decision aids do. While superficially decision aids may look quite different, they are fundamentally similar, being built on similar foundations.

Image credit: Simpsons Trivia.

WORMKILL – CIRCA 1984

The original WormKill (1984 to early 1990s) was a simple, prescriptive strategic program. The WormKill table in effect was a decision aid.

Below is a WormKill table from July 1986.

There are two further things to note.

Firstly, promotion of grazing management as part of worm control is not new.

Secondly, although WormKill (1980s versions) was a prescriptive program, regular worm egg count (WEC) monitoring was done on a number of properties. A WEC of 500 strongyle eggs per gram of faeces (epg) was used as a benchmark, with drenching considered advisable when WECs significantly exceeded this level.

WORMKILL 2

A modified drenching program for farms where ALL sheep have been on WORMKILL for 2 years

* Barber's pole worm has been beaten on farms where WORMKILL has been used for 2 years
* This has made it possible to drop the August Seponver drench on these properties
* You can graduate to WORMKILL 2 if you have been on WORMKILL for 2 years
* Yes, it has been tested under field conditions
* If liver fluke is a problem, you will need to add efficient fluke drenches in August and April (see previous section).

WORMKILL 2						
Date	Adult sheep & hoggets		Lambs & weaners		Grazing Management	Added fluke control (all sheep)
	Seponver	Broad-spectrum	Seponver	Broad-spectrum		
1st August		♦				♦
1st November	♦	♦	♦	♦	Move ewes & lambs to low-worm pastures	
1st February	♦		♦	♦	Move lambs to low-worm pastures	
1st April				♦		♦

* The pre-lambing and post-lambing broad-spectrum drenches for ewes can be varied according to lambing time as in WORMKILL.

WORMTEST FOR LIVESTOCK AND GUIDE TO EGG COUNTS - PRIMEFACT, I&I NSW

This Primefact (2003 and 2007 editions) discusses various factors in interpreting WECs. See the two tables below. Primefact 480. http://www.dpi.nsw.gov.au/agriculture/livestock/sheep/health/internal/wormtest-eggcounts

Egg counts in sheep – summary	
<200 (epg)	drench probably not required (exception: summer drenching in DrenchPlan areas)
200-500 epg	seek advice
>500 epg	drench probably required

For more information, see Table 1 – Guide to worm egg counts in sheep, or Table 2 – Guide to egg counts in cattle.
epg = eggs per gram

Table 1. Guide to worm egg counts in sheep

Worm egg count epg	Interpretation/comments (see box page 4. 'NB Tables 1 and 2 are guides only')
0-100*	A good result. There would be few situations where you would contemplate drenching at this level. Consider another WormTest 4–6 weeks after significant rain, or before a 'management event' such as a summer drench, pre-lambing, prior to yarding, or when there are signs consistent with parasitism. Be aware, however, that sheep in some cases can get heavy worm burdens quickly before egg counts rise. An example might be a thin necked intestinal worm (Nematodirus) problem in young sheep following rain after a dry spell.
100-200*	This range of egg counts is still low, but can be a trigger to drench in certain situations such as the first or second summer drench in the DrenchPlan area of central and southern NSW. Traditionally summer drenches have been done in DrenchPlan areas if mean counts exceeded 100 epg or thereabouts. Farmers, especially regular WormTesters, may tolerate higher egg counts – especially in adult dry stock – in the interest of preserving drenches for a little longer. Consider another WormTest 4–6 weeks after significant rain, or before a 'management event' (see above).
200-500*	Productivity losses and scouring may be occurring, especially if the counts are dominated by scour worms rather than barber's pole worm. (Barber's pole worm actually tends to constipate.) Depending on prevailing weather conditions and other factors, you may consider drenching, or repeating a WormTest in about four weeks. A count of 500 epg has been a commonly used if somewhat conservative benchmark in WormKill areas (northern NSW) where barber's pole worm often predominates. At this point, drenching may be necessary, especially if conditions favour increasing numbers of larvae on pasture, or there are signs consistent with parasitism, including anaemia, 'bottle jaw', scouring or ill-thrift.
500-1000*	In the DrenchPlan areas of central and southern NSW – where worm burdens are often mostly black scour and brown stomach worms – this range of counts is entering the 'high' range. Production losses are becoming significant. This count is also of significance in WormKill areas. Scour worm burdens could be quite significant, and the stage may be set for a rapid escalation in numbers of barber's pole worm if conditions are warm and moist. In any case, treatment with an effective drench will be required in many if not most cases.
1000-2000*	These counts are into the high range, especially if worms are mostly scour worms. Production losses could be quite significant and clinical signs – especially related to scour worms – may be quite obvious. Anaemia and exercise intolerance from barber's pole worm may not yet be clearly evident. However, barber's pole numbers could rapidly increase in a short time under favourable conditions.
2000+*	Production losses are likely to be severe. Deaths may be occurring or imminent. Treating with a highly effective drench and moving to a low risk paddock is clearly a priority.
Nematodirus	Eggs of the thin-necked bowel worm are bigger and distinctly different from strongyle roundworm

Figure. Table prepared for the revised editions of Primefact 480, and also 'WormKill - the basics' (in preparation).

Benchmark Worm Egg Counts – WormKill Zone

Barbers pole worm	Scour worms
800 (600-1000)	300 (200-400)

Strongyle egg counts will mainly come from barber's pole worm and the scour worms, small brown stomach worm and black scour worm.

To use this table, a WEC as well as a larval culture (worm type) will be necessary in order to determine the WECs attributed to barber's pole worm and the scour worms.

The benchmarks of 800 and 300 are for sheep in average condition (Fat score (FS) = 2.5) and average pasture quality and quantity.

Err towards the lower ends of the WEC ranges (600 for barber's pole worm, and 200 for the scour worms) if one or more of these apply: sheep in poor condition (FS less than 2.5), poor feed; sheep less than one year old.

Work towards the upper end of the WEC ranges (1000 for barber's pole worm; 400 for the scour worms) if these apply: sheep in good condition (FS greater than 2.5); feed is very good; adult dry sheep.

Thin-necked intestinal worm can cause scouring and ill thrift in young sheep in particular. They have an egg quite different from strongyle eggs and are counted separately.

THE RENDELL MATRIX

The Rendell Matrix (Source: The Weekly Times 18.9.2002)

David Rendell is a sheep veterinary consultant in western Victoria. He developed this matrix some years ago: the version below is from 2002. He has tested it in the field among his clientele.

Source: The Weekly Times 18.9.2002.

Remember that decision aids are applicable only for the areas for which they have been developed. The WECs (aka FECs) in the table above come mainly from black scour worm and brown stomach worm, with little from barber's pole worm, apart from farms close to the Victorian coast.

And the make up of 'scour worms' can vary from one area to another. In the NSW northern tablelands Trichostrongylus colubriformis tends to be more common than another type of black scour worm, Trichostrongylus vitrinus, which tends to be more pathogenic and produces fewer eggs. Also, the further one goes north in summer rainfall areas, small brown stomach worm (Ostertagia (Teladorsagia) circumcincta) - a relatively poor egg layer - becomes less common, to the point of being uncommon in Queensland. As one moves south into the non-seasonal and especially the winter rainfall areas of south eastern Australia, T. vitrinus and Ostertagia become more important.

VET LAB MANUAL - INDUSTRY & INVESTMENT NSW (FORMERLY DEPT. PRIMARY INDUSTRIES)

The next table a guide to worm egg counts in sheep from the I&I NSW Vet Lab Manual. http://www.dpi.nsw.gov.au/agriculture/vetmanual/specimens-by-discipline/parasitology/egg_counts

These WEC benchmarks may seem alarmingly high: that's because this table is not really a drench decision aid, but rather a guide to WECs that may be associated with clinical disease.

By the time parasitism is clinically obvious, productivity and economic returns have already taken a substantial hit, hence the lower benchmarks used in most drench decision aids.

In round figures, internal parasites cost the Australian sheep industry $400 million a year, and about 80% of this is from production losses, most of which is not obvious. This is why objective measurement (usually by way of worm egg count monitoring) is an important part of worm control.

ASK THE BOSS

Ask the Boss is the decision aid in WormBoss. http://www.wool.com/Grow_WormBoss_Ask-the-Boss.htm

The user interacts with Ask the Boss, and a worm egg count result is assumed.

The user is then presented with recommendations.

DECISION AID - IPM-S PROJECT (SUMMER RAINFALL)

This is one of the more recent drench decision aids. It was developed by Lewis Kahn and others (UNE / Sheep CRC) as part of the

Figure. The Rendell Matrix
(Source: The Weekly Times 18.9.2002)

SHEEP WORM RISK MATRIX

	High risk	Medium risk	Low risk
AGE	under 1 year	2 years & cast for age	3,4 & 5 years
FAT SCORE	less than 2.0	2.0 to 3.0	more than 3.0
PASTURE (green) (kg dry matter/ha)	under 800 (25mm high)	800-1500 (25mm to 50mm high)	1500 plus (50mm plus)
GRAZING HISTORY (last 3-6 months)	High risk sheep * fat score less than 2 * under 1 year * lambing ewes	medium risk sheep *fat score 2-3	low risk sheep or cattle * drench capsuled sheep * adult dry and fat score 3.0
LACTATION	lambing to mulesing	mulesing to weaning	dry
FAECAL EGG COUNT (eggs per gram)	300 plus	100 – 300	less than 100
LAST DRENCH	more than 6 weeks	4 – 6 weeks	less than 4 weeks

KG Weekly Times 18.9.2002 Source: Dr David Rendell

SHEEP DRENCH STRATEGIES

	High risk	Medium risk	Low risk
Summer drenching	Yes, first drench in November	Yes	Yes, drench in December unless risk is very low
Second summer (Jan-Feb)	FEC test Jan/Feb	FEC test February	FEC test February
After autumn break, check alertness and scouring	Begin at 4 weeks	6-8 weeks	Not required
Faecal egg count test	7 weeks, then fortnightly	10 weeks, then every 4 weeks	Not required
Maximum winter drenching frequency	5 weeks	7 weeks	Not required
Post drench (on green feed) Check for alertness and scouring twice weekly	Begin at 4 weeks Drench by 6th week	6 weeks FEC test 7-8 weeks	Not required
Lambs' first drench	3 months after lambing	3.5 months after lambing	4-4.5 months after lambing
Ewes pre lambing	Drench	FEC test	Leave alone
Ewes lamb marking	Drench	FEC test	

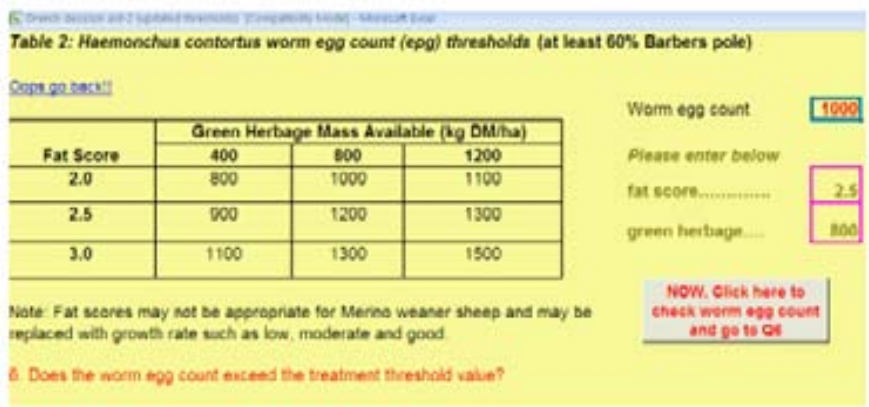
Figure-Vet Lab Manual – Guide to Egg Counts

Guide to faecal egg counts in sheep (indicating pathogenic burdens)

Species	Young Sheep	Older Sheep
Haemonchus contortus	2,000	2,000
Ostertagia spp.	500	500
Trichostrongylus spp.	500	1,000
Nematodirus spp.	500	>200
Oesophagostomum columbianum	300	1,000
Chabertia ovina	500	1,000
Fasciola hepatica	100	100+
Paramphistomes	500+	

*Compiled from various reference sources: Cole VG (1986) Appendix 1 pp 233-239; Love SCJ, Hutchinson GW (2003) Table 4, pp 329-333 ; Skerman KD, Hillard JJ p7 (1966)

Figure – Screenshots of computer (top) and hard copy (bottom) based versions of the IPM-S (Summer Rainfall) Drench Decision Aid



Barber's Pole worm greater 60% of culture	Pasture quality / quantity		
Fat Score	Poor	OK	Good
2.0	800	1000	1100
2.5	900	1200	1300
3.0	1100	1300	1500

Scour worms	Pasture quality / quantity		
Fat Score	Poor	OK	Good
2.0	300	500	700
2.5	400	600	800
3.0	500	700	900

IPM-S project properties in the summer rainfall zone of north eastern NSW and south-eastern Queensland.

The aid's 'interface' can be computer-based (interactive Excel spreadsheet) or hard copy (a table / matrix). Like other aids it aims to take into account a number of factors including WEC, condition of sheep and nutrition.

To the right/above are snapshots (first the computer-based version; and then the hard copy versions ('Worm egg counts to treat')).

More information on IPM-S: http://www.wool.com/Grow_Animal-Health_Integrated-Parasite-Management_Integrated-Parasite-Management-sheep.htm

TRICLABENDAZOLE-RESISTANT LIVER FLUKE IN CATTLE ON THE NSW SOUTH COAST

(From WormMail 201007121300)

Readers will be aware that there are a relatively small number of strains or isolates of *Fasciola hepatica* (liver fluke) resistant to closantel or to triclabendazole in south eastern Australia, although there is a cluster of triclabendazole resistance in the Goulburn Valley, a dairying and fruit growing area centred on Shepparton, Victoria.

In a NSW DPI - RLPB (LHPA) fluke survey several years ago, we also picked up an extra case of triclabendazole resistance in NSW (in sheep in the Monaro district of southern NSW (District Veterinarian: Chris Haylock).

More recently District Veterinarian Ian Lugton (South East LHPA - Bega) in collaboration with CSU-Wagga researchers and Virbac have uncovered triclabendazole-resistant fluke on a south coast cattle property at Numbugga (near Bega).

The media release (18 June 2010) follows.

RESISTANT LIVER FLUKE FOUND ON THE COAST

Dr Ian Lugton

"A recent collaborative effort between a local beef producer, the South East Livestock Health and Pest Authority, researchers from Charles Sturt University (Wagga Wagga) and Virbac, has identified resistant liver fluke on a Numbugga property. Fluke eggs were recovered from cattle after treatment with triclabendazole (TCBZ) used under controlled conditions. This suggests that adult liver fluke have survived the treatment and that the flukes may be resistant to this drench class. It represents a treatment failure. This is the first local property, and the first to show resistance, when investigated for a poor response to the use of TCBZ. This chemical is the active ingredient found in most of the commonly used fluke treatments, both oral and backline. Alternative injectable flukicides for cattle contain unrelated actives, such as nitroxynil, and clorsulon.

"Liver fluke are a common and debilitating parasite on the coast resulting in lost profits for farmers. This parasite may be gaining an advantage from the warmer winters and the increased activity of

the water snail intermediate hosts. Cattle blood and protein is lost to these parasites: they have a cumulative and adverse effect on liver function causing significant depression of appetite, loss of production, anaemia, bottle jaw and possibly death. Flock and herd burdens will increase if stock are not treated for a number of years. In particular problems arise where small ruminants are run with cattle or where drenching has been ineffective.

“Resistance to TCBZ use in sheep was first reported in Australia in 1995. TCBZ has been used to treat liver fluke since the release of Fasinex® several decades ago. TCBZ is heavily relied upon for its ability to kill immature fluke down to 2 weeks of age. Since 1995, it was only a matter of time before resistance became more widespread in Australia and was recorded in other countries. Less effective forms of dosing, such as “backlines, may have also contributed to the development of resistance on cattle properties.

“If you have treated your cattle with TCBZ, and believe it was not fully effective please contact Dr Ian Lugton at the Authority on 64921283 if you want this further investigated. There are other alternative strategies and products that can be recommended. Charles Sturt University researchers can be involved free-of-charge in this investigation. If resistance is identified an alternative effective drench will be supplied free to treat trial cattle.

Media contact: Ian Lugton. Mobile: 0417296739; Bega NSW 2550; phone: 02 6492 1283 fax: 02 6492 3516.

"PIONEER PARASITOLOGIST CHALKS UP FIFTY YEARS OF LOCAL FLUKE RESEARCH

(PROFILE OF DR JOE BORAY)

Bruce Watt, Senior District Veterinarian, Tablelands Livestock Health and Pest Authority, Bathurst

The following article by Bruce Watt was written originally (16 June 2010) for the ‘Western Advocate’ newspaper, Bathurst NSW.

It was reprinted in WormMail 201006171500 and also here with permission.

This profile of Joe Boray follows on the heels of Dr Boray's detailed **essay on liver fluke**, first published in the WormMail e-newsletter (2010.03.1200), archived at www.wormmailinthecloud.wordpress.com), and also in Turning the Worm, Issue 26, May 2010.

Below is a picture of Dr Boray and friend (*Fasciola hepatica*) I retrieved from the archives. This was taken in 1999 at EMAI, when Joe was in his early-seventies. (Photographer unknown).

Dr Joe Boray with 'friend'. EMAI, 1999.

“A few months ago an impromptu group of farmers gathered at the Hampton Halfway House (between Oberon and Lithgow) to hear Dr Joe Boray talk about liver fluke. A few days previously, Joe had mentioned to me that he was travelling up to Hampton as he has done for the last fifty years to collect liver fluke snails and to study liver fluke.

Liver fluke is an important parasite on the tablelands and I was keen to learn more myself and to share this information with producers in a known fluke area. However, I also wanted farmers to meet Joe because he has made so many important contributions to the study of parasites that he is a legend and an inspiration.

Joe graduated in veterinary science from the University of Budapest in 1950. Soon afterwards, he commenced his research career and completed a PhD on hydatids. However, he also commenced work on the treatment of liver fluke.

You might recall that in 1956 following widespread student protests, the Hungarian people sought some independence from Stalin’s Soviet domination. The standard Soviet reaction to a rebuff was to send in the tanks. Many people died and over 200,000 Hungarians fled. These refugees included some of Hungary’s best and brightest and many have made prominent contributions to Australia.

Was it because of a fluke that Joe chose Australia? Anyway, he arrived in 1957 and commenced a twelve-year stint with the CSIRO. He sought to understand the biology of the fluke and snail. He also sought improved treatments for fascioliasis (fluke infestation).

Joe interrupted his work with CSIRO to accept an invitation from the University of Hanover. Here he studied the survival of fluke larvae under different climatic conditions. From 1969 to 1972, he taught parasitology to medical and veterinary students and studied the chemical treatment of fluke in Switzerland.

In 1972, Joe started ten year's work with the pharmaceutical company Ciba-Geigy. His team worked on the development of new chemical treatments for parasites. These included treatments for ticks in cattle and parasites in dogs. However, Joe was also responsible for the development of cyromazine (Vetrazin(R)) which remains highly effective against blowflies and triclabendazole (Fasinex(R)) which has become the cornerstone of fluke control.

In 1983, Joe moved to the NSW Department of Agriculture at Glenfield then Camden where he looked at chemical resistance in sheep lice and liver fluke. Joe however also looked at chemical combinations to improve the treatment of fluke. He found that triclabendazole acted in synergy with oxfendazole improving the kill of immature fluke. This combination is now marketed as Flukazole C(R).

In 1999, aged 73, Joe 'retired' from NSW Agriculture (or was it DPI) to set up an independent consulting company. I know that Joe was involved in developing a new combination of chemicals to treat fluke to decrease our dependency on triclabendazole. The combination is marketed as Nitromec(R).

At home, Joe has a laboratory in which he continues to breed liver fluke snails, as you do, hence his visit to Hampton to replenish his snail breeding stock. Joe makes these snails available to researchers wishing to study their interaction with fluke larvae

The work of Joe Boray underpins most of what we know about the treatment and control of fascioliasis. For example Joe established that both fluke and snails become dormant in winter so that treatment in April-May with a product such as triclabendazole and oxfendazole (developed by Joe and team) or Nitromec(R) (developed by Joe and team) will kill both adult and immature fluke, suppressing the spring build up in fluke larvae and so reducing the treat of disease and lost production in our tablelands stock.

I still have a few questions about liver fluke. Do we have drench resistance in our fluke population? What fluke control programs should we recommend for properties with low levels of fluke or no apparent loss from fluke. What are fluke infestation costing producers on these properties? Joe Boray has given us a wonderful foundation as we seek to answer these queries".

NEMATODIRUS IN SHEEP – A CONVERSATION

Following is a 'conversation' (from WormMail 201007191015) with various parasitologists and veterinarians regarding *Nematodirus*. The more recent responses appear first:

PAUL NILON, VETERINARY CONSULTANT, TASMANIA

[snip]... *Nematodirus* seems to affect all types of young sheep. I suspect that cross-bred lambs may be less vulnerable because they are run easier. Moreover, if they are on green tucker they may be exposed to other species.

We see a rapid drop off in *Nematodirus* in faecal egg counts (FECs; Sorry, Steve, WECs) after the first rains. After 3 years of drought in the midlands they were present until mid winter in spite of good rain. Maybe their presence involves competitive inhibition with other species. [snip]

DAN SALMON, DISTRICT VET, DENILIQUIN, NSW

In the western Riverina *Nematodirus* causes an occasional train crash.

Especially in tough years we can get very significant burdens, particularly in young sheep. The worms form a visible mass along significant lengths of the small intestine: more like pig ascarids than sheep worms.

The episodes can occur in the absence of what we could consider suitable environmental conditions: warm dry autumns after hot dry summers.

The embryonated eggs are extremely hardy, one year we had tracer lambs picking up 15,000 *Nematodirus* per week in September on a paddock which had been de-stocked since May.

The very little histopathology that I have had done on clinical cases has hinted that the damage may be due to the immune response rather than the damage caused by the parasites.

It may be that we are starved of true parasites: *Teladorsagia* is our dominant parasite with *Trichostronglyus* being an issue about one year in ten and *Haemonchus* about one year in 25.

JUSTIN BAILEY, TECHNICAL SERVICES VETERINARIAN, NOVARTIS ANIMAL HEALTH AUSTRALASIA

Hi Steve,

I agree with your comments about *Nematodirus* being a second tier worm after the big three (in our part of the world), but I still have it well ahead of the rest of the pack (third tier) in terms of importance. My experience in the New England (region, northern NSW) is mainly of outbreaks in weaners in autumn with scouring, loss of condition and some mortalities (and often worm egg counts (WECs) of not much more than 100 eggs per gram of faeces (epg) which was my treatment trigger). In some cases weaners failed to thrive following successful resolution of the infection and histology subsequently indicated severe chronic damage to the small intestinal mucosa. A real issue heading into winter! Rad Nielsen of VHR would have more up to date information on this.

You are also right about *N. filicollis* being of greater concern in New Zealand. It is present mainly in Southland (bottom of South Island) with *N. spathiger* (less cold tolerant) increasing in prevalence as you head north. Apparently *N. filicollis* takes longer to develop to third stage larvae (L3) in the egg than *N. spathiger,*so you see the classic lamb to lamb infection with *N. filicollis*. This is a result of some of the weaner contamination in autumn not developing to L3 stage pre-winter, surviving winter and then contaminating next seasons lambs with clinical signs usually occurring in November. It is common for pre-weaning treatment to be given for *Nematodirus* control. John Smart is the guru in this area.

I agree with your comments on Paul's article - great reading. (Paul Nilon's article on sheep worms in Tasmania. See Turning the Worm Issue 26, May 2010; or 'WormMail in the Cloud')

BILL POMROY, PROFESSOR, VET PARASITOLOGY, MASSEY UNIVERSITY, NZ

http://ivabs.massey.ac.nz , http://vet-school.massey.ac.nz

HI Steve, I had better comment since I am quoted below. In NZ, *Nem spathiger* would generally be considered a second order parasite that can contribute to clinical disease on occasion. It was a significant issue in the 80s when BZ resistance was first becoming an issue as BZ resistance in *Nem spathiger* was the most common cause of drench resistance we saw at that time. There were a large number of cases of clinical disease on farms who didn't realise they had an issue with resistance and lambs would die of large burdens of this particular species – presentation pretty similar to a heavy burden of *Trichostronglyus*(black scour worm). This did illustrate that if not controlled *N spathiger*can be a very significant parasite throughout the country. *Nem filicollis* is considered to be an occasional problem in the cooler southern areas where numbers of larvae build up and are available to young lambs soon after birth with resultant clinical problems even before weaning. It is generally considered a species that needs a period of chilling for the larvae to develop. There are less issues with this clinical presentation now than reports would suggest for 30 years ago. We didn't see the same issues with BZ resistance in this species as with *Nem spathiger*. Overall though we are actually somewhat deficient in our understanding of the epidemiology of both *Nem spathiger* and *Nem filicollis*, especially the picture in recent years. There can be an issue where egg counts are low but burdens are very high, especially in lambs in the 3-9 months of age bracket presumably with some level of immunity but not enough. *Nem. helvetianus* in cattle is a very occasional parasite of young cattle and I can't recall ever seeing a significant burden.

Trichostrongylus axe(stomach hair worm) in sheep would be more likely to be seen in older sheep than young lambs unless you get the exceptional situation of lambs grazing pasture heavily contaminated by young wormy cattle. Remember in NZ we are referring here to Romney-type breeds where the mixed age ewes can largely control nematodes on their own without assistance, but from time to time we see subclinical/clinical burdens that require intervention. However, you do see them as part of mixed burdens even in young sheep but usually in smaller numbers compared to intestinal species. We have yet to see significant issues with resistance in this species which could change that picture.

DAVE GARDINER, DISTRICT VETERINARIAN, LHPA, MUDGEE NSW

Dear Steve,

I read Paul's column with interest as I too have recognised Nematodirus as a serious problem in Merino weaners around here, mostly Merryville bloodlines and guess Pauls are Saxons. I have set a level of 200 or above epg as being associated with ill thrift and mortality so maybe 150 will become my new trigger level for a drench. It is funny how these disappear in adults and I suspect it is a combination of immunity in the older sheep and management as weaner paddocks I suspect are flogged year after year there usually not being much choice when it comes to finding a paddock with good feed and good fencing in wool growing country. I have also associated Nematodirus and

other worm burdens in weaners as being associated with Se & Co deficiency and suspected Cu deficiency in the Gulgong/ Dunedoo area so immune suppression may play a role.

PAUL MASON, CONSULTANT PARASITOLOGIST, NEW ZEALAND (SOUTH ISLAND)

Hi Steve

Here is something I sent to you in 2005, with a few additions:

Nematodirus is a common parasite of lambs in the South Island of New Zealand. The emphasis in the previous sentence is on lambs, because the involvement of ewes in the life cycle of Nematodirus is minimal. [When I worked in the MAF diagnostic lab, finding *Nematodirus* eggs in ewe faeces was a good indicator for Johnes.]

On many farms lambs can become heavily infected with *Nematodirus* about a month prior to weaning, and many of the pathogenic effects can occur before the worms have started laying. This would suggest that these *Nematodirus* require a period of cold during their free-living time (as occurs with *Nematodirus* species in the UK) and that a synchronised hatch has occurred in the spring. If such an outbreak is unexpected, the cause is not detected until the lambs are passing eggs, so considerable pasture contamination with *Nematodirus* eggs has occurred by the time of diagnosis and treatment. When this happens we know that there is the potential for the same condition to develop next season to lambs on the same pasture.

So, we have *Nematodirus* with a one year life cycle that is essentially restricted to cycling through lambs. On farms where Nematodirus is expected pre-weaning farmers routinely drench lambs
3 to 4 weeks before weaning, usually early November.

In support of this diapause is the observation that Nematodirus is erratic to grow in larval culture. I achieved much better yields in culture when I incubated for 10 days, put the culture in the fridge for 14 days, then incubated for a further 10 days.

Many years ago I read somewhere in the literature that age resistance to *Nematodirus* is a threshold effect and occurs after exposure of the lamb to a particular number of worms, which may explain why it occurs somewhat erratically through a mob of lambs. But we used to find that there was little point in running a FECRT (faecal egg count reduction test) for *Nematodirus* after about mid-January. The first effect of age resistance was a suppression of egg laying by the *Nematodirus* worms, so it was common at this time to cut open a lamb and find a *Nematodirus* burden, even though there were no *Nematodirus* eggs to be seen in the faeces.

The most abundant *Nematodirus* species in sheep in NZ is now *N.spathiger*. It was not always so. This probably happened because *N.spathiger* was an early adopter of resistance to BZ drenches.

DR PETER ROLFE, HEAD, SAFETY AND CLINICAL DEVELOPMENT, NOVARTIS ANIMAL HEALTH AUSTRALASIA

Hi Steve,
A few thoughts from the bunker. *Nematodirus* in lambs is a significant issue on the southern tablelands of NSW and in conditions mentioned in (your) text below -especially first summer lambs after storm rains or under irrigation. FEcs (faecal (worm) egg counts) tend to be quite low/variable and not reflect the clinical /subclinical disease that has been caused but are still diagnostic once patency is reached. You have also captured other risk factors. I am not sure it is second order in the south especially if they are dying....which was quite common this last summer. They are always present in some numbers and should be closely considered especially when the conditions do not seem to be favorable for parasitism, for example in hotter dry conditions with sporadic downpours.

ELIZABETH BRADDON, SENIOR DISTRICT VETERINARIAN, YOUNG OFFICE, LACHLAN LIVESTOCK HEALTH AND PEST AUTHORITY. NSW

Hi Steve,

We certainly see Nematodirus in Young district as pathogenic in weaners <11-12 mos of age. As mentioned counts can be a bit misleading particularly if just had rain after dry … get mass hatchings and lots of immature so our trigger is 100-150 epg (or higher counts in ewes / older wether mobs as an indicator of contamination for lambs).

We have had deaths – without scouring – just illthrift, poor performance compared to feed available and then find dead or moribund then dead! PMs show very large numbers of Nematodirus (immature and mature).

I would agree with all the comments below.

Eliz

THE START OF THE 2010 NEMATODIRUS CONVERSATION: WORMMAIL 201005131100

Following is the start of a conversation regarding *Nematodirus* (thin-necked intestinal worm; 'Nem') with Graham Lean following on Paul Nilon article on Parasites in Sheep in Tasmania(Turning the Worm newsletter Issue 26, May 2010; also here).

Graham has given permission to put this in a WormMail i.e. essentially public). If you would like to comment - and agree to have you comments added to a final compilation to be published in WormMail i.e. public)- then feel free to reply to this email.

Here is the conversation:

[GL]: Hi Steve,

[GL]: I enjoyed Paul's article. I thought it was very good.

[SL]: I agree. Interesting stuff and nice writing style. It was the second in a series...the first (some time go) being one on sheep worms in the Falklands.... (Derek Clelland, TTW Issue 5, July 1999)

[GL]: I also thought that his observation of Nematodirus was similar to mine in SW WA when I was there and also here in western Victoria. Some parasitologists agree with our view, others dismiss it.

[SL}: Here is what Paul Nilon said in his TTW article

Nematodirus spp [3] (don't ask which species) predominates in dry summers and autumns. While it is regarded as relatively benign in other parts, in Tasmania it can cause significant parasitism, particularly in weaners. Moreover, because of sporadic egg output FEC Faecal worm egg count. triggers for treatment are low (150 epg).

[SL]: My view.... It is a second order parasite (in NSW at least) compared to *Haemonchus-Ostertagia-Trichostrongylus* in sheep - but under certain circumstances can be quite important...

[SL]: eg.

* young sheep - more vulnerable.
* certain seasonal conditions ... eg rain after prolonged dry spell...through which the tough Nem eggs can survive for extended periods
* certain management conditions...e.g paddocks set-stocked with young sheep or regularly used by young sheep...resulting in higher numbers of Nem eggs
* other stressors contributing.... nutrition, weather, other parasites
* drench resistance

[SL]: And... there may be clinical disease before Nem egg counts rise much at all...due to large numbers of immatures

[GL]: Agree with all that. Nicely put.

[SL]: Nem (*N filicollis* at least?) is a big deal in NZ...but it was not always so. I seem to recall it become a 1st order parasite only since the 1960s? (Love and Hutchinson 2003) .... not sure why....Changes in farming practices?? (Our NZ colleagues may help out here)

[SL] [Postscript] Regarding *Nematodirus* species in sheep in NZ, Pomroy lists *N. filicollis* of major importance, and various other species (*spathiger, helvetianus*, and *abnormalis*) of minor importance.(Interestingly Pomroy also lists *Trichonstronglyus axei* - stomach hair worm- as of major importance, which is generally not the case in Australia).

[SL]: Maybe we can run Paul's comments (in the Tassie article), your comments, and my comments above.... through WormMail...and invite comments... then compile all the comments into a follow-up??

[GL]: More than happy to see that occur.

[GL]: Hate to open up a can of worms (yes, I couldn't resist the pun), but this might be worth looking in more detail at some stage in turning the worm, or worm mail? What do you think?

Cheers, GL

[GL]: = Graham R. Lean BVSc, MAAAC, authorised rep AFS License No. 316516 (futures) PO Box 105 Hamilton VIC 3300 Australia Principal Consultant Graham Lean and Associates Farm Business Advisers

[SL]: = Stephen Love

REFERENCES (from SL)

Pomroy WE (1997).Internal helminth parasites of ruminants in New Zealand. In, Sustainable control of internal parasites in ruminants, Animal Industries Workshop, June 1997, Lincoln University, NZ. Ed: GK Barrell

Nematodirus at WormBoss: http://www.wool.com/Grow_WormBoss_Know-your-worms_Thin-necked-intestinal-worm.htm

Love and Hutchinson (2003):

"Nematodirus spathiger is a very common parasite of young Australian sheep, and usually relatively

non-pathogenic unlike the situation in New Zealand where this parasite inexplicably become more
important from the 1960s. Heavy infections, scouring and ill thrift with mortalities can be seen in young sheep under or soon after drought conditions in Australia (south western NSW, for example)
presumably become *Nematodirus* eggs are relatively desiccation–tolerant. Clinical nematodirosis is also not uncommon in young lambs in irrigation areas such as the Riverina area of southern New
South Wales."

(Love and Hutchinson 2003) or Love SCJ, Hutchinson GW (2003). Pathology and diagnosis of internal parasites in ruminants. In *Gross Pathology of Ruminants*, *Proceedings 350, Post Graduate Foundation in Veterinary Science, University of Sydney,* Sydney;Chapter 16:309-338.

For more information on service providers such as Paul Nilon and Graham Lean go to: http://www.wool.com/Grow_WormBoss_Professional-service-providers.htm

NEMATODIRUS - THE CONVERSATION IN 2005

(TURNING THE WORM - ISSUE 19 – 5 DECEMBER 2005)

Nematodirus ('Thin-necked intestinal worm') is usually not a big problem in sheep but under certain conditions it can be! This parasite's little speciality is its hardy egg. It can survive a long time on pasture under tough, droughty conditions and then - with a break in the season (good rain) - young sheep in particular can pick up sizeable burdens of *Nematodirus* in a short time. The result may be scours and ill-thrift, sometimes with low or even zero *Nematodirus* faecal egg counts.

Dr John Evers - District Vet at the RLPB at Young - tells me they have had *Nematodirus* problems two years running in autumn drop lambs in his district. In one case lambs were drenched with a known effective drench at marking, and three weeks later had a clinical problem with *Nematodirus*.
The reasons for this may be the weather pattern in Young and other districts for the last two years: a very dry autumn, and a season break occurring a month or so later (~ May/June) than usual. Nutritionally stressed late-pregnant and lactating ewes perhaps were passing more *Nematodirus* (and other worm) eggs in the faeces than usual, and this contributed to lambing paddocks being more heavily contaminated than in normal years. Young lambs, with minimal ability to handle worms, picked up significant burdens in a short time.
You might wonder about management factors, but John says that set-stocked as well as rotationally grazed farms have been affected.
The solution? Regular WormTesting (worm egg count monitoring) is one of the pillars of good worm control, but in unusual seasons, this may sometimes pick up *Nematodirus* problems after 'the horse has bolted'. This is one obvious situation where local, expert knowledge (vets like John Evers for example) is invaluable.

Other comments on *Nematodirus*:

Dr Justin Bailey (Veterinarian and PhD student at the University of New England).

Hi Steve – 'Just a brief comment with regards to *Nematodirus*. Results from worm monitoring at Veterinary Health Research, Armidale certainly bear out the value of using levamisole against *Nematodirus* - in fact it is the only drench consistently found to be fully effective against this parasite. *(Another vet replied with information on the value of a particular product against Nematodirus but, as this was not a registered claim, it cannot be reproduced here. –Ed).*
However, a case of scours and ill-thrift in a weaner mob in the New England last year provides a cautionary tale and underlines the potential significance of *Nematodirus*. The weaners in question displayed scours and ill-thrift in >20% of the mob with a mean FEC of not much more than 100epg for *Nematodirus* and minimal other roundworm infection. Treatment with levamisole did not alleviate the clinical signs, although a further monitor indicated that the treatment had been fully effective. An autopsy on one of the more severely affected animals showed little in the way of gross pathology. However, subsequent histopathology clearly demonstrated the effects of the prior *Nematodirus* infection on the gut lining. This resulted in continued scours and ill-thrift for a considerable period of time after the successful resolution of the infection. The cost in terms of lost animal production would have been significant. (UNE Armidale 22 Aug 05).

Dr Dan Salmon (District Veterinarian, Riverina RLPB, NSW)

(Regarding the efficacy of various drenches…)
That pretty well agrees with the results Harry Suddes and I got in our survey last year.

- We found that on14 ex17 farms, levamisole had 100% efficacy (faecal egg count reduction) against *Nematodirus, on* 1 ex17 the efficacy was 99%; and on 2 ex17, the efficacy 89%.

- For albendazole we found 100% efficacy on 5 ex17 farms, 95-99% on 4 ex 17; 85-94% on 3 ex 17, and <85% on 6 ex 17 farms.

Of interest we are seeing more worms than for 15 years, mostly *Ostertagia* and *Nematodirus*, some almost pure growths of *Nematodirus* with significant clinical problems.
(Comment: because Nematodirus faecal egg counts (FECs) are usually low and variable, efficacy based on FEC reduction post-treatment needs to be interpreted with caution. – Ed).

Dr Brown Besier (Senior Vet Parasitologist, Albany WA):

Hello Steve - One point possibly of relevance - in WA, at least, is that we find that levamisole is still usually effective against *Nematodirus*. Where we see almost all *Nematodirus* eggs in a count, and virtually no strongyles, it is an opportunity to use a drench of otherwise little use (in situations where there is no *Haemonchus*).
(The same applies in NSW: few if any Nematodirus eggs are seen in a count following a levamisole drench, whereas some Nem eggs are commonly seen post-BZ drenches.
So, this is the situation with levamisole:
o *resistance in small brown stomach worm (Ostertagia/Teladorsagia) and black scour worm(Trichostrongylus) is very common*

o *barber's pole worm is still susceptible to levamisole on most farms, but this is now changing. (It would be wise to consider routinely using levamisole in combination with other drenches, eg naphthalophos).*

o *Levamisole still seems to be effective against Nematodirus. – Ed)*

Dr Paul Mason (Consultant Parasitologist, Dunedin, New Zealand)

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WORMMAIL VS TURNING THE WORM

Turning the Worm is a newsletter for sharing worm management related information, especially information that otherwise would have a limited circulation or not otherwise be readily accessible. It is published on the Industry and Investment-NSW (Primary Industries) website and, is a registered serial (ISSN 1442-8466). See http://www.nla.gov.au/services/issn.html and http://trove.nla.gov.au/.

Normally we aim to publish TTW 3-4 times a year, but for various reasons this is the only issue for 2009.

WormMail is the name of a mailing list, and serves as a conduit:

- WormFax, which is mailed (through the WormMail list) as well as posted on our website
- Issues of Turning the Worm
- Occasional, usually weekly, updates, which are referred to as 'WormMails', and of late have also been posted to http://wormmailau.wordpress.com/ .

Much of the content that normally would have been published in TTW has this year been published in WormMails. This issue of TTW contains some information already sent out as WormMails.

To subscribe to WormMail, go to: http://www.dpi.nsw.gov.au/agriculture/livestock/sheep/health/internal/worm-mail

WORMBOSS

WormBoss is a national repository of information and guidance on sheep worm management.

In recent times its home has moved from www.wormboss.com.au to the Australian Wool Innovation (AWI) site, www.wool.com/wormboss .

There have been some issues since the move, but please be patient: with the assistance of AWI information technology staff, we are working on ironing them out.

Have you subscribed to the monthly WormBoss News/Outlooks? If not, subscribe at the website.

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[Turning the worm] is a newsletter for those interested in the management of endoparasites of farmed animals.

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