

“Practical disease control strategies in the face of a changing climate”



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Edinburgh

Scottish Government Agriculture & Climate Change KE Workshop,
Royal Botanic Gardens Edinburgh, 7th October 2011

Policy context

- All aware of Agriculture's legal obligations under SG Climate Change Act (2009) – reduce Carbon footprint of livestock farming
- Set against this, increasing global demand for food, inc. livestock products, meat & dairy
- Possible to achieve BOTH objectives through increased biological efficiency of livestock production: “Sustainable intensification” (Sir John Beddington, Govt Chief Scientist, 2011)



Reducing the burden of endemic, production-limiting disease

Nancy Nicholson

Tuesday 23 February 2010 14:41



The Scottish Government has announced a consultation on a possible bovine viral diarrhoea (BVD) eradication programme which it believes could give the country's livestock a unique selling point in future globalised markets.

Announcing the consultation at NFU Scotland's annual meeting (19 February), the rural affairs secretary **Richard Lochhead** said some people believed animal health in Scotland was going through a "quiet revolution".

The move comes hard on the heels of the newly acquired TB-free status for Scottish cattle.

Eradication of BVD would be another boost and could improve farmers' incomes by £50-80m over the next 10 years and make a 3% contribution to Scotland's climate change targets.

Source: Farmers Weekly

Climate Change and Endemic Disease

- **Mitigating the Impact**
 - Disease impact on climate
 - Climate impact on disease

- **Monitoring Change**
 - Change in climate (e.g. Sniffer)
 - Change in diseases (e.g. SAC, MRI)

- **Adapting to Change**

Nancy Nicholson
Tuesday 23 February 2010 14:41



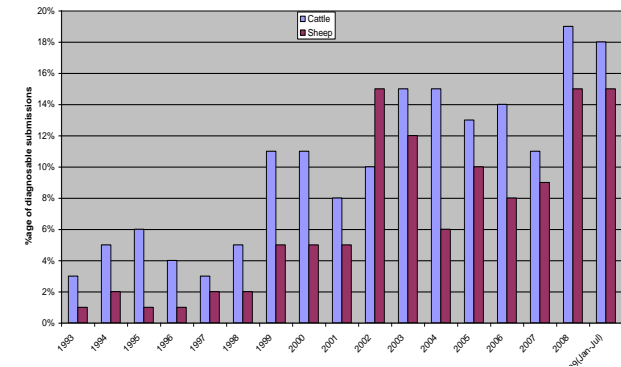
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Liver Fluke Outbreaks as %age of diagnosable submissions



Production-limiting Disease Control

Diagnostics e.g.

- BVDV – routine use
- CLA – on market
- Johne's Disease – development



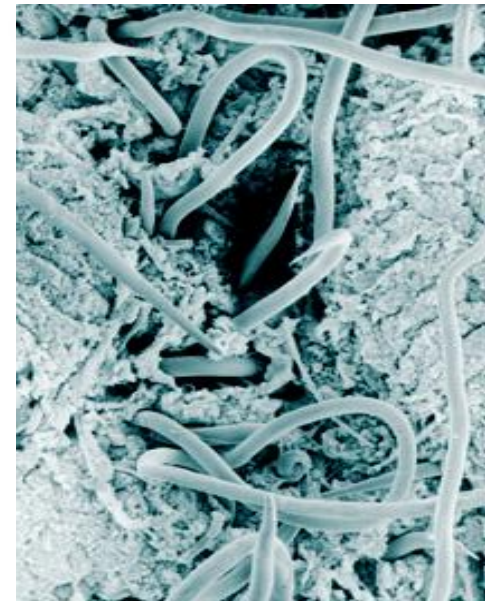
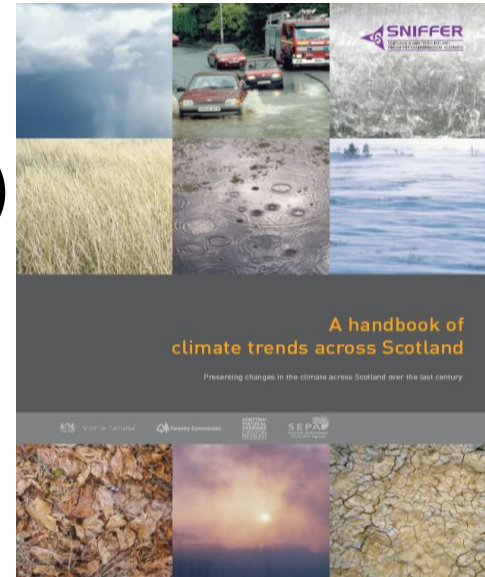
Vaccines e.g.

- *Toxoplasma* – routine use
- *Haemonchus* – near market
- *Chlamydia* - development

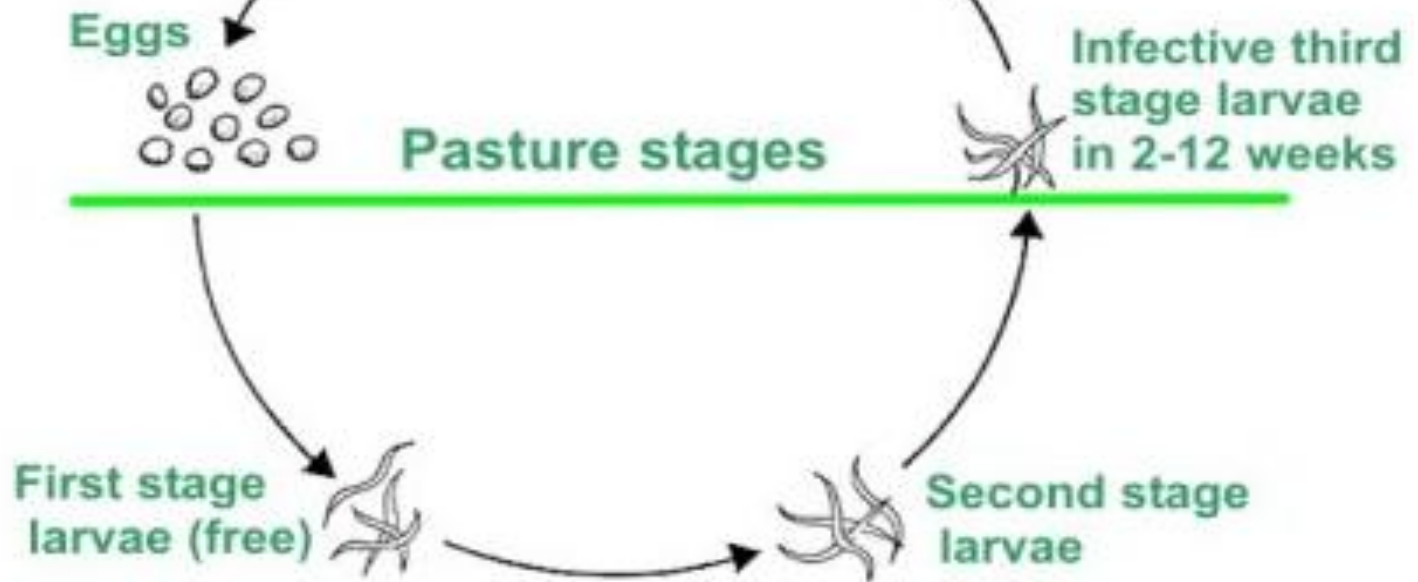
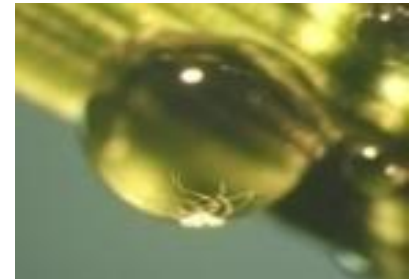
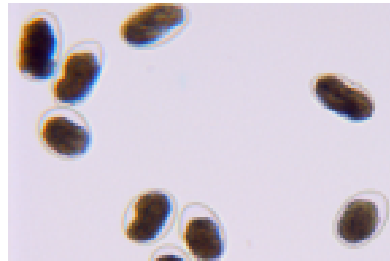


Climate Impact on Disease

- **Climate Change in Scotland (Sniffer report, 2006)**
 - Increased temperature (ave, max & min)
 - Increased rainfall, more extreme events
 - Reduced frost days
 - Longer grazing seasons
- **Disease change in Scotland?** – changes play into hands of pathogens with environmental life-cycle stages e.g. parasitic helminths (“worms”)



Climate and Parasites





Page last updated at 13:31 GMT, Thursday, 2 October 2008 14:31 UK

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Climate change threat to haggis

Global warming could pose a threat to a key ingredient used in one of Scotland's most famous dishes.

An increase in lungworm infections in sheep has been identified by the Scottish Agricultural College Veterinary Investigation Centre.

The parasite renders sheep lung - used to make haggis - unfit for consumption.

The centre's Sandy Clark said climate change could be a factor in the rise of cases and said lung could end up being used less in making the food.

Thurso-based Mr Clark said: "There is the possibility that their part of the ingredients maybe less prevalent and may have to change to another mix."

Eating championship

He added: "Part of the reason will be the parasite is able to live a pretty happy life on the ground because of higher temperatures. Maybe it's climate change.

"The other part is in general farmers are monitoring for roundworms, which is another parasite, and if they don't find this in their animals then they don't treat them.

"The treatment kills all sorts of parasites so unfortunately the lungworm is being left because the other ones are not there."



Haggis is the cornerstone of Burns Night suppers

SEE ALSO

- ▶ Chieftain crowned in pudding race
22 Sep 08 | South of Scotland
- ▶ Scot claims haggis eating crown
30 Aug 08 | Tayside and Central

RELATED INTERNET LINKS

- ▶ Scottish Agricultural College

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Monitoring change

- Change in prevalence, geographical distribution & seasonality of major GI nematodes that contribute to parasitic gastroenteritis (PGE) e.g. *Teladorsagia* & *Nematodirus*



Contents lists available at [ScienceDirect](#)

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar



Sheep helminth parasitic disease in south eastern Scotland arising as a possible consequence of climate change

F. Kenyon^a, N.D. Sargison^{b,*}, P.J. Skuce^a, F. Jackson^a

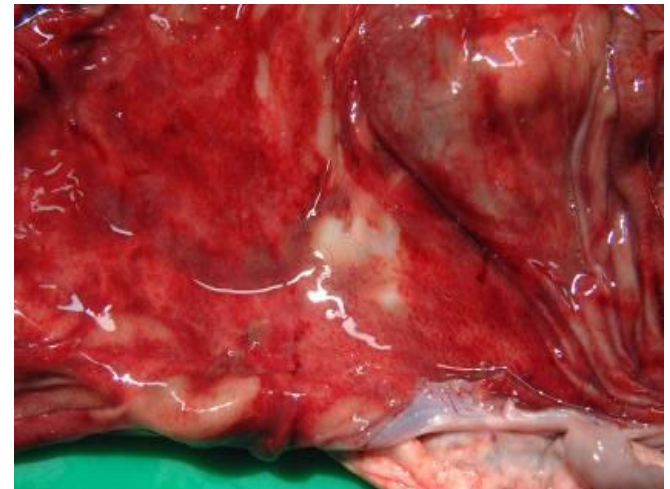
^a Parasitology Division, Moredun Research Institute, Pentlands Science Park, Bush Loan, Penicuik, Midlothian, EH26 0PZ, United Kingdom

^b University of Edinburgh, Royal (Dick) School of Veterinary Studies, Large Animal Practice, Easter Bush Veterinary Centre, Roslin, Midlothian, EH25 9RG, United Kingdom

Emerging Disease Threats

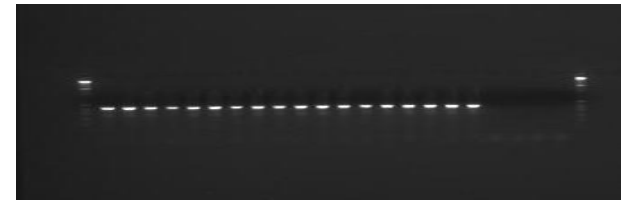
Haemonchus contortus – the “Barber’s Pole” worm

- Most important GI nematode of small ruminants in the world
- Highly pathogenic, blood-feeding parasite
- Scourge of livestock industry in S. Hemisphere, esp. Australia, S. Africa & S. America



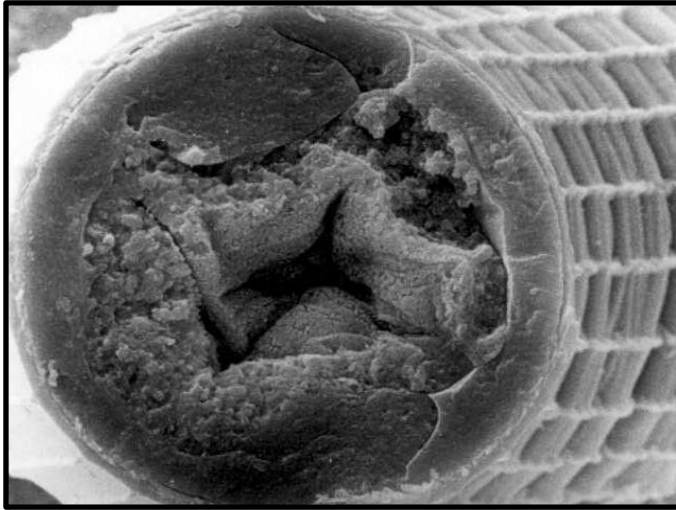
Haemonchus contortus in the UK

Survey of ~200 sheep farms:



	% Farms +ve for <i>Haemonchus</i>	
	Ewes	Lambs
England	66%	59%
Wales	42%	31%
Scotland	29%	22%
% <i>Haemonchus</i> in sample	0-58%	0-93%

Adapting to Change –*Haemonchus* vaccine

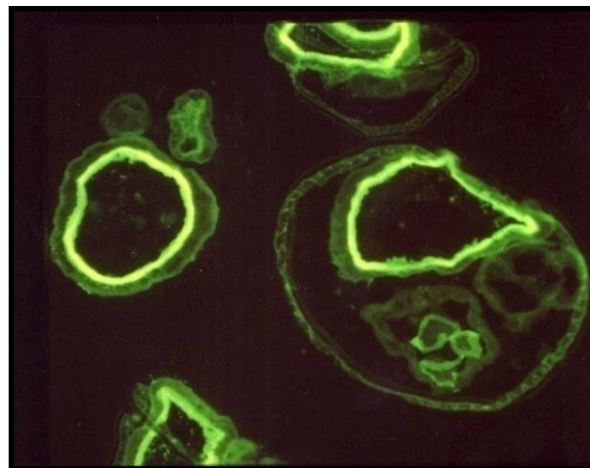


1. Extract proteins from the parasite's gut



2. Inject into sheep, which make antibodies that circulate in the blood

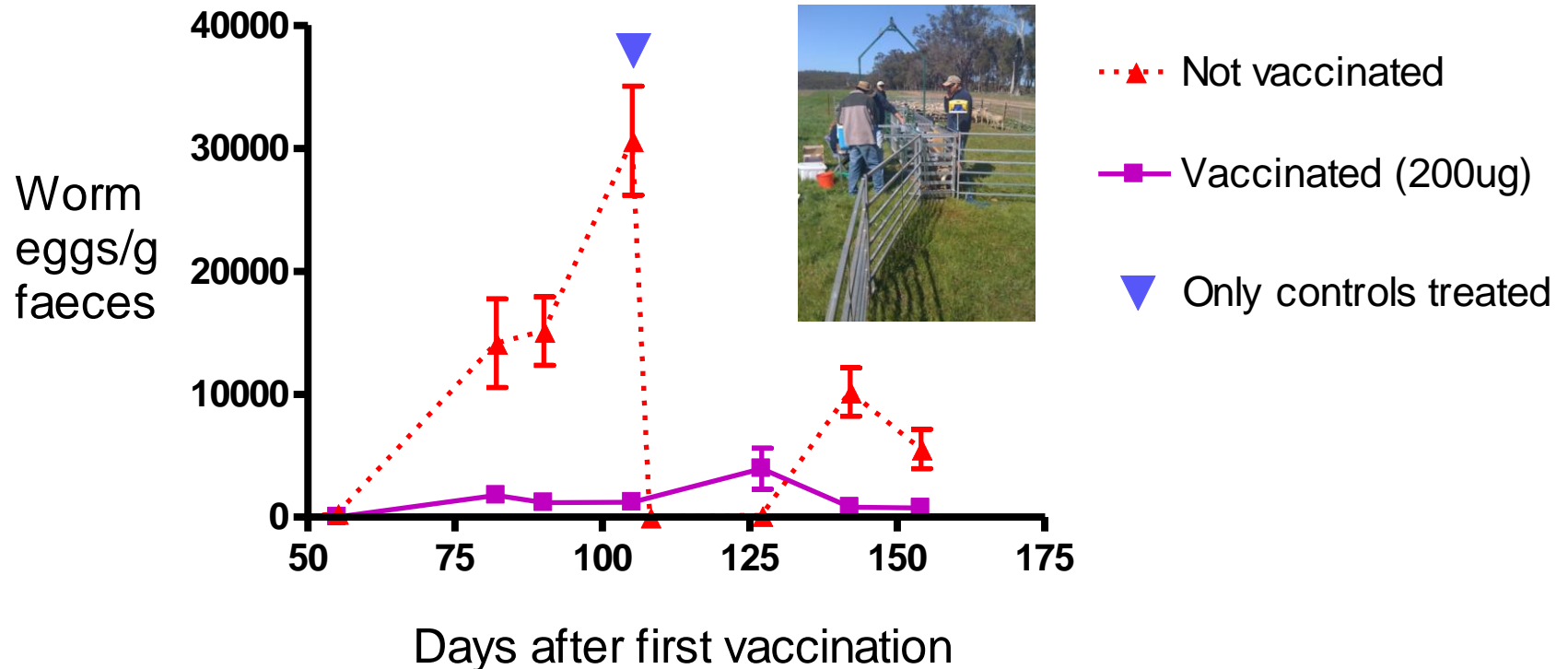
3. When a vaccinated animal gets infected, the parasites ingest blood containing antibodies that bind to their intestines ...



...leading to greatly reduced egg output and worm numbers!

Field trials of *Haemonchus* vaccine

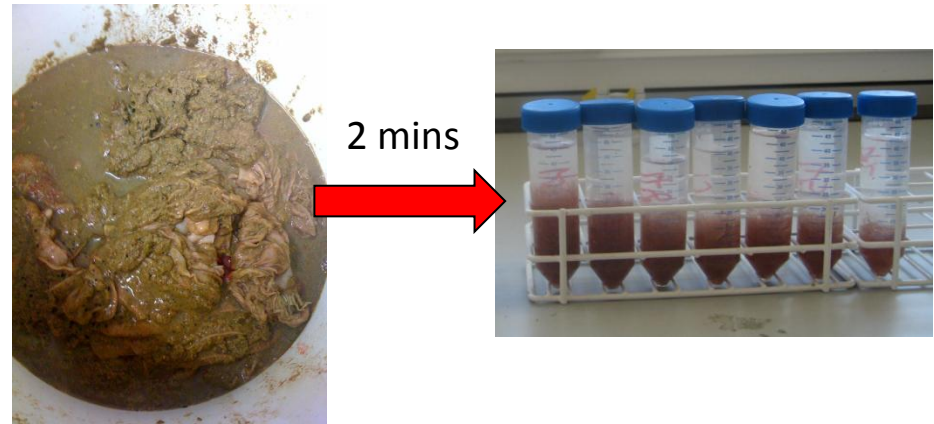
Effect of vaccine on grazing Merino lambs in NSW



Trialled in calves, grazing lambs & goats in S. Africa, Australia & Brazil

Commercial vaccine production

- Machine for rapid recovery of adult *Haemonchus* from infected abomasa coming off the line at an abattoir
- One person can purify ~1.5 million doses (@2 μ g) of vaccine in <2 weeks
- This represents the first vaccine for any gut worm in any host, inc. man!



Adapting to Change - Extreme Weather Events



- Higher incidences of flooding will increase the risk of faecal contamination of water courses, thus posing an increased public health risk.

BBC NEWS You are in: **Scotland**
Sunday, 4 August, 2002, 10:19 GMT 11:19 UK

Cryptosporidium strikes again



Few cases of illness tend to be linked to water supplies

The discovery of the cryptosporidium parasite in water supplies in Glasgow comes a matter of months after an outbreak struck the north east of Scotland.

The latest alert has affected about 140,000 people in Glasgow after the infection, which can cause severe diarrhoea, was detected in the Mugdock Reservoir in Milngavie.

Those in the affected areas have been urged to boil water before drinking it.

However, Scottish Water said it was safe to use for washing clothes and dishes and for bathing - although not for bathing babies.



Cryptosporidium is commonly spread by animals

No-one has yet reported any illness associated with the Glasgow incident.

The most recent outbreak in the UK struck the Grampian region in January.

See also:

- 04 Aug 02 | Scotland Major alert over tap water parasite
- 04 Aug 02 | Scotland Flood aftermath 'a national emergency'
- 18 Mar 02 | Scotland Water bug outbreak grows
- 11 Oct 01 | England Alert over water-borne bug
- 18 Apr 00 | UK Sheep infect drinking water
- 03 Nov 98 | Health Clampdown on water bugs

Internet links:

- Scottish Water
- Drinking Water Inspectorate
- Greater Glasgow NHS Board

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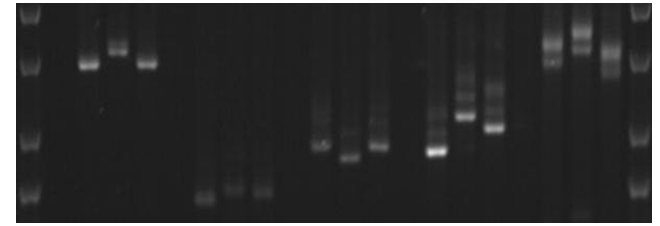
- Change to World

Cryptosporidium

- Protozoan parasite, common in cattle and sheep
- Also affects humans
- Molecular (DNA-based) typing tools developed to understand transmission and improve prevention
- Recent problem in cattle in Aberdeenshire - “CryptoBeef” project



Parasite diversity



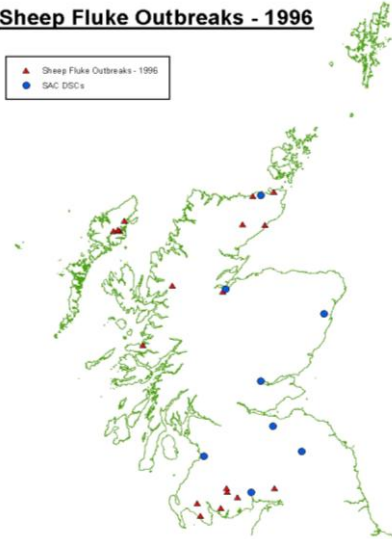
Adapting to change

Liver fluke, *Fasciola hepatica*

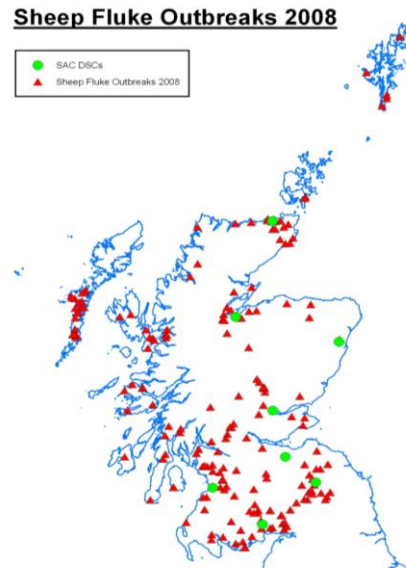
- Emerging disease during last Programme
- Need for improved control measures
- Focus of research in new RESAS Programme



Sheep Fluke Outbreaks - 1996

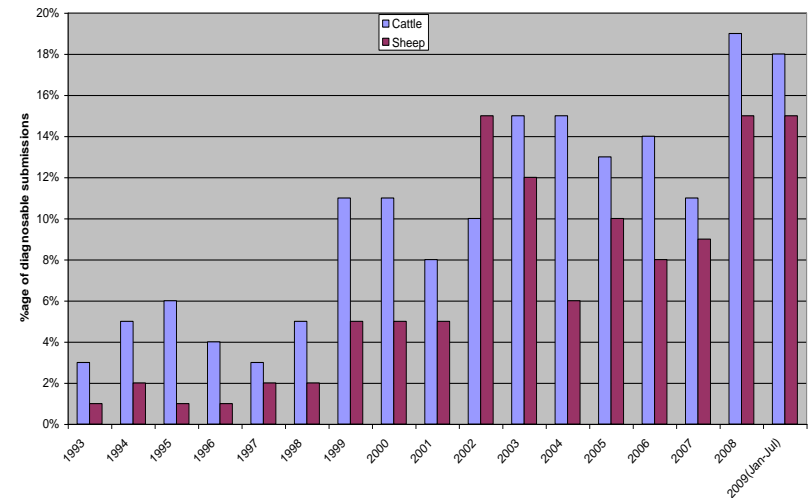


Sheep Fluke Outbreaks 2008



Data SAC VIS

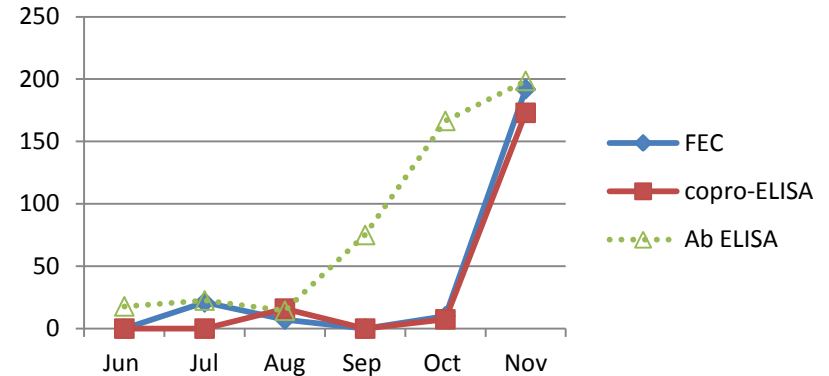
Liver Fluke Outbreaks as %age of diagnosable submissions



The Scottish Government

New Needs: Liver Fluke Diagnostics

- Live Animal
 - invasive (blood)
 - non-invasive (faeces)
- Treatment efficacy
 - Faecal egg count reduction test (FECRT)
 - Coproantigen reduction test (CRT)
- Pasture burden
 - fluke in snails
 - cysts on pasture



Acknowledgements

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