Improving the control of liver & rumen fluke in suckler cows and beef cattle

Associate Professor Theo de Waal

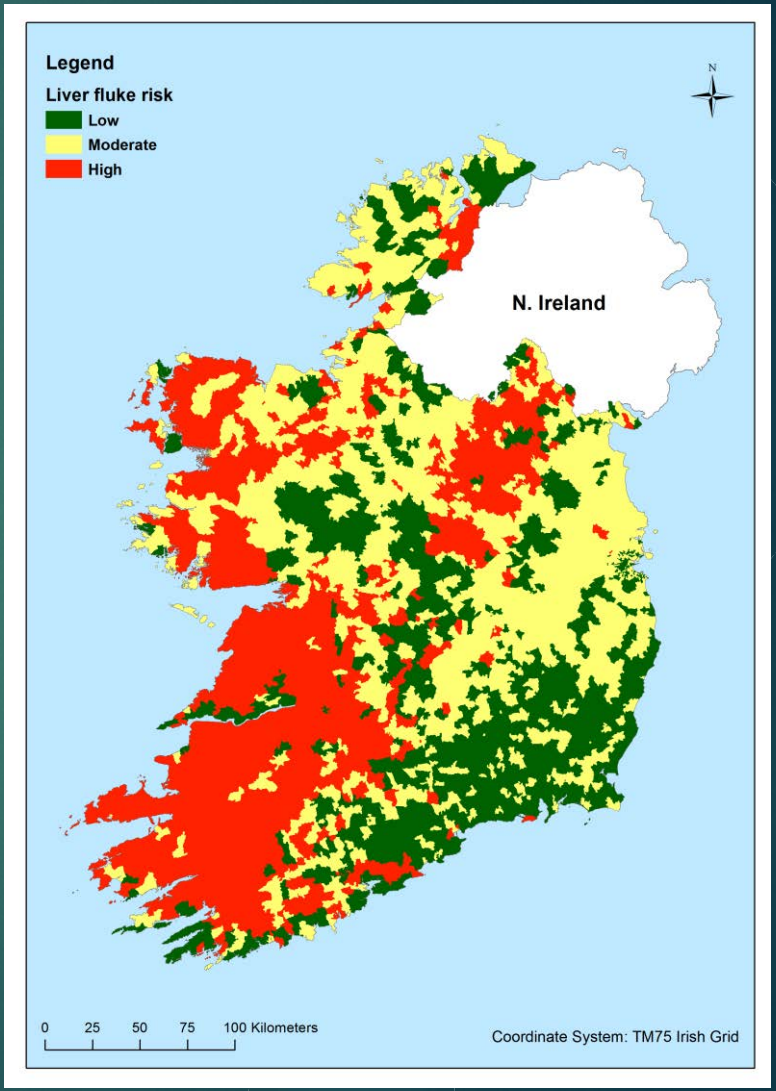
University College Dublin
School of Veterinary Medicine

Outline

- Brief review
  - Life cycles
  - Epidemiology
  - Pathology
- Strategies for treatment and control

Introduction liver fluke

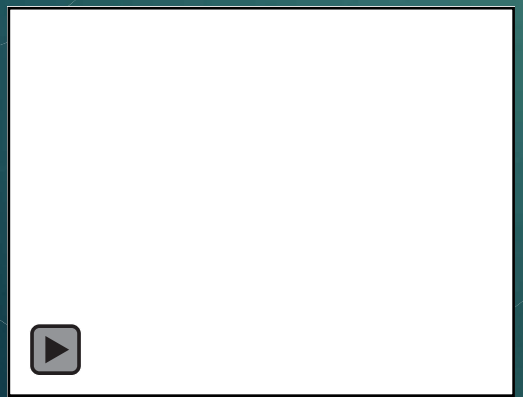
- Parasitic disease of major importance
- 82% of dairy herds exposed
- Annual economic loss >€60 million
  - Acute & subclinical disease
    - Milk production ↓8%
    - Weight gain ↓8-22%
    - Reduced conception rates
- Increase in anthelmintic resistance

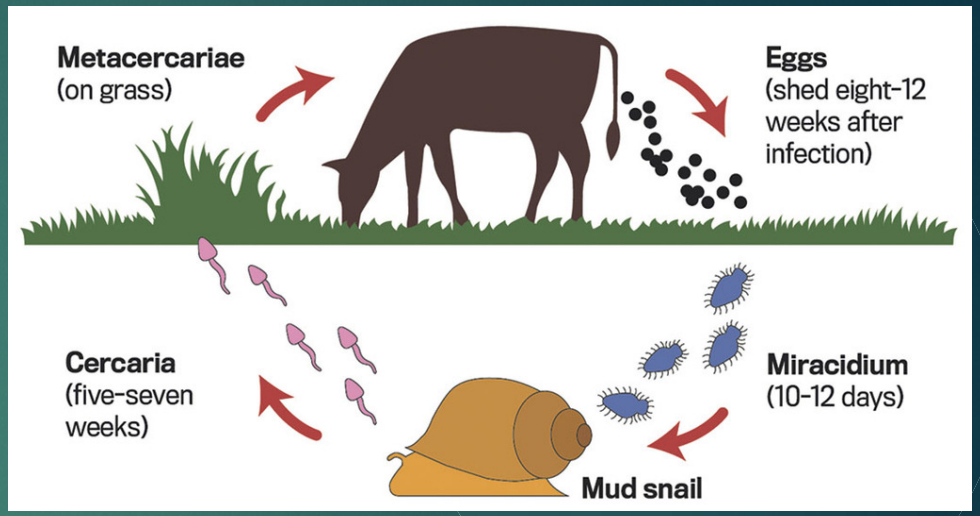


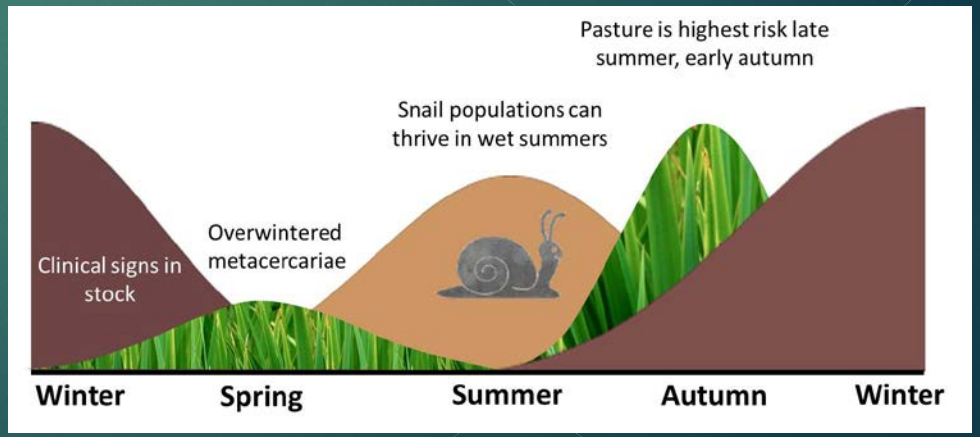
Selemetas, et al., 2015. Geospat Health 9, 281-291

Life cycle of *Fasciola hepatica*

- Eggs with bile flow into intestine → faeces
- Develop in aqueous environment → miracidium
- Infect intermediate snail host – *Galba truncatula* – 20-30 h
- Asexual reproduction in snail → cercariae
- Metacercariae on grass
  - Survive several months







Snail biology

Habitat
- Water & wet ground

Permament:
- River banks, ditches, poorly drained fields

Temporary:
- Tracks, footprints, poached land

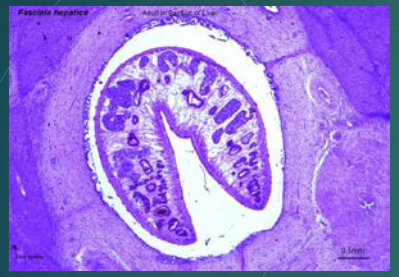
Soil
- Muddy, loamy or clay
- pH 5 -9

Life cycle
- Egg → adult: 3 months
- Development: >10-25 °C
- 2-3 generation per year

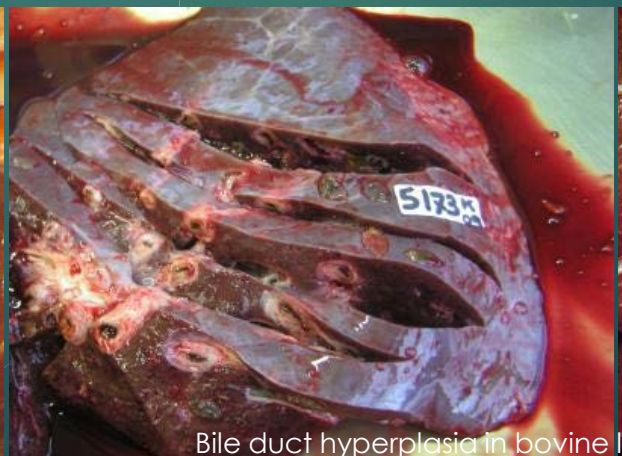
Aestivation
- During drought conditions
- 6 weeks to 4.5 months of dry periods in mud

Hybernation
- Mild winters
- Overwinter (young snails)

Pathogenesis



Phase	Activity	Signs
Juvenile flukes in liver parenchyma ~4days - 6 weeks	Destruction of liver tissue	Anaemia
	Internal bleeding	Hypoalbuminaemia
	Disturb liver function	Metabolic disorders
Adult fluke in bile ducts > 6 weeks	Damage bile duct mucosa & blood sucking	Inappetence
	Loss of red blood cells	Anaemia
	Loss of serum proteins	Hypoproteinaemia
	Degradation of muscle proteins	Weight loss



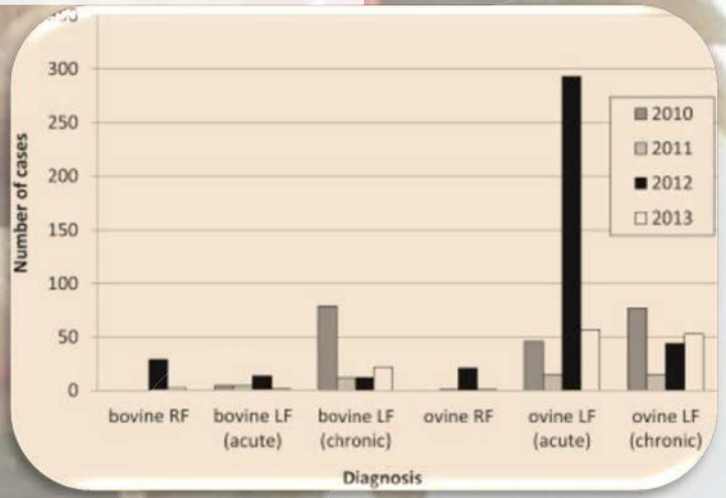
Bile duct hyperplasia in bovine livers chronically infected with fluke

CLINICAL SIGNS: Liver fluke

- Persistent diarrhoea
- Chronic weight loss
- Poor body condition score despite an adequate ration
- 'Bottle-jaw', rarely seen in cattle
- Severe infections may cause anaemia
- Subclinical infections
  - Reduced milk yield & quality

Introduction rumen fluke

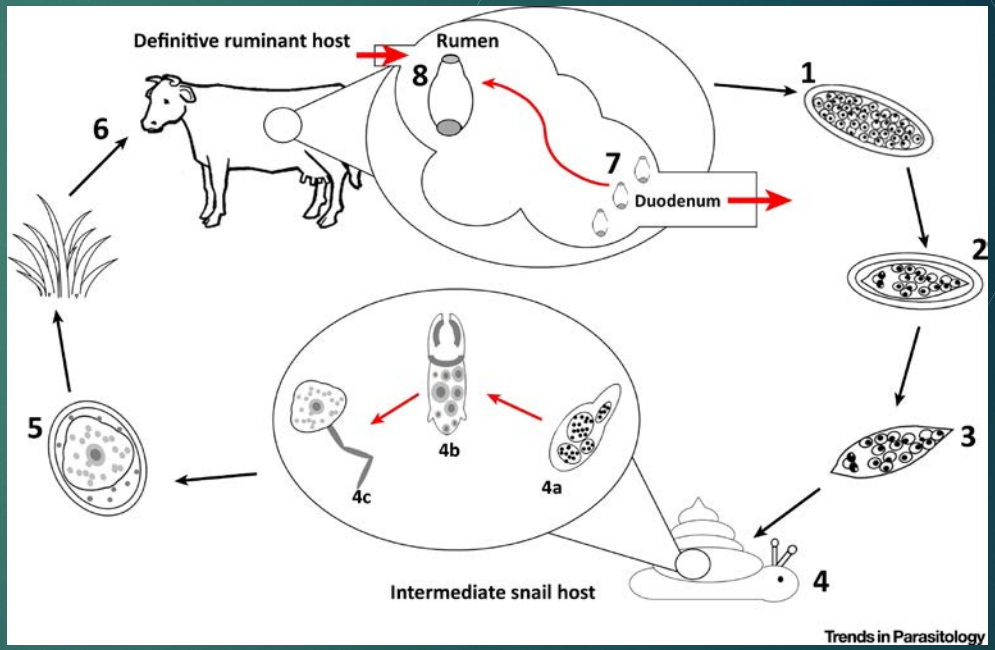
- Historically rarely seen in temperate climates
- In recent years significant increase in prevalence
  - 2006: 5.3% to 42.5% in 2013 of cattle samples submitted to VLS
- Clinical disease and mortality infrequent
  - 2012: 29 cases from 22 herds in 11 counties
- Rumen fluke in cattle = *Calicophoron daubneyi*



Mortality attributed to rumen fluke (RF) and liver fluke (LF) in cattle and sheep in ROI 2010 – 2013; VLS, DAFM based on routine diagnostic necropsy
(Toolan, D.P., *et al.*, 2015. Vet. Parasitol. 212, 168-174.)

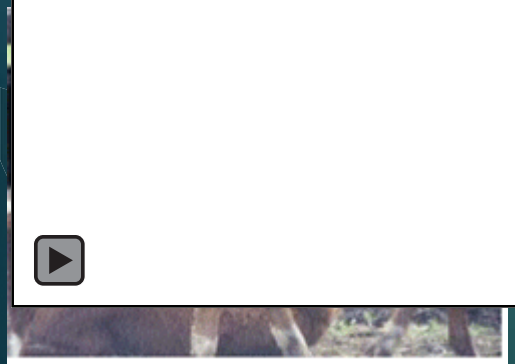
Life cycle rumen fluke "*Calicophoron daubneyi*"

- Eggs in faeces
  - Survive for months in humid environments
- Miracidia invade snail intermediate host
- Cercariae released and encysts (metacercariae) on vegetation
  - Remain viable 3-5 months



Trends in Parasitology DOI: (10.1016/j.pt.2017.07.002)

Clinical disease: Rumen fluke



Calf scouring due to stomach fluke infection. Note emaciated condition of animal.

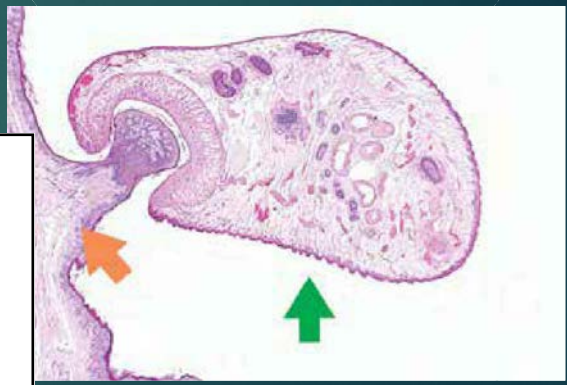
Immature rumen fluke isolated from faecal sample

Severe lesions in small intestine due to immature rumen fluke

Photos: Cosme Sánchez-Miguel, Máire McElroy, Micheal Casey

Adult rumen fluke

- Adults in rumen – minor damage
- Greyish to reddish colour (parasite haemoglobin)
- **Anterior sucker** → Pharynx point away from rumen and probably feed on rumen digesta
- Blind-ended ventral sucker (**acetabulum**) attach to ruminal epithelium



Rumen fluke (green arrow) attached by acetabulum to a plug of ruminal epithelium (orange arrow)
Photo: Cosme Sánchez-Miguel, Máire McElroy

Epidemiology liver- and rumen fluke

- Liver- and rumen fluke: *Galba truncatula* intermediate host
- Environmental conditions for snail and fluke development
  - Moisture is necessary for snail and the swimming cercariae
  - Temperature for optimal development of both snail and fluke larvae
    - > 10 °C (Ideal 18 - 27 °C)
  - Snails prefer slightly acid soils
  - During certain times of the year, almost all pasture land falls into these parameters
- Larval stages may overwinter in snails (winter infection)
- Metacercariae survive over winter

Risk Periods

- Infection: Late summer/autumn
- Disease: Late autumn/winter
- Low after dry summer

Risk conditions

- Wet muddy areas
- Warm & wet summer
- Mild winter

Control options

Identify the risk

Grazing management

- **Avoid grazing high risk pastures**
- **Avoid co-grazing sheep and cattle**

Snails

- **Drainage**
- **Fencing**

Flukicides

- **Strategic** (pasture contamination)
- **Therapeutic** (animal welfare & performance)

Identify the risk

- Identify high risk areas of fluke on farm
- Avoid grazing these pastures in late summer and autumn
- Abattoir feedback on liver rejections
  - Early warning of a fluke problem
  - Early action - minimise reduced performance due to sub-clinical liver fluke infections
- Fluke eggs in faecal samples
  - Composite sample
  - Previous history of disease; snail habitats; treatment history

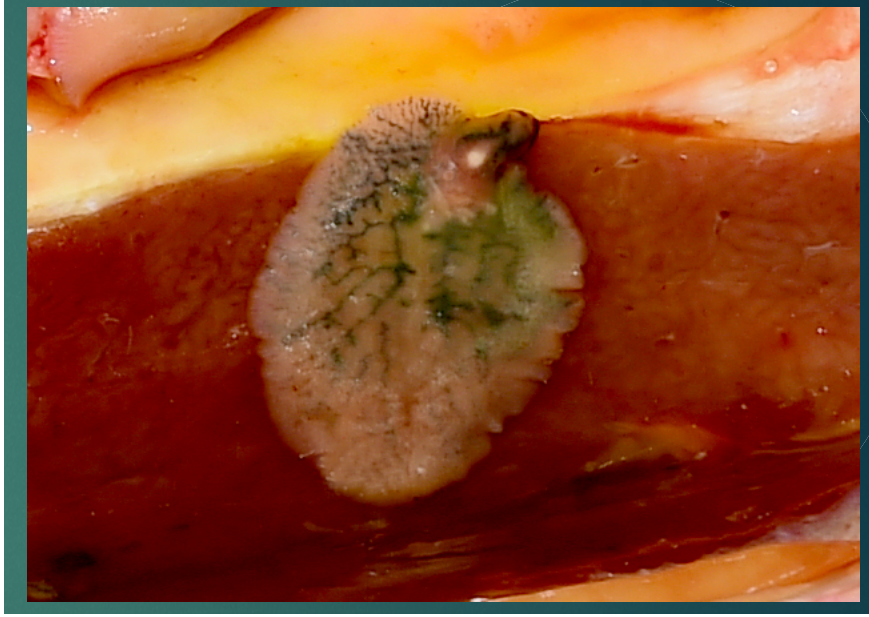
Practical steps

- Fence off wet areas
- Attend to leaking troughs & pipes
- Improve drainage
- Early housing


BEEF
HealthCheck
AnimalHealthIreland.ie
AHI
Animal Health Ireland.ie

Programme objectives

- To develop tools to assist farmers and their vets to control losses due to liver fluke and pneumonia through capture, analysis and reporting of abattoir data.
- To contribute to the development by ICBF of economic breeding indexes that incorporate health and disease data.



AHI
Animal Health Ireland.ie

Beef HealthCheck

Information Leaflet For Temporary Veterinary Inspectors

MEAT INDUSTRY IRELAND

Ibec

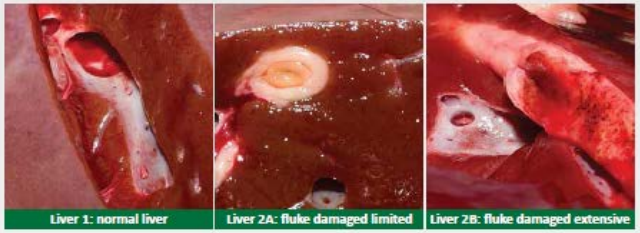
FBD Trust

BEEF HealthCheck
AnimalHealthIreland.ie

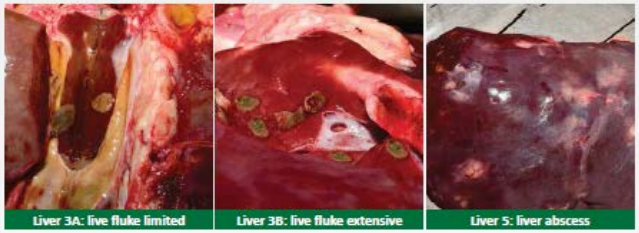
AHI
Animal Health Ireland

Animal Health Ireland,
Main Street, Carrick-on-Shannon, Co Leitrim.
Tel: +353 (0) 71 9671928,
Email: admin@animalhealthireland.ie
www.animalhealthireland.ie

BHCVETINFV.1 01.10.15



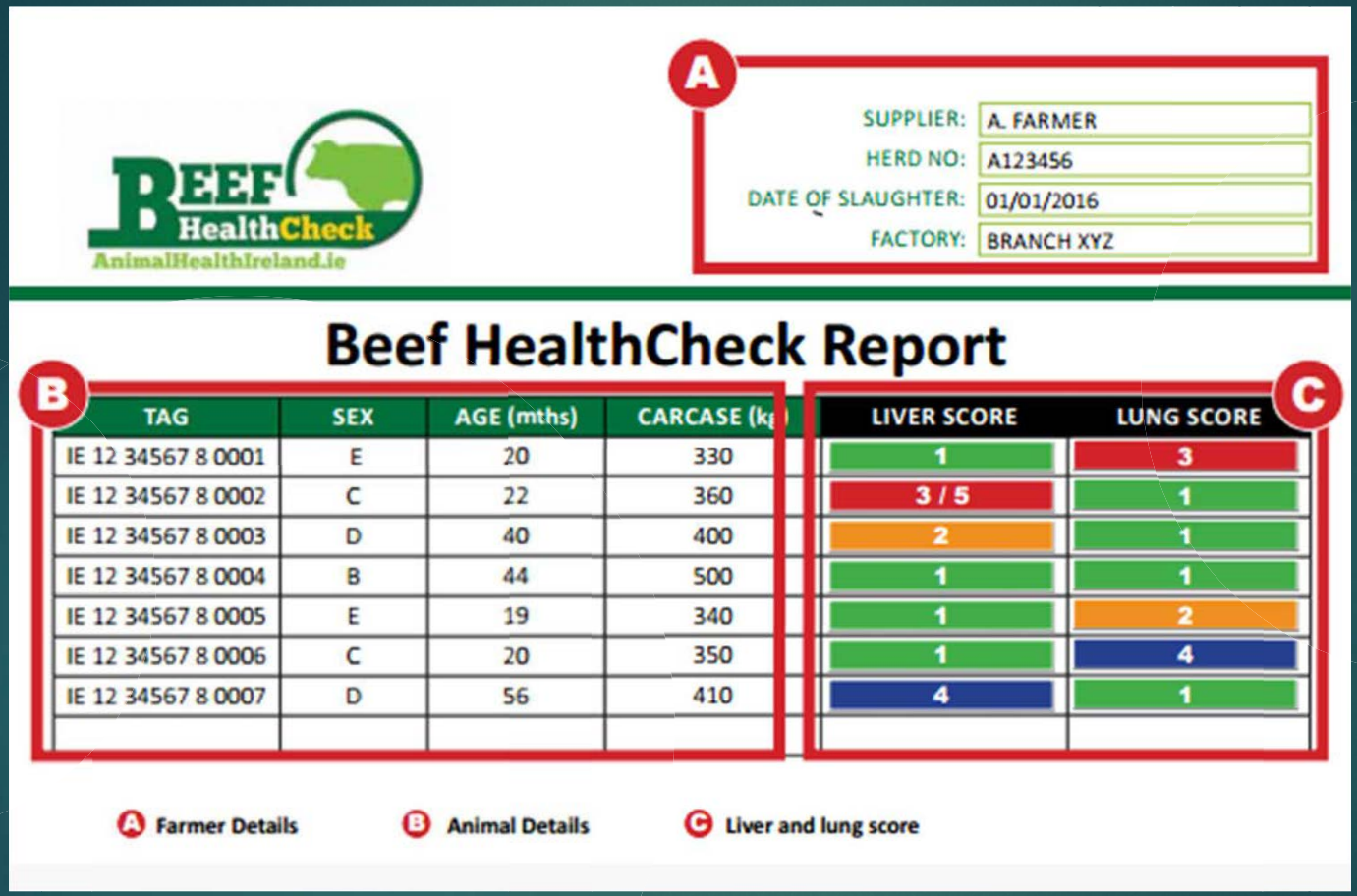
Liver 1: normal liver | Liver 2A: fluke damaged limited | Liver 2B: fluke damaged extensive



Liver 3A: live fluke limited | Liver 3B: live fluke extensive | Liver 5: liver abscess

Lung 1: normal lung | Lung 2: pneumonia limited | Lung 3: pneumonia extensive

Lung 3: pneumonia extensive photo courtesy of Donal Toolan, RVI. Kilkenny.


BEEF HealthCheck
AnimalHealthIreland.ie
A
SUPPLIER: A. FARMER
HERD NO: A123456
DATE OF SLAUGHTER: 01/01/2016
FACTORY: BRANCH XYZ
Beef HealthCheck Report
B
TAG SEX AGE (mths) CARCASE (kg)
IE 12 34567 8 0001 E 20 330
IE 12 34567 8 0002 C 22 360
IE 12 34567 8 0003 D 40 400
IE 12 34567 8 0004 B 44 500
IE 12 34567 8 0005 E 19 340
IE 12 34567 8 0006 C 20 350
IE 12 34567 8 0007 D 56 410
C
LIVER SCORE LUNG SCORE
1 3
3 / 5 1
2 1
1 1
1 2
1 4
4 1
A Farmer Details
B Animal Details
C Liver and lung score

Beef HealthCheck liver results

Normal Liver

Fluke damaged liver

LIVER RESULTS

Liver lesions result in reduced performance

SCORE

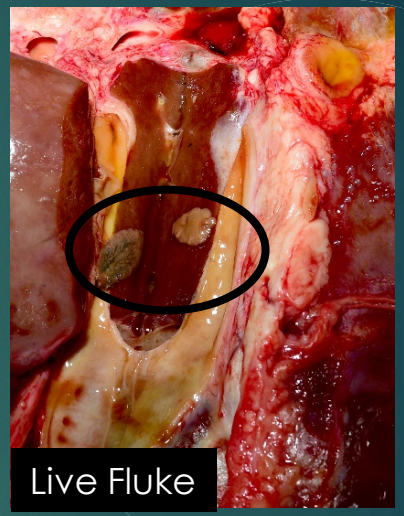
1 Normal Liver: No liver abnormalities detected.

2 Liver damaged by fluke but no live fluke: Fluke may not be observed because the animal has (i) been treated and cured (ii) has under gone 'self cure' or (iii) live fluke may have been present but not observed.

3 Liver damaged by fluke and live fluke present: Live fluke may be present because: the animal was (i) not treated for fluke (ii) re-infected after a previous treatment (iii) treated with a product that only kills adult fluke, leaving young fluke alive (iv) given a product to which the fluke have become resistant.

4 Liver other: Liver damage due to other causes. Examples include liver tumours or cirrhosis.

5 Liver abscess: Abscesses may occur following gut damage from a high grain diet or as an extension of infection from a 'navel ill' or other infection.



Live Fluke

Liver Abscess

Using the information:

Implementation and monitoring of herd health plans

- Dosing programmes (liver fluke)
- Vaccination programmes (respiratory disease)
- Nutritional management (liver abscesses)

Treat appropriately

- Treat with most appropriate product for the time of year

Strategic

- Reduce pasture contamination with fluke eggs
  - April – August (earlier if not housed)

Therapeutic

- Assess risk and remove flukes to prevent damage to host
  - November – March
- Ensure the dose rate is accurate by weighing animals
- Follow manufacturer instructions for storage and administration accurately
- No flukicidal products have residual activity
  - Animals left on infected pastures will become re-infected

Flukicide spectrum of activity

Drug & route	Early immature					Immature				Adult				
Fluke age	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Triclabendazole[1] Oral		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Nitroxynil sc							♦	♦	♦	♦	♦	♦	♦	♦
Closantel sc							♦	♦	♦	♦	♦	♦	♦	♦
Clorsulon sc										♦	♦	♦	♦	♦
Albendazole Oral										♦	♦	♦	♦	♦
Oxyclozanide* Oral										♦	♦	♦	♦	♦

♦ >80% efficacy

* Only drug effective against immature and mature rumen fluke

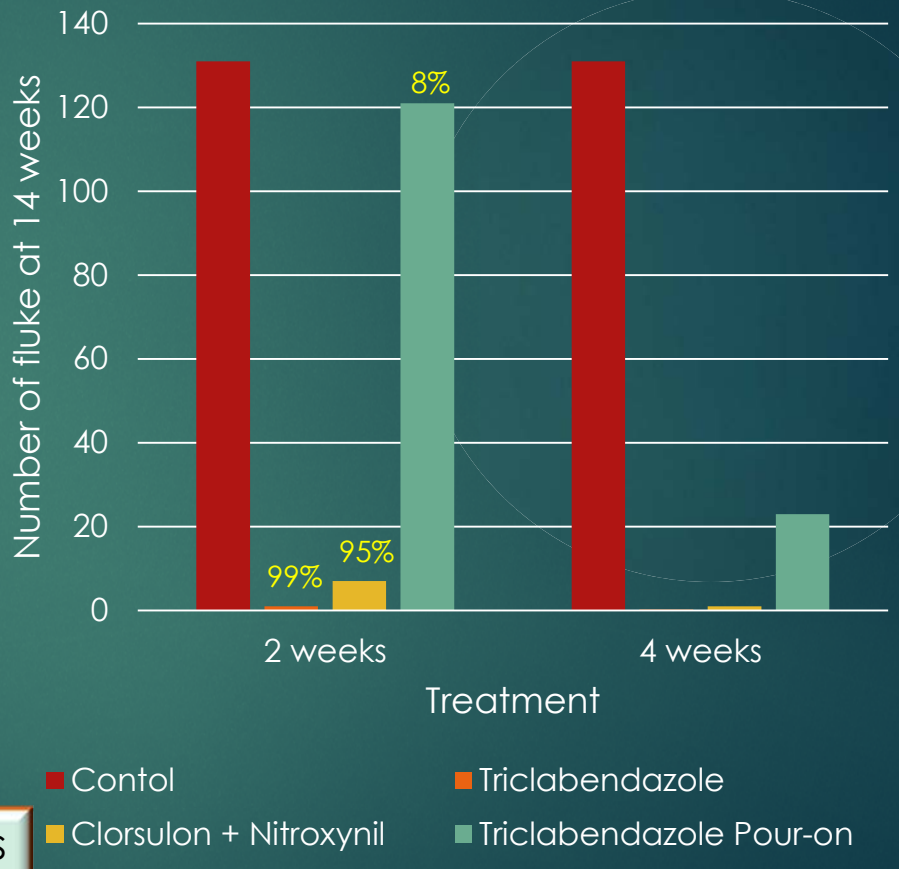
[1]Widespread resistance reported in sheep

Synergy of flukicide combinations

- Limited data to date

Australian study:

- Clorsulon + nitroxynil = activity against 2-week-old juvenile fluke upwards



Day 0: 500 TCBZ-S metacercariae to calves
Treated 2 or 4 weeks pi
Examined ~14 weeks pi

Hutchinson, G.W., et al., 2009. *Veterinary Parasitology* 162, 278-284

Strategic use of flukicides

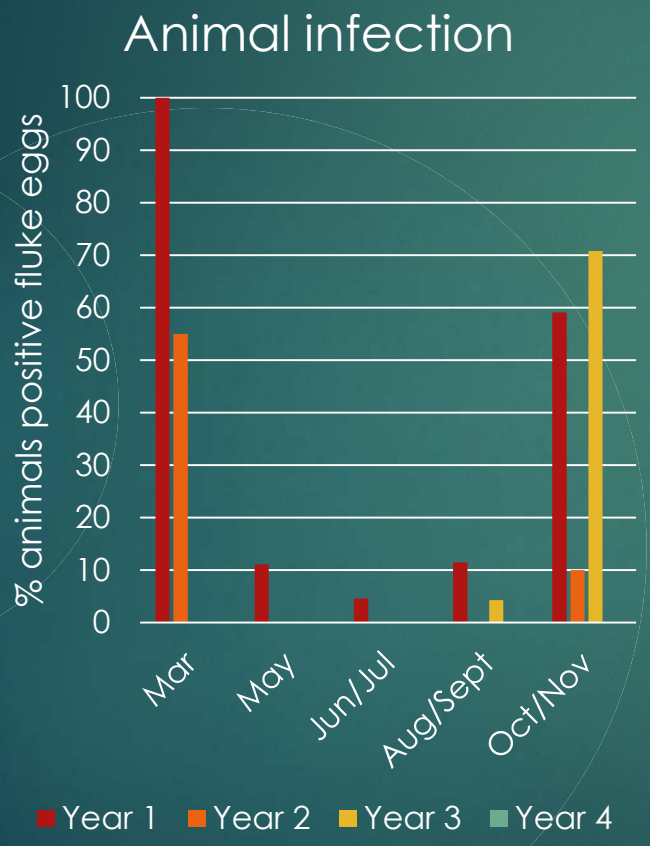
Farm:

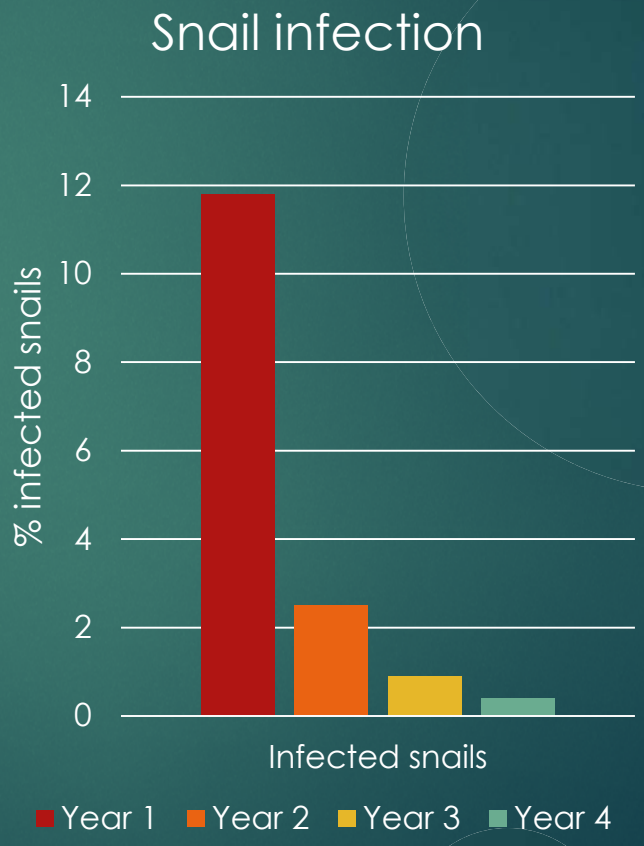
- 40–75 continental-cross heifers bought in as weanlings, kept 12–18 months
- Flock of approximately 30 lowland, cross-bred ewes
- The cattle were housed for the winter
- Treated with triclabendazole

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Y1			℞1		℞2	℞3				℞4		
Y2	℞ (sheep)		℞1		℞2		℞3				℞4	
Y3	℞ (sheep)			℞1						℞(sheep)	℞2	
Y4	℞(sheep)			℞1				℞(sheep)			℞2	

Parr, S.L., et al., 2000. Vet Parasitol 88, 187-197

Strategic use of flukicides

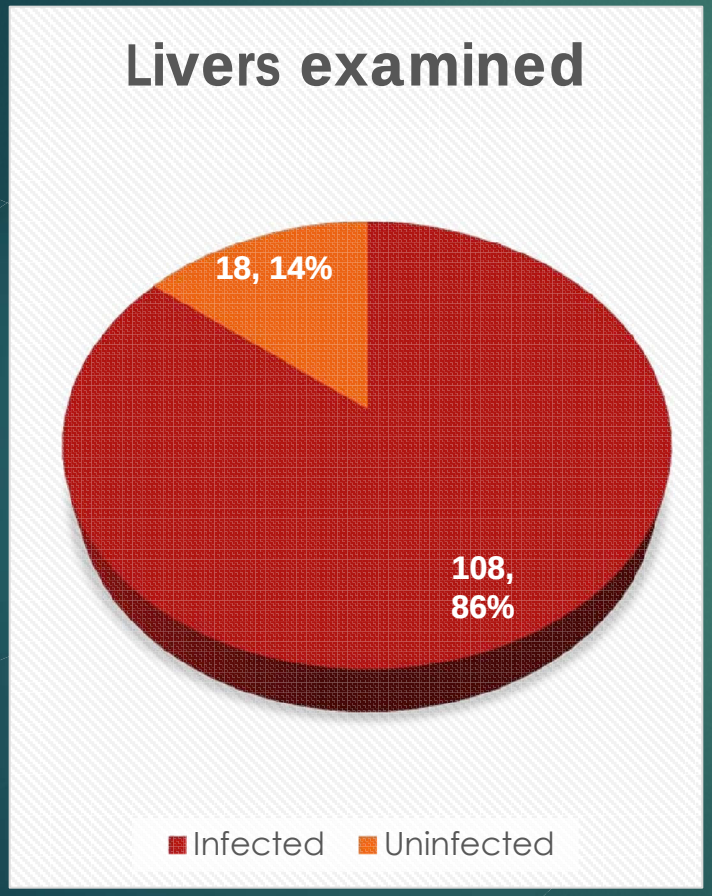


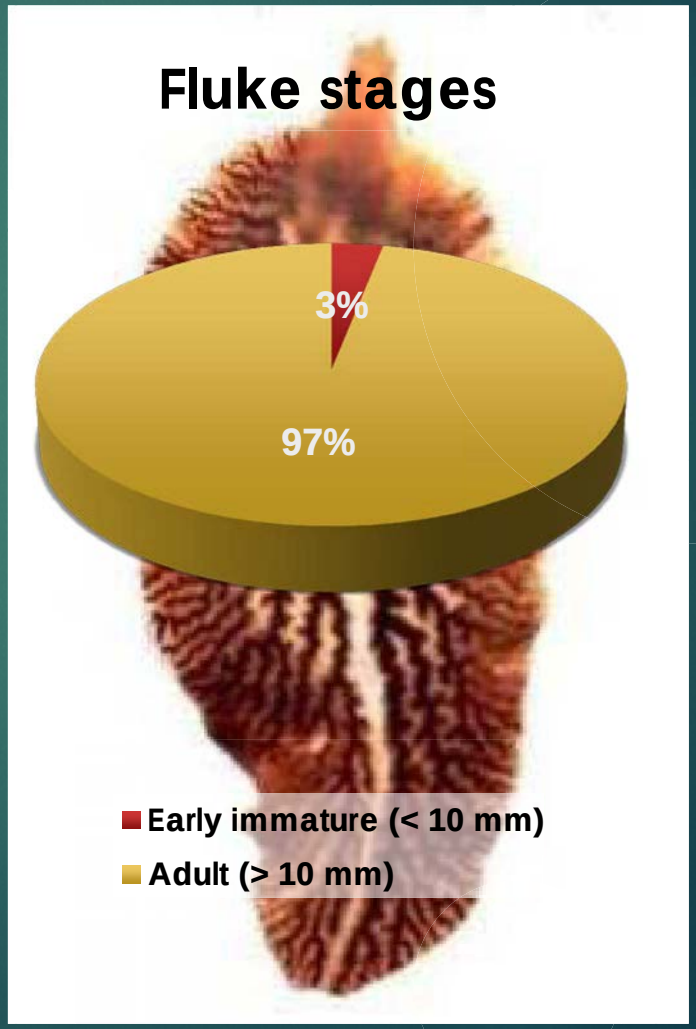


Parr, S.L., et al., 2000. Vet Parasitol 88, 187-197

Flukes in autumn in condemned livers

Identify intensity of liver fluke infestation in autumn/winter in condemned livers of cattle > 18 months, slaughtered in UK & Ireland

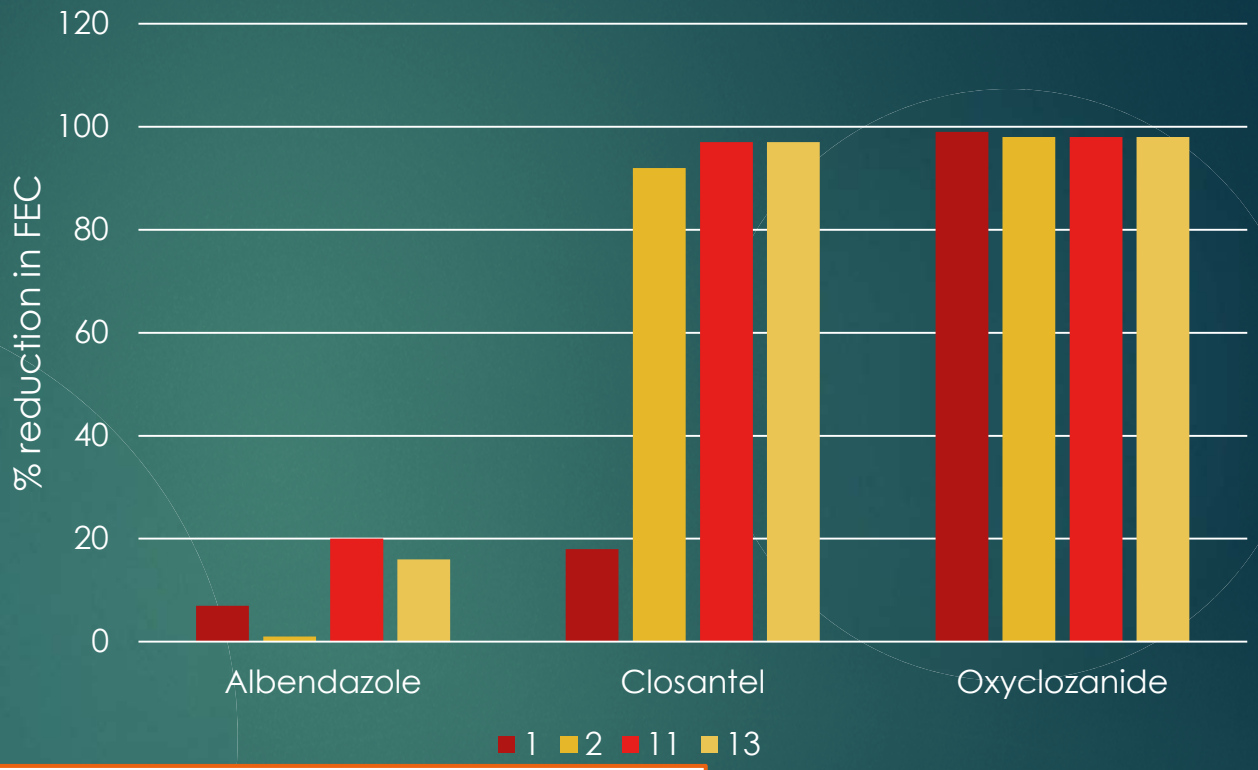




MacGillivray, et al., 2013. *The International Journal of Applied Research in Veterinary Medicine* 11, 1-6.

Rumen fluke anthelmintic efficacy

Naturally infected dairy cows
Albendazole 10 mg/kg per os
Closantel 10 mg/kg per os
Oxyclozanide **15 mg/kg** per os

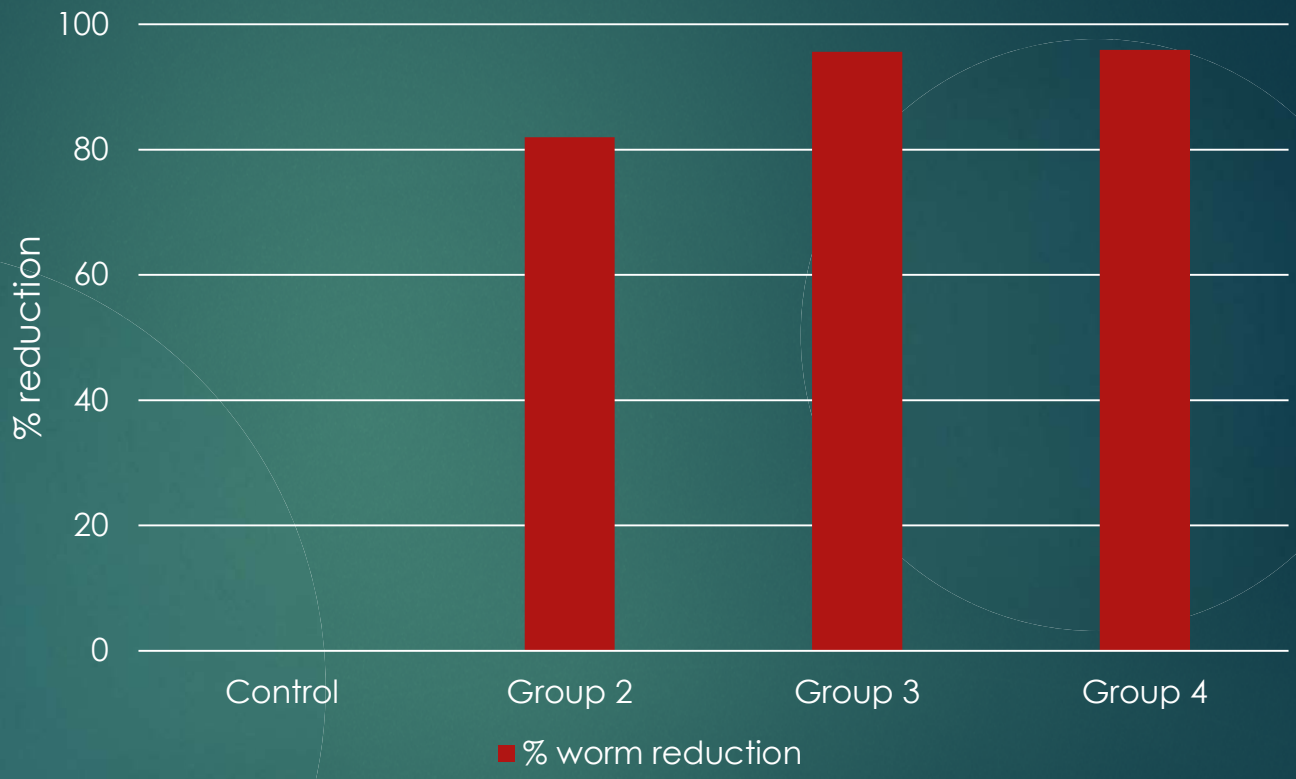


Closantel: 92% reduction in number of positive cattle
Oxyclozanide: 93% reduction in number of positive cattle
Arias, M.S., et al., 2013. Veterinary Parasitology 197, 126-129

Oxyclozanide – variable efficacy against immature rumen fluke in small intestine
Rolfe, *et al.*, 1987. Aust. Vet. J. 64, 328-332

Closantel @ 10 mg/kg s/c: %FECR = 11.2
Malrait, K., *et al.*, 2015. Veterinary Parasitology 207, 134-139

Goats: *Calicophoron daubneyi* ~ *treatment*



Goats: Day 0 - 250 *Calicophoron daubneyi* metacercariae
Group 2: Oxyclozanide 22.5 mg/kg @ 10 dpi
Group 3: Oxyclozanide 15 mg/kg @ 131 dpi
Group 4: Oxyclozanide 22.5 mg/kg @ 131 dpi
Post mortem 138 dpi

Paraud, *et al.*, 2009. The Veterinary Journal 180, 265-267

Avoid resistance

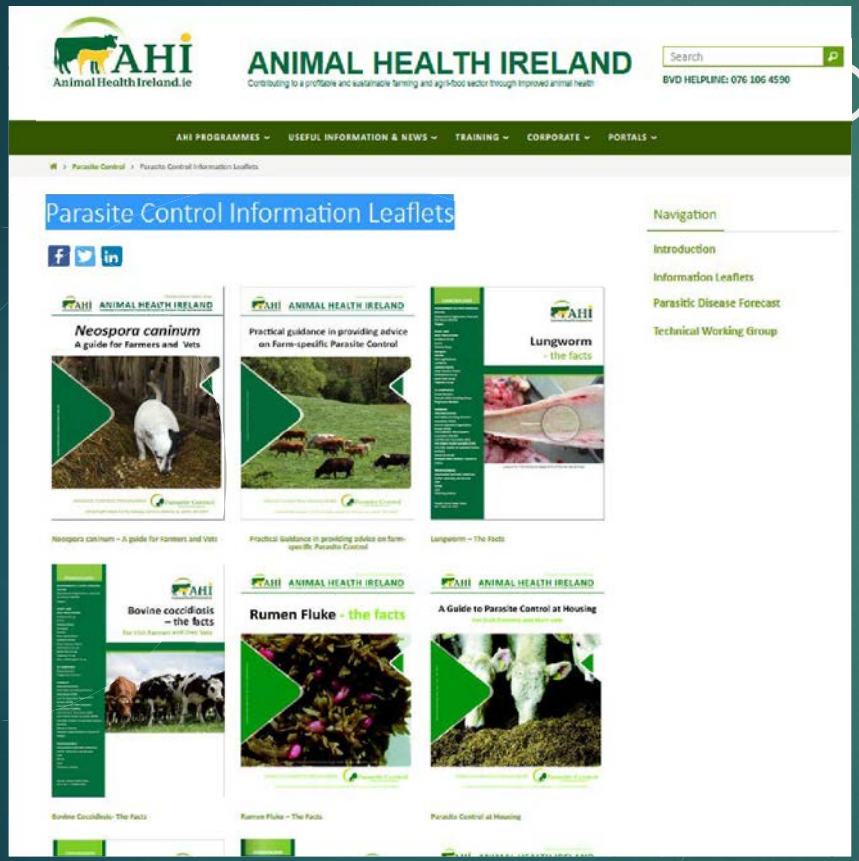
- Resistance to some flukicides[#] already prevalent in sheep and may be emerging in cattle
- If resistance is suspected: Faecal egg count reduction test
- Quarantine of all incoming stock from potential fluke areas
- Triclabendazole reserved for sheep with acute fasciolosis

[#] Triclabendazole & closantel

Golden rules

- **Reduce dependence** on flukicides by monitoring faecal egg counts
- Prevent the introduction of resistant flukes by **quarantining** and treating bought-in animals
- Target **adult flukes** – reduce source of infection for snails (timing therefore crucial)
- In outbreak – **remove** from source & treat
- Wherever possible work out a **control strategy** with your veterinarian or adviser

Parasite Control



http://animalhealthireland.ie/


Resistance
Efficacy
Unit Cost
Pack Size
Persistency
Treatment Interval
Spectrum Of Activity
Choice Of Anthelmintic
Administration Method
Milk Withdrawal Period
Meat Withdrawal Period