Towards sustainable control of worms in cattle

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The plan

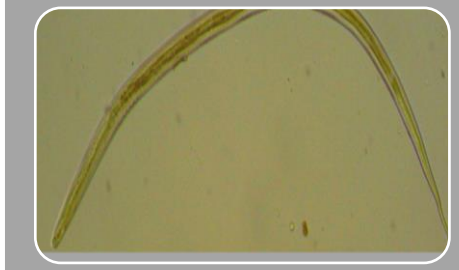
- GIN and their impact on young cattle
- Epidemiology of GIN infection
- Risk assessment & monitoring strategies

1. Gastrointestinal nematodes of cattle and their impact on youngstock

What GIN cause disease in cattle?

Over 20 species of gastrointestinal worms can infect cattle – 2 are of greatest concern:

Ostertagia ostertagi



- Small, slender red-brown worm
- Inhabits the abomasum
- The most pathogenic GIN of cattle
- Females lay an average of 350 eggs per day[1]
- Prepatent period is 21 days
- Development from the egg to the infective stage takes under 7 days in optimal conditions
- Approx 4% of developing larvae undergo hypobiosis (arrested development) – risk of type 2 disease[1]

Cooperia oncophora

- Small reddish worms up to 10mm long
- Inhabits the small intestine
- The most prevalent parasite of cattle
- Females very fecund, laying an average of 3000 eggs/day[2]
- Pre-patent period is 15-18 days
- Development from egg to infective stage takes 4 days in optimal conditions

1. Verschave et al 2014 Int J Parasitol 44: 1091-1104
2. Verschave et al 2016 Vet Parasitol 223: 111-114

Adverse effects of a GIN burden

DIRECT

- Worms utilise host nutrients
- Tissue damage

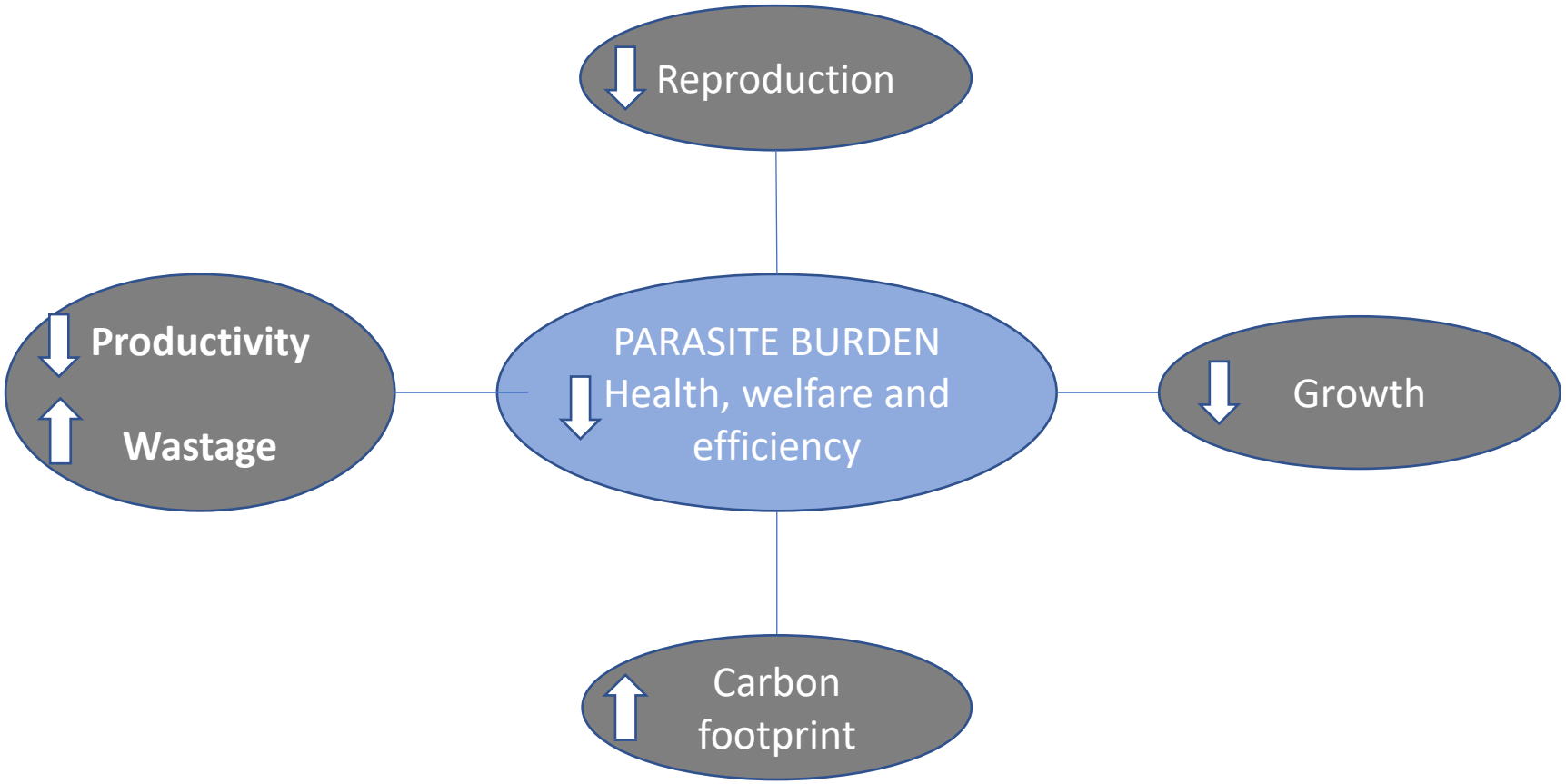
INDIRECT

- Inflammation
- Immune response uses hosts protein

REDUCED FEED INTAKE

- Resulting from parasite-induced hormonal changes

Why control GIN?



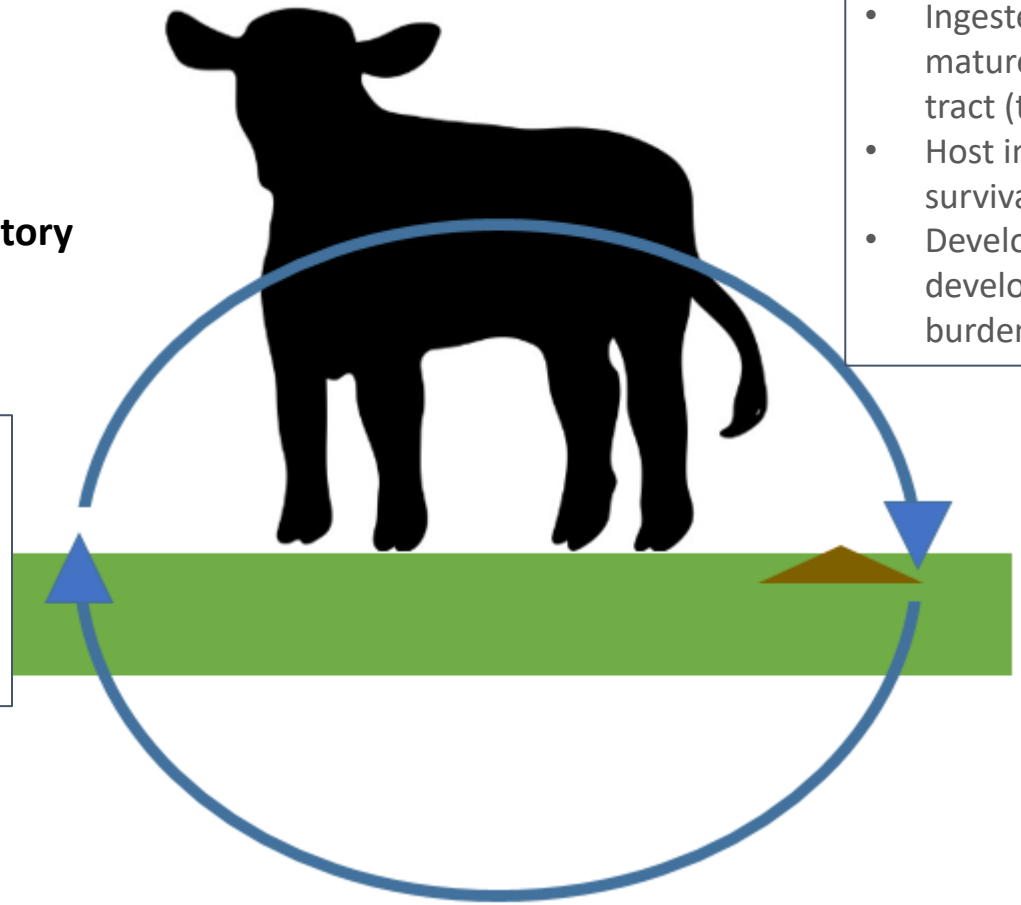
The outcome of a GIN burden at grass

Mixed worm infections within the abomasum and intestine
Risk is proportional to the pasture challenge

Clinical disease:
Typically occurs in non-immune youngstock
Watery diarrhoea; poor coat; anorexia; loss of body condition
Subclinical disease:
Impacts on growth & productivity without overt signs
Occurs in cattle of all ages

Lifecycle of cattle gastrointestinal nematodes (GIN)

Direct, non-migratory



Within the host:

- Ingested L3 larvae develop to sexually mature adults worms in the gastrointestinal tract (the pre-patent period)
- Host immunity inhibits development, survival and fecundity
- Developing larvae (EL4) can arrest their development – immunity, climate & worm burden are influencing factors

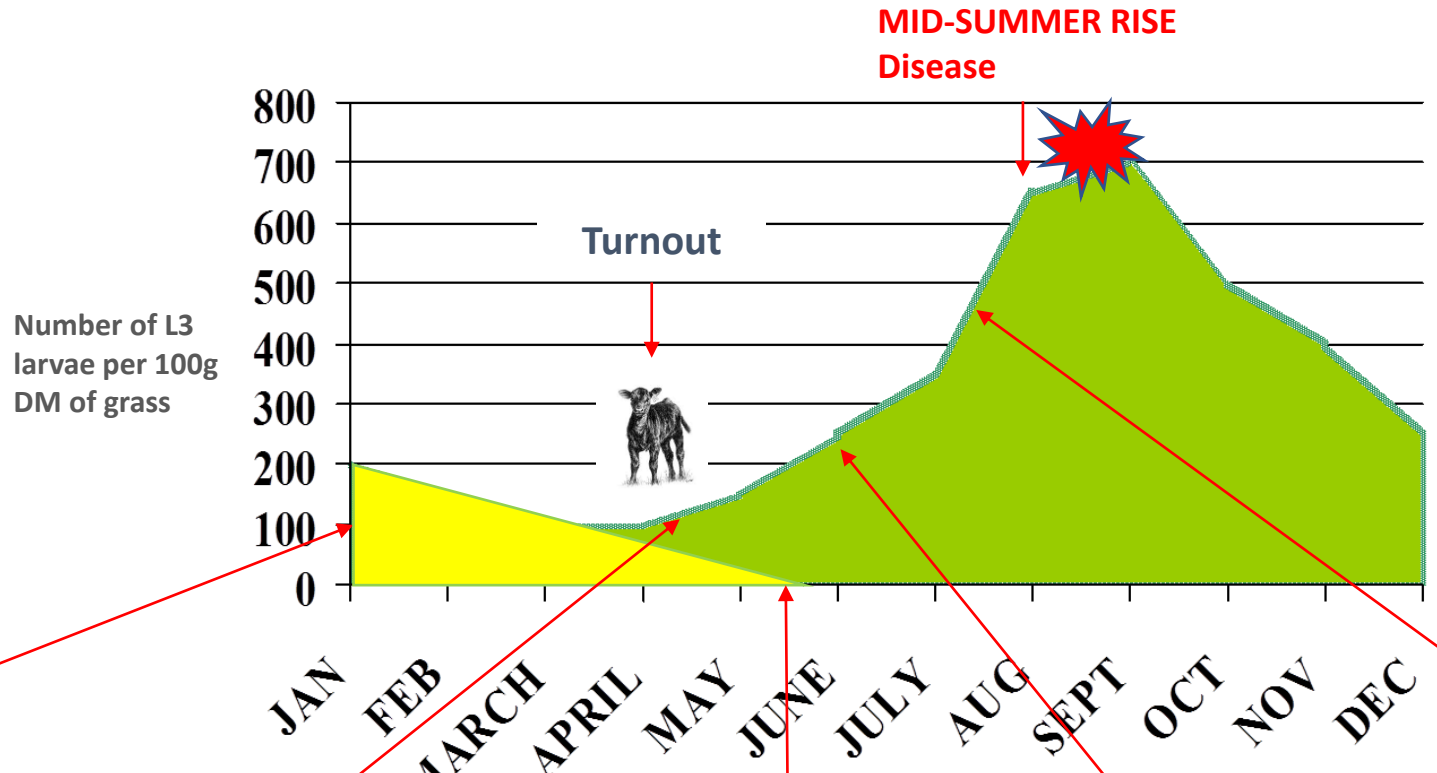
Free-living stages on pasture:

- Eggs hatch and develop to the L3 larvae the dung pat
- Warm (20-30^{o}C) wet weather favours development and survival
- No development below 5^{O}C

Risk of type 1 disease at pasture and type 2 disease – winter scours – if mass emergence during housing period

2. Developing sustainable control strategies

What would happen if we did nothing?



Overwintered L3 larvae survive on the pasture from the previous year

Young, non-immune cattle initially become infected without showing signs of scouring

Overwintered L3 larvae on the pasture will die off by mid-June

Eggs shed onto pasture result in increased larval challenge

Cycles of reinfection and optimal climatic conditions lead to rapid increase in pasture contamination

Strategic control

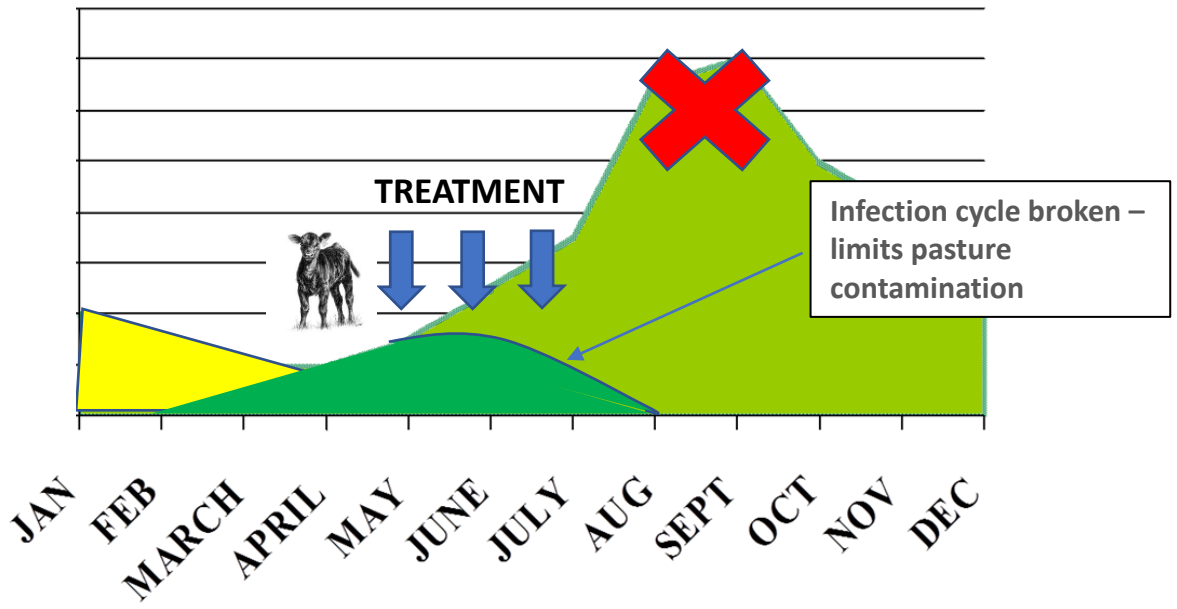
Timed treatment of groups of susceptible animals to prevent heavy worm burdens, reduce pasture contamination & disease

PROS

- Proven, reliable approach
- Season-long parasite control

CONS

- Requires repeated whole group treatment
- Preventative – treatments may not be needed



Can we adapt our approach to reduce reliance on anthelmintics and incorporate farm-level risk assessment to target treatments?

- Strategic worming with additional risk assessment to refine timing.
- Targetted selective treatment

Anthelmintic resistance – a driver for change?

Why?

Class	First released	First resistance
1-BZ	1961	1964
2-LV	1970	1979
3-ML	1981	1988

How?

Reduce reliance on anthelmintics through integrated parasite control

Avoid risky practices:

- Frequent treatment
- Blanket treatment
- Whole group treat & move strategies

Implement a quarantine programme

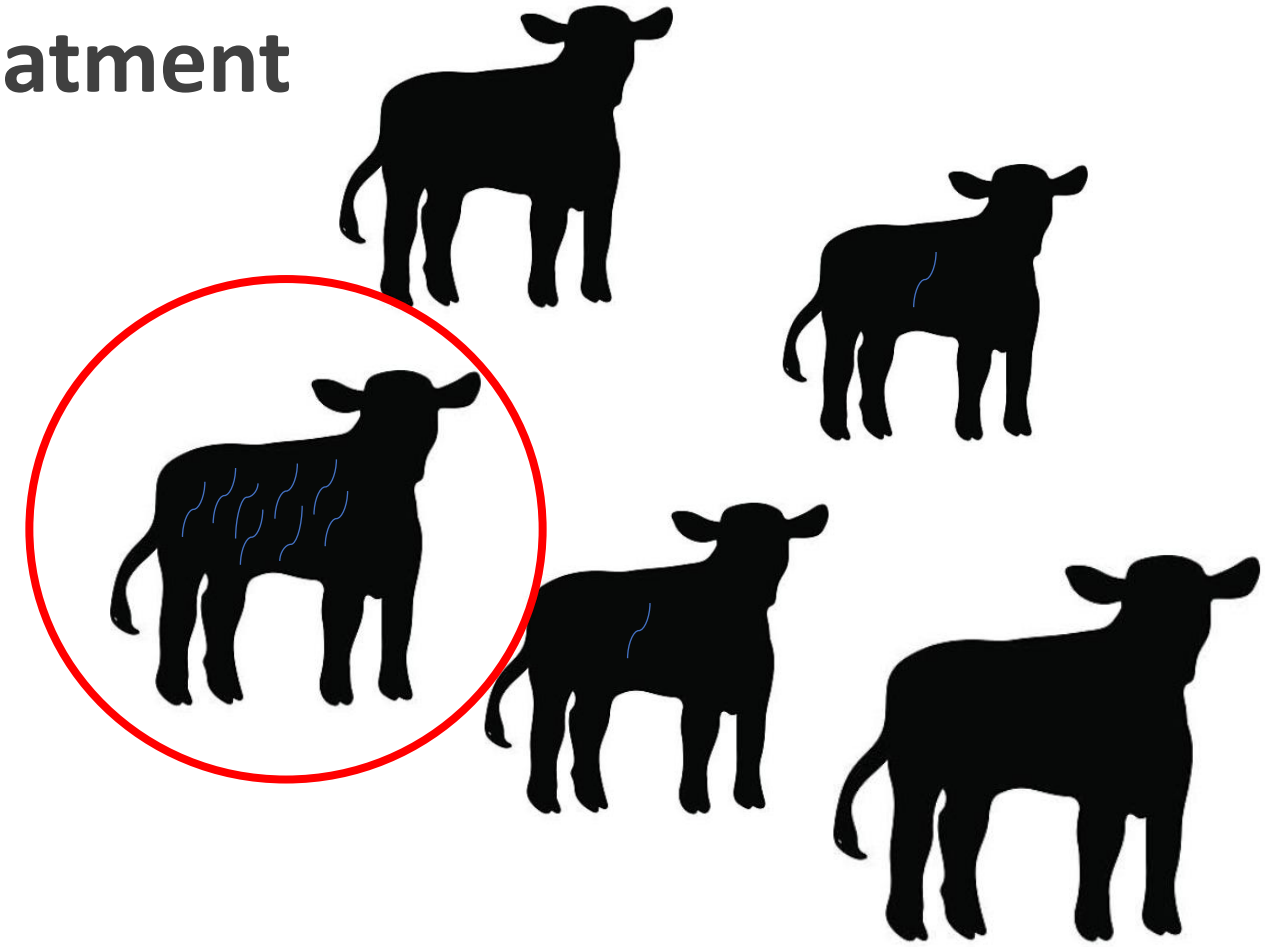
Assessing the risk to target treatment

Overdispersion – the 80:20 rule

- GINs tend to be unevenly distributed among hosts, with few of the animals in a group carrying more of the parasites.

This distribution can be related to variation in:

- host exposure e.g. different grazing behaviors
- parasite establishment or survival eg resistance/resilience of the host



Animal risk assessment

Risk Factor	High	Medium	Low
Age/Grazing Season*	< 1 year First grazing season	1-2 years Second grazing season	>2 years Adult
Age at Turnout (Weaned calves)	< 6 months	6-8 months	>8 months
Weight gain 2 months post turnout (<2 yo)	<0.7kg/day	0.7-0.8kg/day	>0.8kg/day
Faecal Egg Count (epg) Weaned calves 2m post to	>200epg	50-200epg	<50epg
Bulk Milk O.ostertagi AB OD Ratio	>1.0	0.6-1.0	<0.5

*Suckled calves with their dams are low risk

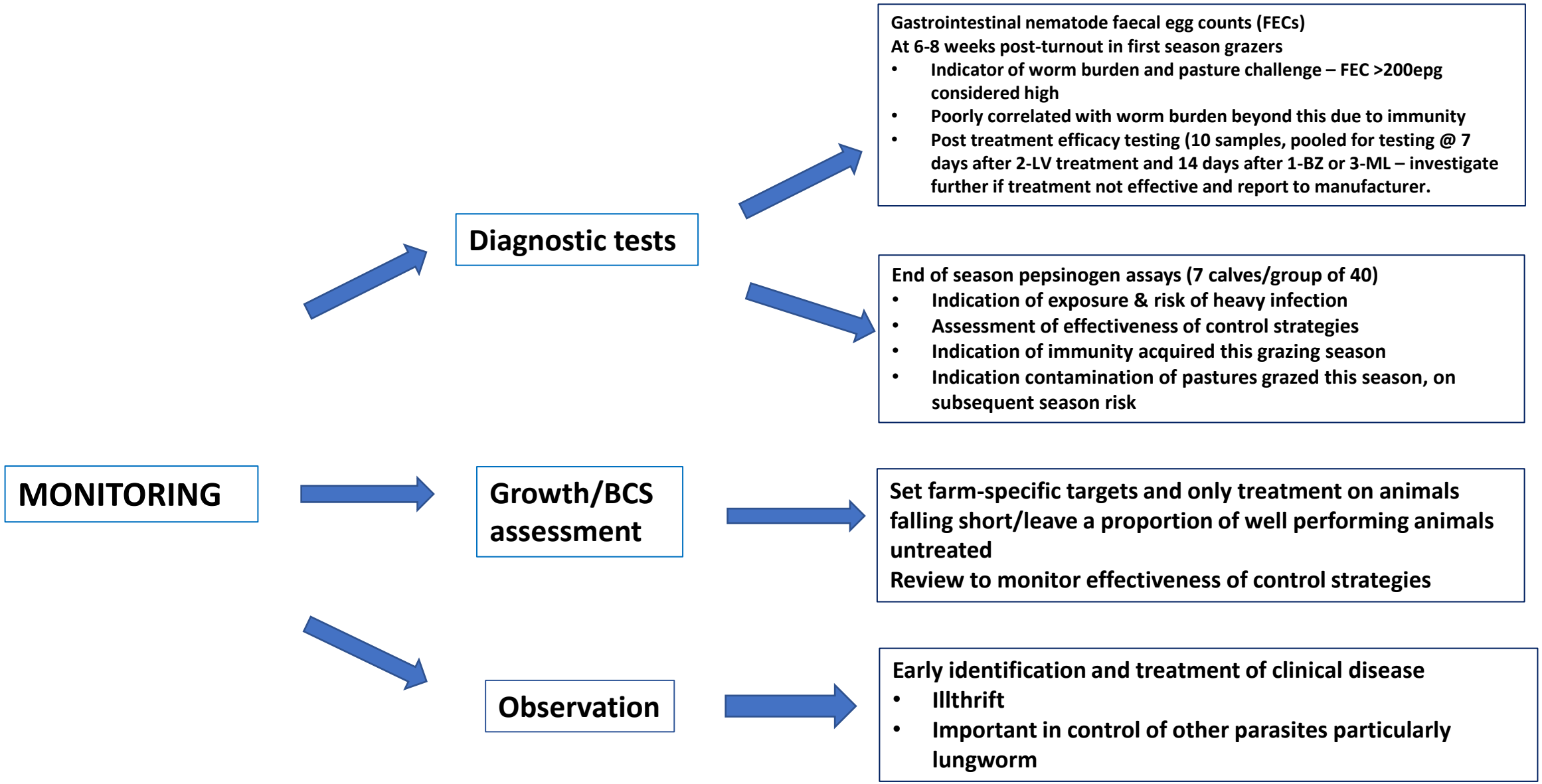
Pasture risk assessment

Risk Factor	High	Medium	Low
Herbage mass	<1000 kg DM/ha	1000-2000 kg DM/ha	>2000 kg DM/ha
Sward height	<4cm	4-8cm	>8 cm
Field type	Permanent pasture	Aftermath	Reseeding
Grazing history	Grazed by cattle <1yo in last year	Grazed by cattle 1-2yo in last year	Grazed by adult cows, sheep or other species*

*This may impact on fluke control

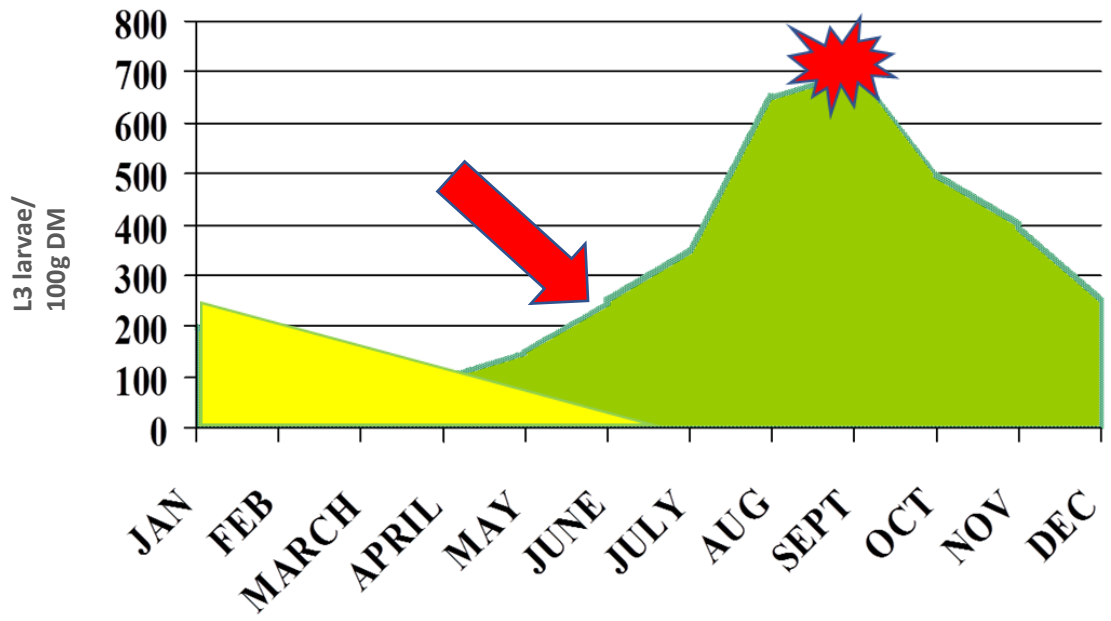
Pasture risk management

- An ongoing process, using grazing history and farm data and parasite forecasts to review and categorise pasture risk
- Allows planned grazing – prioritisation of ‘clean’, low risk pasture for high risk groups
- Consider the impact of climatic conditions and grazing practices on pasture challenge and worm burden
- Rotational grazing – can be used as a tool to manage risk, but a

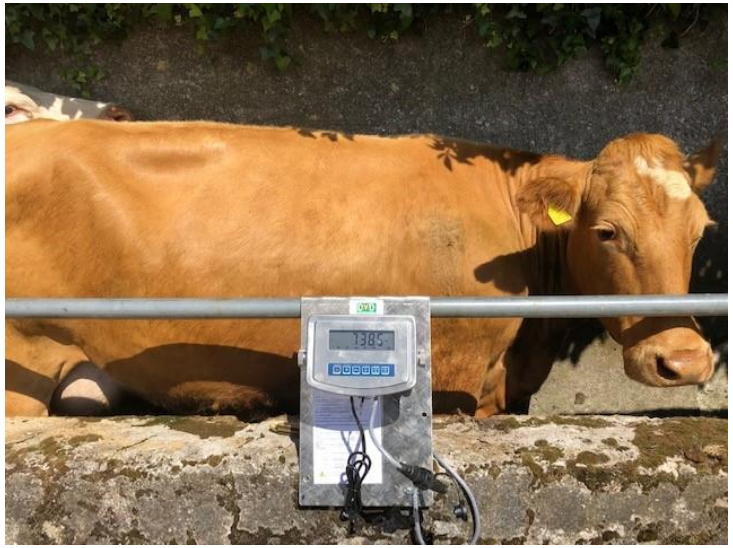

MONITORING
Diagnostic tests
Gastrointestinal nematode faecal egg counts (FECs)
At 6-8 weeks post-turnout in first season grazers
• Indicator of worm burden and pasture challenge – FEC >200epg considered high
• Poorly correlated with worm burden beyond this due to immunity
• Post treatment efficacy testing (10 samples, pooled for testing @ 7 days after 2-LV treatment and 14 days after 1-BZ or 3-ML – investigate further if treatment not effective and report to manufacturer.
End of season pepsinogen assays (7 calves/group of 40)
• Indication of exposure & risk of heavy infection
• Assessment of effectiveness of control strategies
• Indication of immunity acquired this grazing season
• Indication contamination of pastures grazed this season, on subsequent season risk
Growth/BCS assessment
Set farm-specific targets and only treatment on animals falling short/leave a proportion of well performing animals untreated
Review to monitor effectiveness of control strategies
Observation
Early identification and treatment of clinical disease
• Illthrift
• Important in control of other parasites particularly lungworm

Use of FECs:
What can they tell us and what can't they tell us?

- No correlation between FEC and worm burden
- **Regular pooled FECs in first half of grazing season can monitor egg shed onto pasture to manage risk of disease later in the year**
- Helps to avoid treatment before its necessary
- Allows controlled establishment of refugia before treatment takes place



Product selection and administration

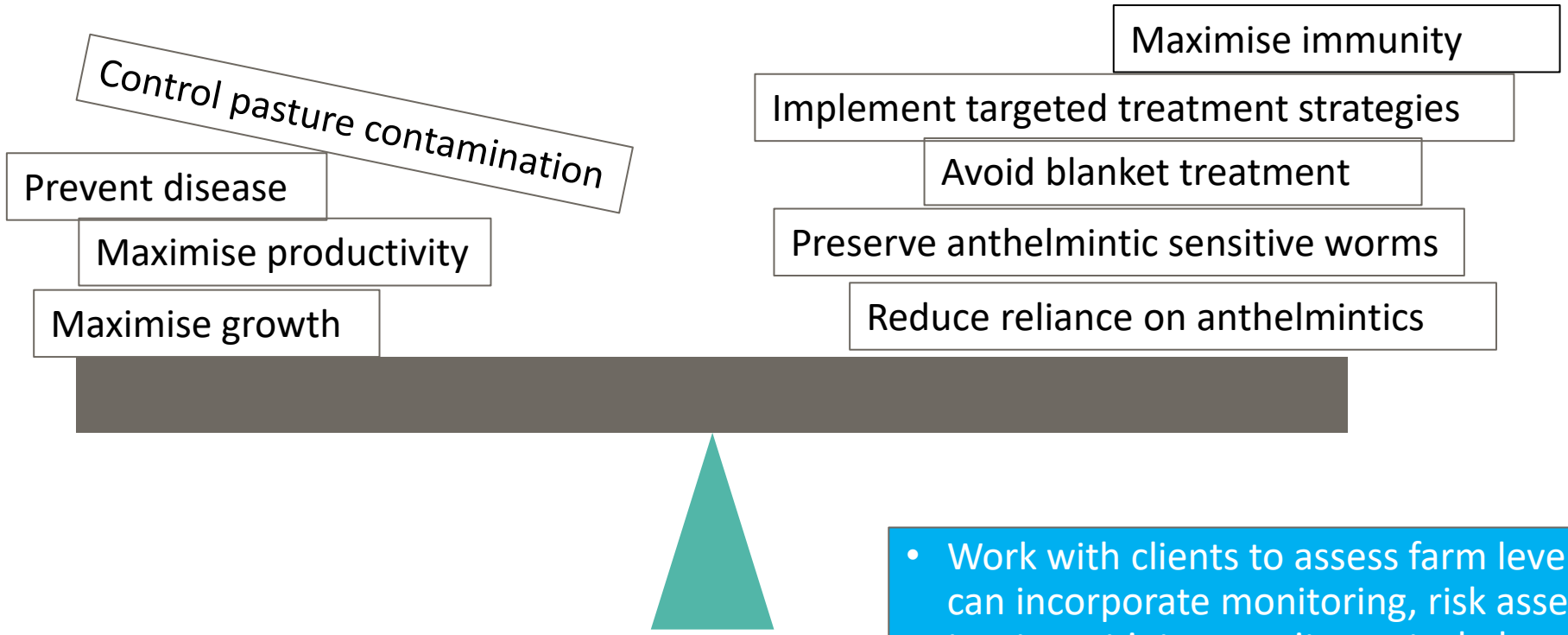


Use the most appropriate product for the animals and the time of year – active ingredient, spectrum, persistency, route of administration, WD period

Administer it correctly - under-dosing compromised treatment efficacy and can select for resistance

- Use an appropriate, well maintained and calibrated applicator
- Ensure that weight is accurately determined and the dose calculated correctly

Aligning the objectives for sustainable control



- Work with clients to assess farm level risk and determine how you can incorporate monitoring, risk assessment and targeted treatment into parasite control plans
- Small changes can have a big impact on the long term sustainability of parasite control