BVA CONGRESS 09
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Presentation at BVA Congress

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Simple solutions and Simplicity

"everything should be made as simple as possible, but not one bit simpler"
Albert Einstein 1879-1955

"Seek simplicity, and distrust it"
Alfred North Whitehead 1861-1947

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Anthelmintic resistance: Responsible approaches to control

Maximum control effort – complex, expensive - minimum morbid effects but also a risk of accelerated parasite adaptation

Optimum control effort - less expensive & less complex – reduced rate of adaptation

Minimum control effort - simple cheap – major morbid effects and high risk of mortalities

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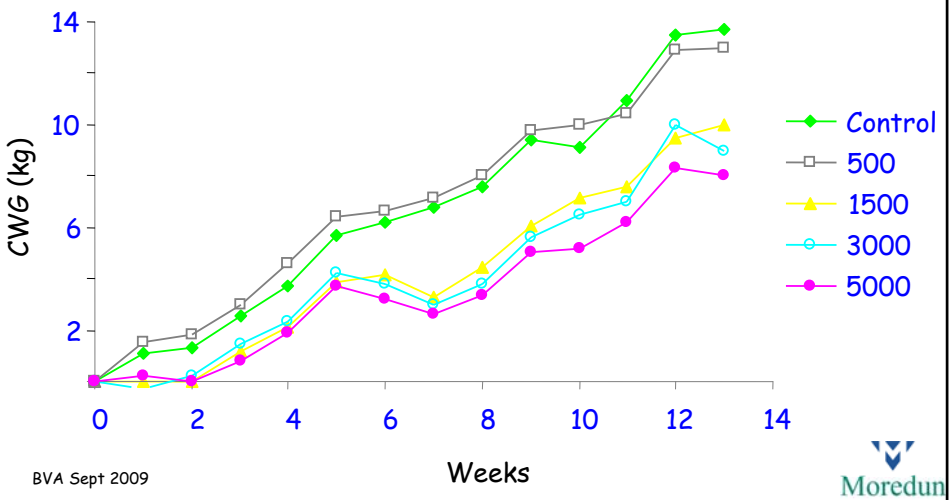
Nematodoses: Tolerable levels of infection

Cumulative weight gain of *Teladorsagia* infected grazing lambs



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Approaches to control

Control Strategies

Chemical	Immunological	Managemental	Biological
Therapy Prophylaxis	Vaccines Genetic Selection Nutrition	Grazing management	Predation

Bioactive forages
'Nutraceuticals'

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Anthelmintics and anthelmintic resistance: Responsible approaches to control

Anthelmintics & anthelmintic resistance

Prevalence of anthelmintic resistance

Selection of anthelmintic resistance

Management of anthelmintic resistance

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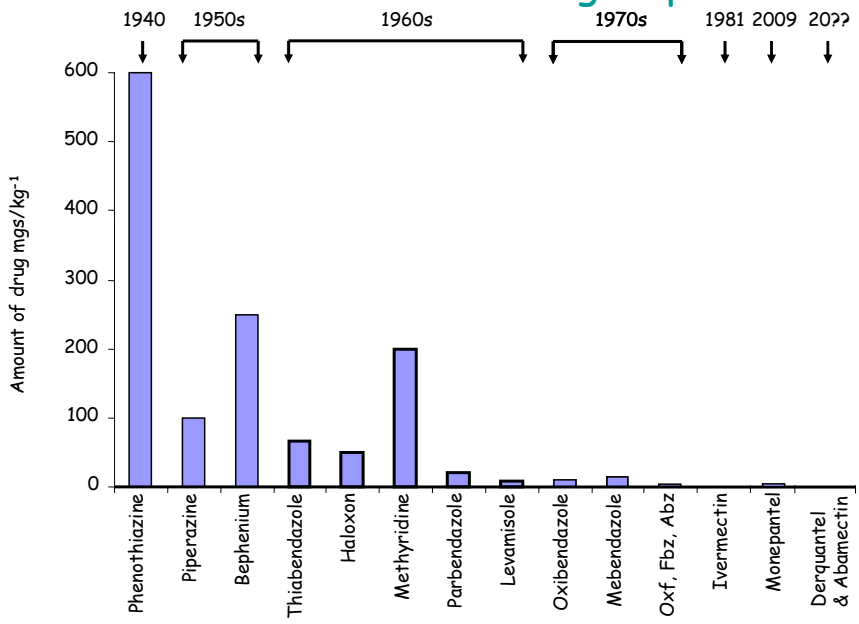
Anthelmintic groups



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Prevalence of anthelmintic resistance

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Anthelmintic resistance: Prevalence in S.America, S.Africa and Australasia

Country	Bz	Lev	Ml	Bz/ Lev	Ml/ Lev/ Bz	Clos.	Rfx
N. Zealand[7]	35	10	25	-	8	-	-
Australia[6]	90	80	60	60	-	60	-
S.Africa[1]	79	73	73	-	-	-	89
Brazil[2]	90	84	13	73	-	20	-
Argentina[3]	40	22	6	11	-	-	-
Paraguay[4]	73	68	73	-	-	-	-
Uruguay[5]	80	71	1	-	-	-	-

1 = Van Wyk et al 1999
2 = Escheverria et al 1997
3 = Eddi et al 1997
4 = Maciel et al 1997
5 = Nari et al 1997
6 = Love 2003
7 = Waghorn et al 2006

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Anthelmintic resistance in Scotland

MRI surveys have shown:

- 80% of lowland farms have Benzimidazole (BZ) resistance.
- 30% have evidence of ivermectin (IV) resistance.
- 8% of the sheep farms in the University of Edinburgh large animal practice have multiple (BZ, IV and LEV) resistance.

The first case of moxidectin resistance in Europe has now been reported in sheep

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AR: reports and surveys in cattle

MI Resistant spp.	Europe	New Zealand	North America	South America	South Africa
Cooperia	+	+	+	+	-
Haemonchus	-	-	+	+	-
Ostertagia	-	?	-	-	-
Trichostrongylus	-	+	-	+	-

Country	Bz	Lev	Ivm	Species
N. Zealand[1]	76	6	92	*Cooperia*

74% of the farms had resistance to both Ivm and Lev
Some initial evidence of Ivm resistance in *Ostertagia* on 4 farms

1 = Waghorn et al 2007 Nz Vet Journal 54, 278-282

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Selection of anthelmintic resistance
The role of refugia

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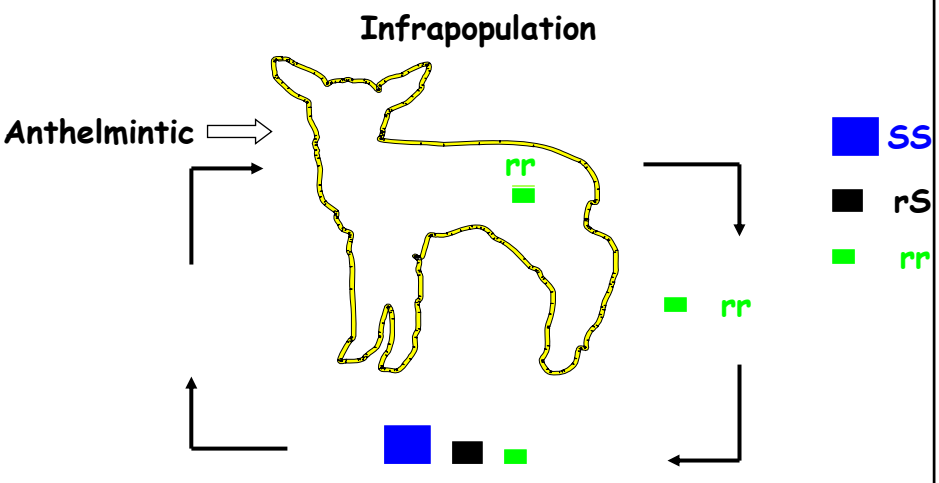
Influence of population in refugia



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Management of anthelmintic resistance

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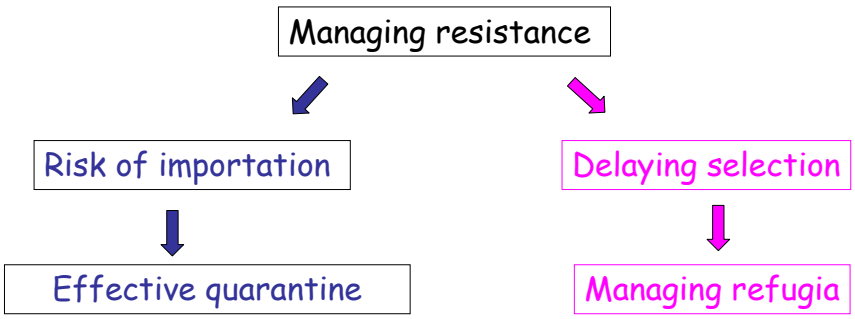
Management of anthelmintic resistance



Both approaches need to maintain:

- Susceptible parasite populations
- Animal performance/welfare

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Effective quarantine for UK nematodes

Treat sequentially with anthelmintics from 2 drug classes

ML & Lev preferably (due to widespread BZ resistance)

In future use new anthelmintic class

Hold on hard standing (48hrs if possible)

Turn onto 'dirty' pasture

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Checking anthelmintic efficacy

Results obtained from a commercial farm in 2008 which had used a benzimidazole for 5 strategic lamb treatments

Faecal egg count reduction test findings

Drug	*BZ*		*LEV*		*IVM*		*Mox*	
Day	0	14	0	14	0	14	0	14
EPG	144.1	284.5	141.6	13.6	155.4	18.2	120.2	0.3
Efficacy	0%		94.3%		92.3%		99.3%	

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Anthelmintic treatment strategies

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Chemoprophylactic approaches to the control of nematodoses

Metaphylaxis	Whole herd/flock treatments administered at the appearance of disease
Suppressive chemoprophylaxis	Whole herd/flock treatments administered within or close to the pre-patent period of the target parasites
Strategic chemoprophylaxis	Targeted treatments whole herd/flock treatments administered at times of maximum epidemiological vulnerability
Targeted selective chemoprophylaxis	TST treatments part herd/flock treatments administered to the most susceptible individuals and/or those responsible for the bulk of pasture contamination.

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Optimising anthelmintic use: Targeted & Targeted Selective Treatments

Targeted treatments (TT) are those where the entire group (whole flock or mob) of animals is treated

Challenge is to find times to treat when there are sufficient worms in refugia to minimise treatment impact regarding drug resistance

Targeted selective treatments (TST) are those where individuals within the group are treated on the basis of need.

Challenge is to find ways of deciding who to treat

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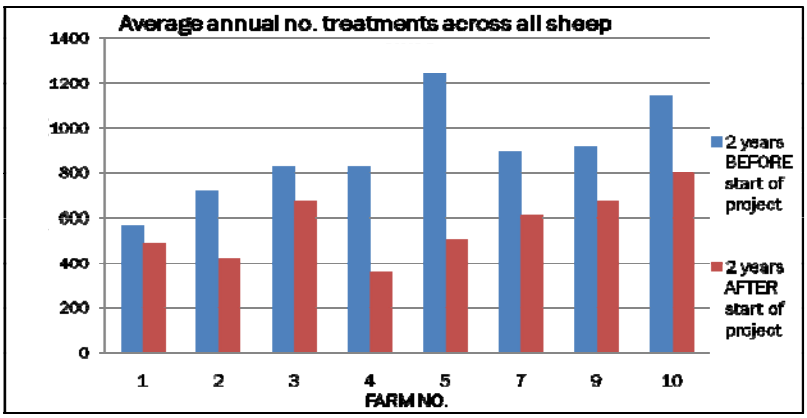
Targeted treatments using FEC



35% reduction in no. treatments compared to previous usage

Equates to average savings across 8 farms = £663.86

Innovis Wales

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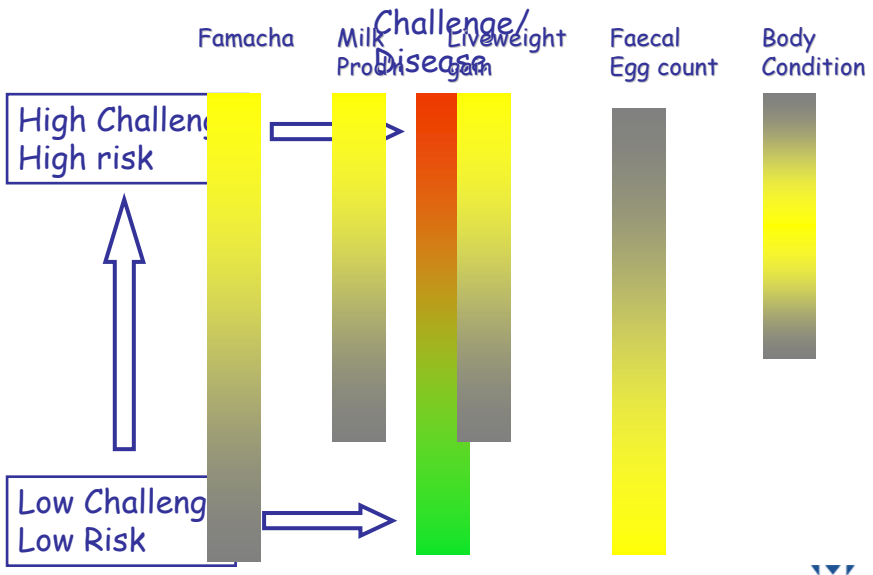
Potential of various indicators for TST



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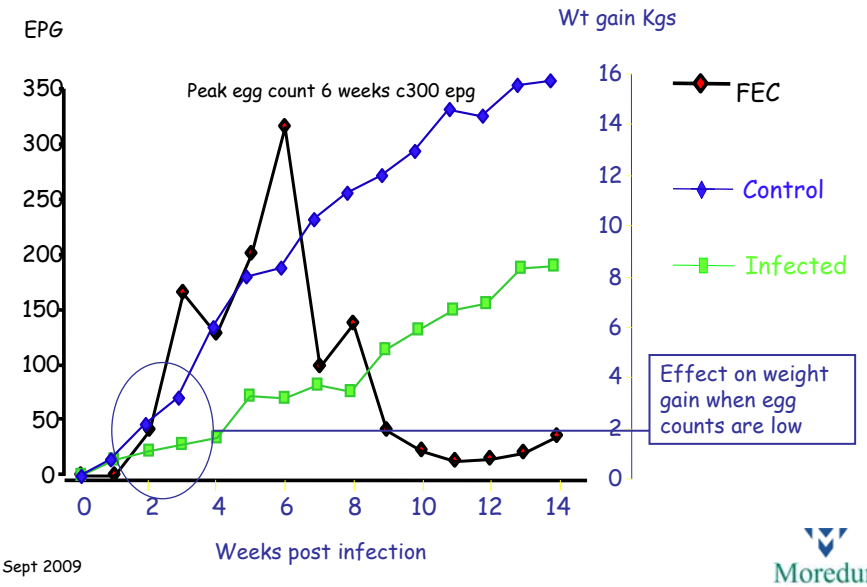
Sensitivity of liveweight gain



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TST studies in sheep at Moredun

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Anthelmintic resistance at Firth Mains Farm

Benzimidazole (white drench) resistance.
In 1983 white drench resistance resistance became evident at Firth Mains. Since then we have used an annual (IVM-LEV) alternation

Resistance against Levamisole and Ivermectin.
Faecal egg count reduction test conducted in 2005

Anthelmintic	Benzimidazole	Levamisole	Ivermectin Full dose (half dose)
Efficacy % (2005)	53.0	53.2	96.0 (79.2)

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Decision support system DSS

Animals that are performing efficiently are unlikely to benefit from anthelmintic treatment

If left untreated these animals will help to maintain susceptible parasite supra and infrapopulations.

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Using production efficiency (PE) for DSS'

Calculation is based on: 1 minus the inefficiency

HF = ((1 – (MEg-NE)/MEI)/(Intake %/100))/TE

MEg	=	Metabolisable energy available for growth
NE	=	Net energy deposited
MEI	=	Metabolisable energy intake
Intake %	=	% of the max. likely achievable intake
TE	=	Relative efficiency due to temperature

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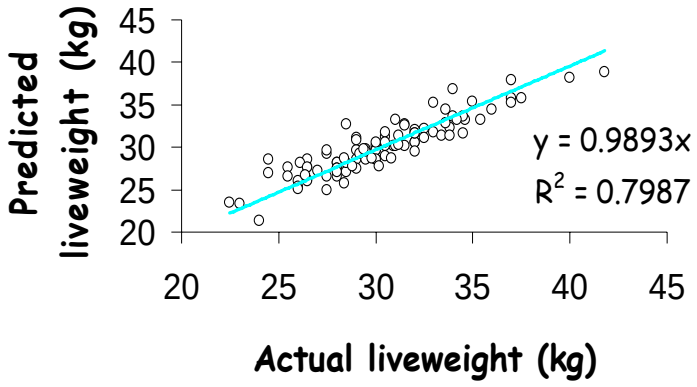
Ability of the DSS based on production efficiency to predict liveweight gain



In the initial phase of the study 88% of the TST treated animals showed an immediate improvement in production efficiency

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Strategies tested at MRI

Replicated studies using 4 treatment strategies and at least 20 lambs per group

Targeted Selective Treatment group (TST):
Partial flock treatments aimed at maintaining a population *in refugia*.

Neo-suppressively treated group (NST):
Whole flock treatments given at regular intervals close to the pre-patent period of the parasites.

Targeted Treatment group (TT):
Whole flock treatments given at *appropriate* times.

Metaphylactic/Therapeutic Treatment group (MT):
Whole flock treatments administered following the appearance of clinical indicators (FEC, ill thrift, scouring etc).

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Summary of findings 2006-2008

Group	EPG	Growth rate	Treatment ratio	Change in mean efficacy
NST	54	152	1.9	-17.6
TST	171	150	1.0	-2.3
TT	165	147	1.1	-2.0
MT	250	132*	0.9	+2.2

* P = 0.017

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Summary of findings 2006-2008

In this system TST provides the optimal use of anthelmintic with regard to the number of treatments maintained production and anthelmintic efficacy

Metaphylactic/Therapeutic treatment strategy carries a production penalty and monthly treatments a resistance penalty

Given an understanding of the epidemiology targeted whole flock treatments offer acceptable growth and maintain susceptibility

Are we targeting some specific sector of the sheep population when we treat on the basis of efficiency of production?

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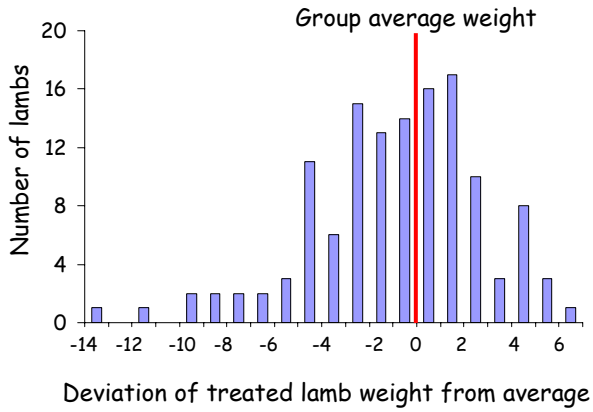
The weight of treated animals compared with the mean weight of the TST group 2007 - 2008



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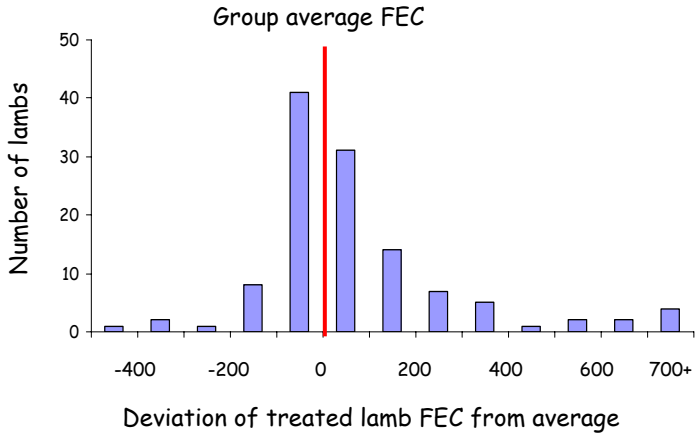
The FEC of treated animals compared with the mean FEC of the TST group 2007 - 2008



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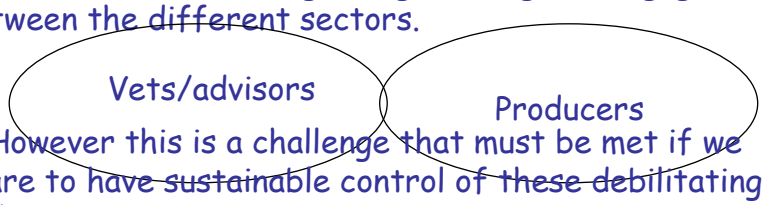
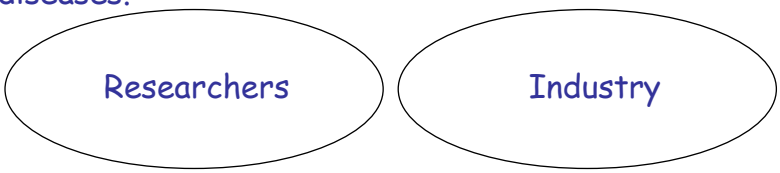
Responsible (Sustainable) control: The challenges

Developing and implementing **affordable,** complex, site specific integrated strategies imposes demands upon the various stakeholders regarding training and engagement between the different sectors.



However this is a challenge that must be met if we are to have sustainable control of these debilitating diseases.



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