

agresearch Farming, Food and Health. First  
Te Ahiwhenua, Te Kai me te Whai Ora, Tūatahi

## Worm Resistance in sheep: fact or fiction?

John McEwan  
8<sup>th</sup> July 2011  
Nithdale

**WormFEC™**

## History

- 1980 Wallaceville seln lines
- 1881-83 Woodlands (resistance moderate h2)
- 1985 Perendale lines
- 1985-90 results (worm burden, FEC selection)
- 1991-94 MRDC
  - GXE (not a problem)
  - h2, rg (index prod and resistance)
  - breeds (sires more imp)
  - FEC reasonable predictor

**WormFEC™**

## Host Resistance to Roundworms

Age (months)	Resistant (% immunity)	Normal (% immunity)	Susceptible (% immunity)
0	0	0	0
2	10	5	2
4	30	15	5
6	55	30	10
8	75	50	20
10	85	65	40
12	95	75	60
14	100	85	75

**WormFEC™**

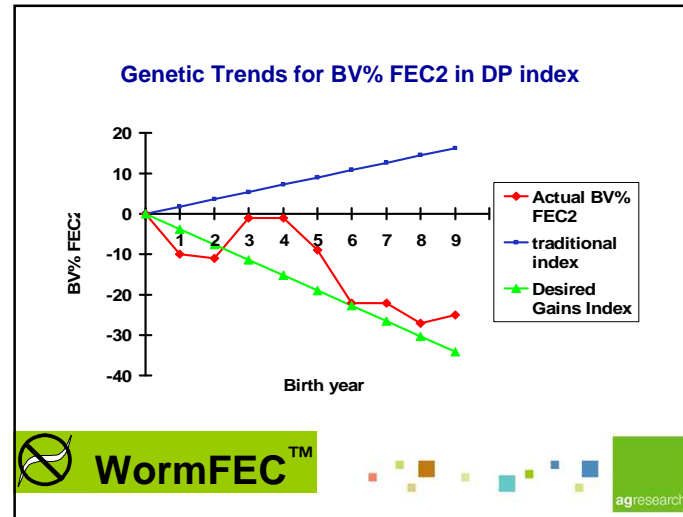
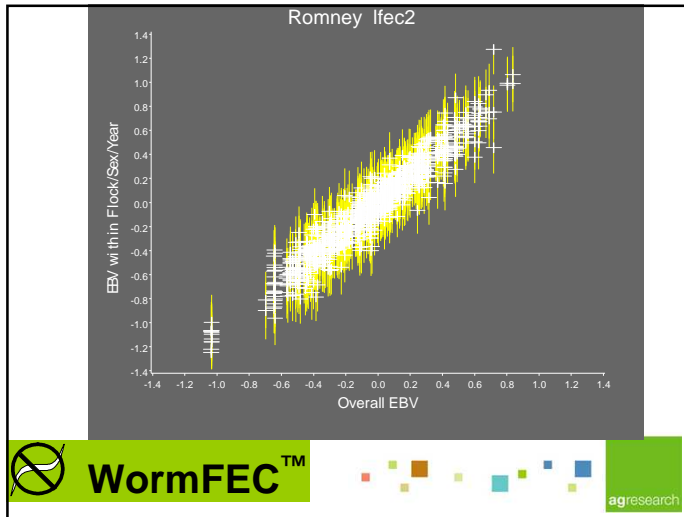
agresearch

## Parasite field challenge protocol

wean drench	sample drench	sample bleed
↓	↓	↓
<i>challenge</i>	<i>challenge</i>	
█	█	█
WWT	FEC1 NEM1	FEC2 NEM2 ELFC2

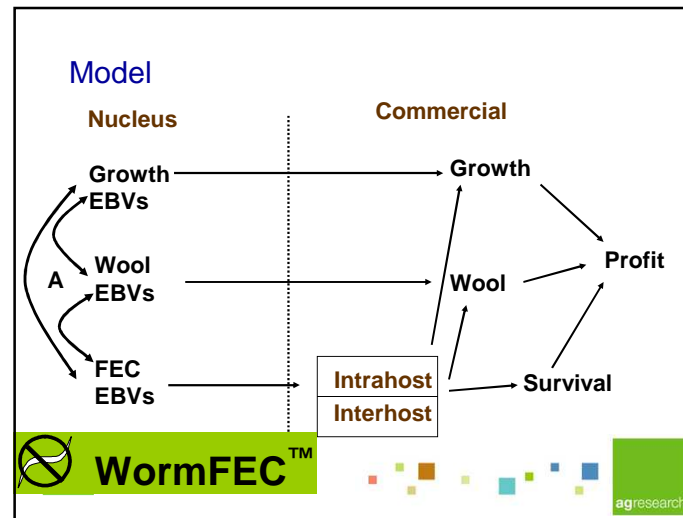
**WormFEC™**

agresearch



### Economic Value?

- Difficult to estimate the economic value of host resistance
- \$ value required for maximal benefit
- Independent methods developed for Australia & NZ



## Epidemiological Model

- Used Leathwick et al (1992) epidemiological model
- parameters
  - lambing 1st week Sept
  - wean at 12 weeks
  - ewes 10 su/ha
  - LW/EM 110%
  - lambs sold Feb mid April



## Estimates of loss

Lamb drenches	None		3X6 weeks		6x4 weeks	
	LW	FW	LW	FW	LW	FW
Normal	10.8	1.11	5.6	0.58	3.9	0.40
50% Res	6.6	0.68	2.6	0.27	1.9	0.20
Benefit	4.2	0.48	3.0	0.31	2.0	0.20



## Sensitivity (3x6 week)

	Lambing % (A)		Ewes/ha (B)		A+B	Peri-Part	DOL
	80	160	5	15	160+	0.5x	+30d
Benefit %	93	100	60	123	130	60	107



## Economic value

- Estimated as \$0.083/% FEC reduction (SIL, Amer 2004)
- benefits
  - higher lamb carcass weights
  - higher survival
  - higher hogget fleece weights
  - higher hogget live weights



## Effect on genetic change

trait	Genetic change/yr		\$ change/yr	
	trad	+FEC	trad	+FEC
LW8	0.408	0.307	0.24	0.18
FW12	0.039	0.028	0.15	0.11
NLB	0.012	0.012	0.17	0.17
FEC1%	1.3	-2.8	-0.02	0.04
FEC2%	1.8	-3.9	-0.03	0.06
AFEC%	0	-4.1	0	0.12
Total			0.52	0.67

 **WormFEC™**



## Results

- Increases \$ value of genetic gain by 28% over traditional index
- host resistance contributes 33% of total index gain
- host resistance increases by 32% potential rate
- index efficiency if actual value \$
  - 0.6 -1.4x >96%
  - 0.2x 85%
  - 1.8x 93%
  - 0x 77%

 **WormFEC™**



## Summary

- \$ value of host resistance derived
- not sensitive to alterations in farming system
- 40% +/- less than 4% effect \$ value GG
- 80% +/- less than 15% effect
- + \$ value of genetic gain by more than 20%
- Aust. And NZ epidemiological models produce similar results
- Recent Aust expts show predicted benefits
  - Less drench
  - Faster growth
  - More wool
  - When resistant animals grazed separately

 **WormFEC™**



## What about dags?

### •INDUSTRY DATA

- 2 million pedigree recorded animals from SIL.
- >90,000 dagginess records
- >500,000 FEC/NEM records
- >900,000 NLB records
- >1.7 million WWT records
- > 1 million LW8 records
- >700,000 FW12 records

- Recalculate industry genetic parameters
- Recalculate the dag model
- Address misconception
  - Strong association between dagginess and worm burden



 **agresearch**

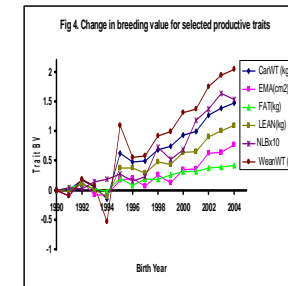
 **Massey University**  **beef+lamb**  **Ovita®**

## Summary

- Dag3 and Dag8 have moderate heritability
    - And are highly correlated with each other
  - Low negative relationship with liveweight
  - No relationship with NLB
  - And very low to zero correlation with FEC/NEM traits
- 
- Selecting against dags will have;
    - Positive, but little effect on liveweight,
    - Little or no effect on FEC/NEM
    - Best solution is index selection

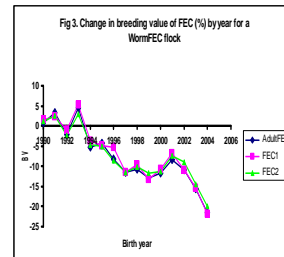
## What are the benefits: Production traits?

- Current BLUP system
- 10 years selection (94-04)
- **Typical DP flock ~700 ewes**
- Used economic indices
- Trialled outside rams
- Sire referencing
- Gains (all progeny)
  - 2.0 Weanwt (kg)
  - 1.5 Carcass Wt (kg)
  - 0.8 EMA (cm<sup>2</sup>)
  - 1.1 Lean (kg)
  - 0.15 NLB (lamb)
  - 1.4% survival



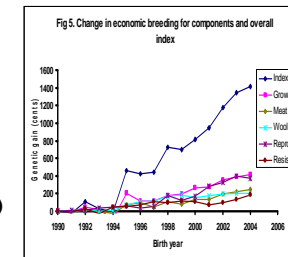
## Benefit disease traits

- 19-21% reduction in worm eggs shed
- Summer
- Autumn
- Adult ewes



## Convert this to \$

- Converted to \$ the gains are:
  - Growth \$4.13
  - Meat \$2.44
  - Wool \$2.02
  - Reprod \$3.72
  - FEC \$1.86
  - **TOTAL \$14.16/ewe/year**
- All traits are improving
- Index is optimal way to select
- **\$34,500/year/farm (2500 ewes)**
- **\$378M/year for NZ industry**



## Nithdale?

