

Breeding practices in the Merino industry

Andrew Swan

Animal Genetics and Breeding Unit

University of New England

Introduction

- ◆ The production and ram breeding sectors of the Merino industry
- ◆ Breeding objectives
- ◆ Genetic evaluation
- ◆ Breeding programs

Trends in commercial Merino production

- ◆ 85% of sheep are Merinos
- ◆ Income from wool has historically dominated meat
- ◆ Meat prices are now high relative to wool:
 - Dual purpose focus in many commercial enterprises
 - Widespread use of terminal sires over Merino ewes
- ◆ Specialised wool flocks more likely to be fine wool

Future challenges

- ◆ Drought and reduced sheep numbers
- ◆ Low wool prices
- ◆ Phase out of mulesing by 2010

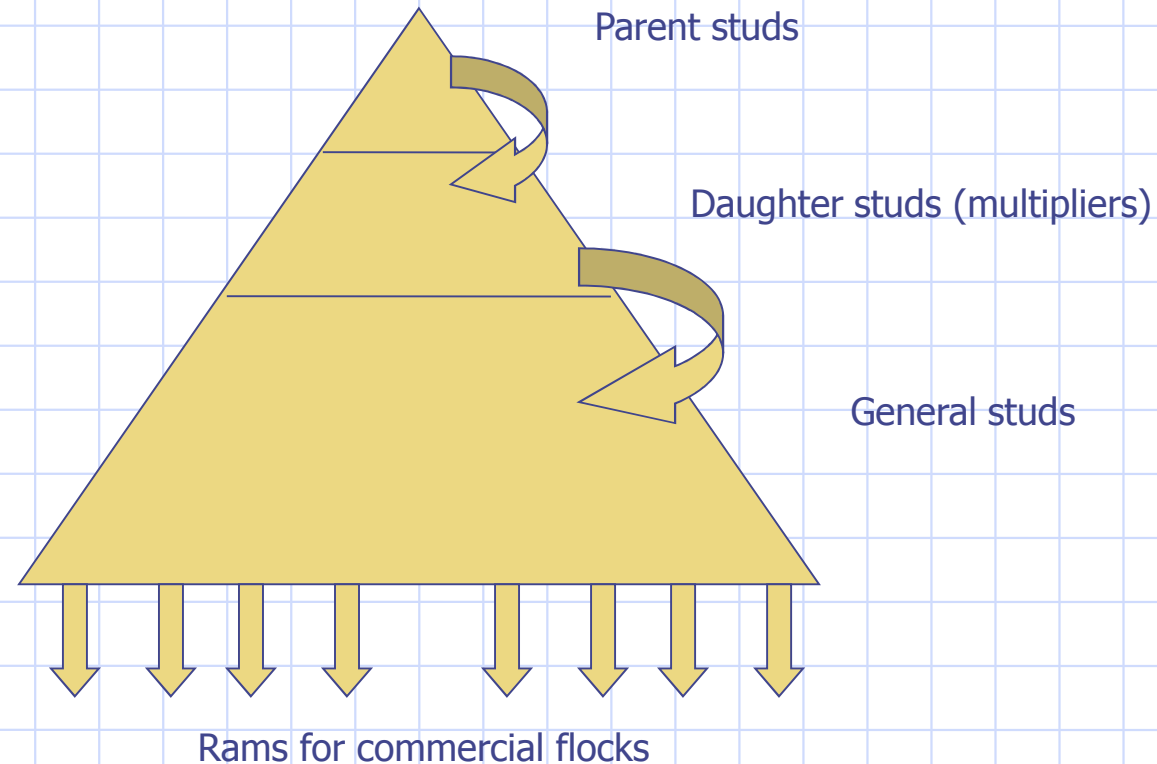
Comparison of enterprises

Enterprise	Gross Margin (\$/DSE) 5 year average prices	Gross Margin (\$/DSE) July 2003 prices
Merino wethers (17 μ)	27.50	41
Merino wethers (19 μ)	22	19
Merino wethers (21 μ)	12	21
Merino ewes (17 μ)	31	48
Merino ewes (19 μ)	28	34
Merino ewes (21 μ)	22	36
First cross lambs	17	38
Second cross lambs	13	36

Source: Rogan (2003), Sheep CRC

Structure of the ram breeding sector

- ◆ Around 1000 studs across Australia
- ◆ Traditionally a hierarchical structure



Structure of the ram breeding sector

- ◆ Group breeding schemes appeared in the 1970's:
 - Open nucleus schemes (see Turner and Jackson)
- ◆ Australian Merino Society (AMS)
 - <http://www.ausmerino.com.au/>

Structure of the ram breeding sector

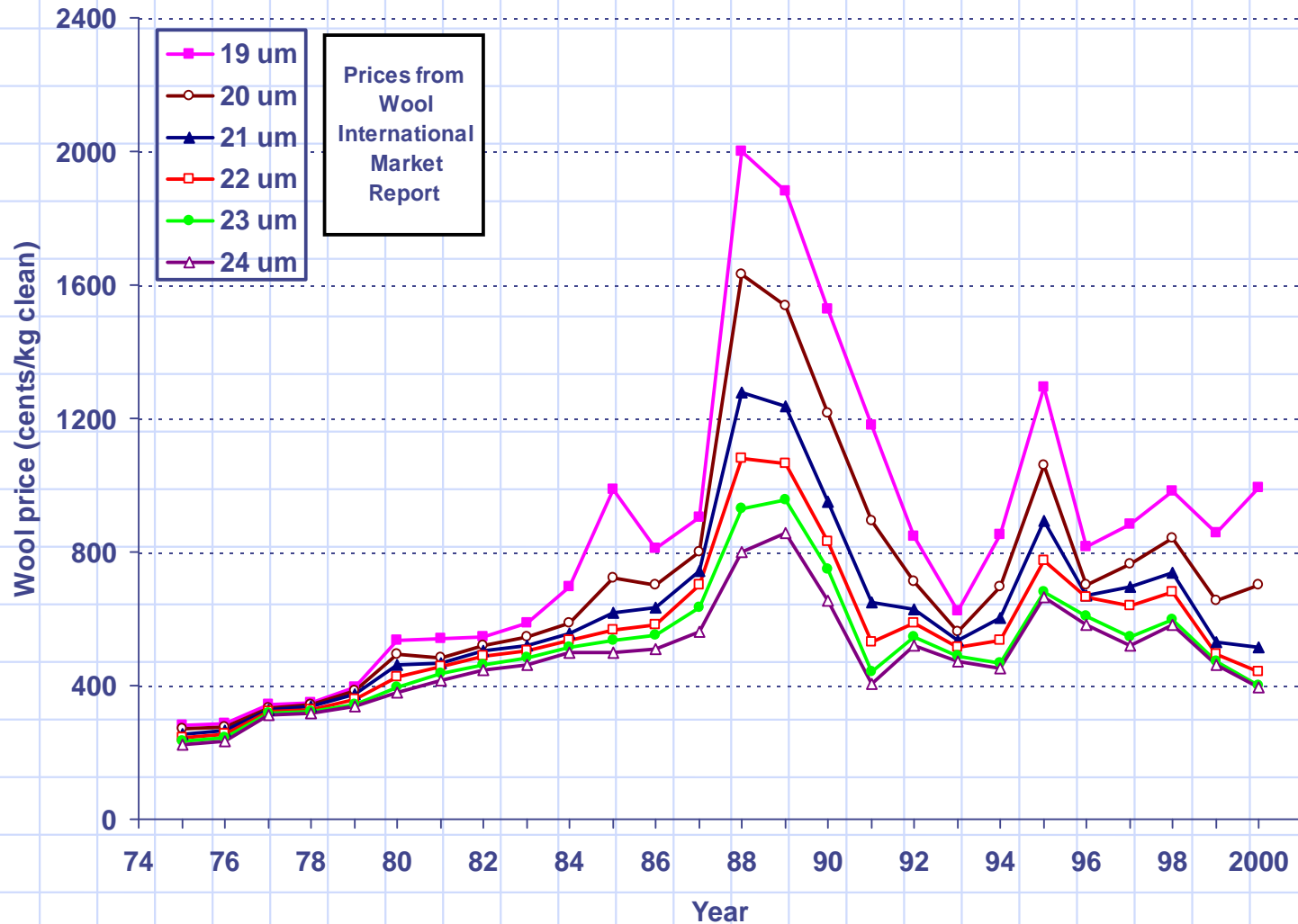
- ◆ Development of across flock evaluation in the 1990's:
 - Use of performance data and AI led to breakdown of parent – daughter stud relationships

Breeding objectives

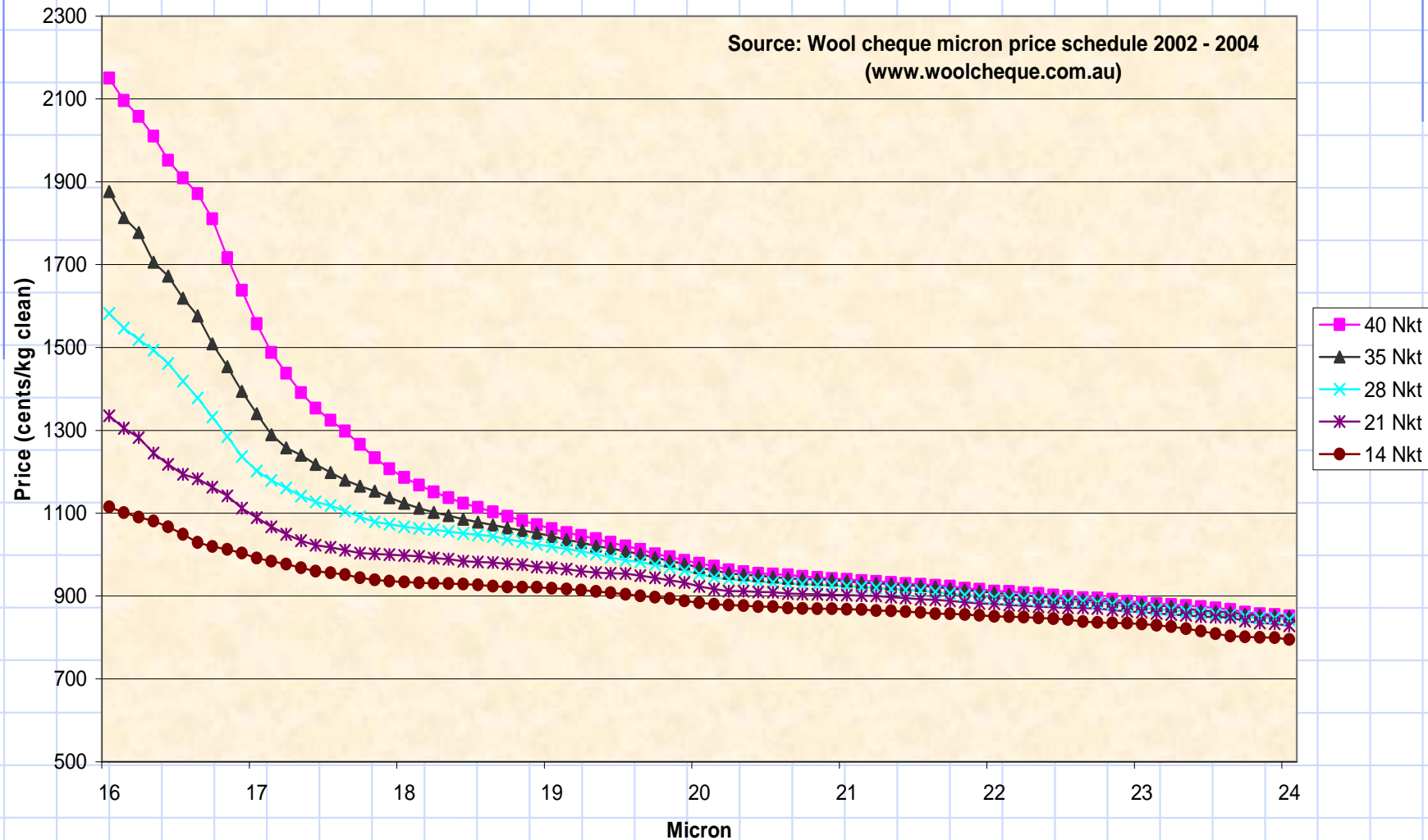
◆ Economically important traits:

- Wool production (fleece weight)
- Wool quality (fibre diameter, staple strength, style)
- Reproduction
- Disease
- Growth and carcass
- Feed intake
- Easy care and welfare related traits (e.g. mules free sheep)

Wool price between 1974 and 2000



Fibre diameter and staple strength are the major determinants of wool price



Heritabilities of wool traits:

(From Safari et al 2005, LPS 92:271)

	Dir effects	Mat effects	
	h^2	h^2	m^2
GFW	0.37	0.25	0.08
Yield	0.56	-	-
CFW	0.36	0.28	0.06
MFD	0.59	-	-
FDCV	0.52	-	-
SS	0.31	-	-
SL	0.46	-	-

Important genetic correlations for wool traits

◆ Antagonistic:

- Fleece weight and fibre diameter (≈ 0.3)
- Fibre diameter and staple strength (0.37)

◆ Favourable:

- Clean and greasy fleece weight (0.86)
- CV of fibre diameter and staple strength (-0.52)

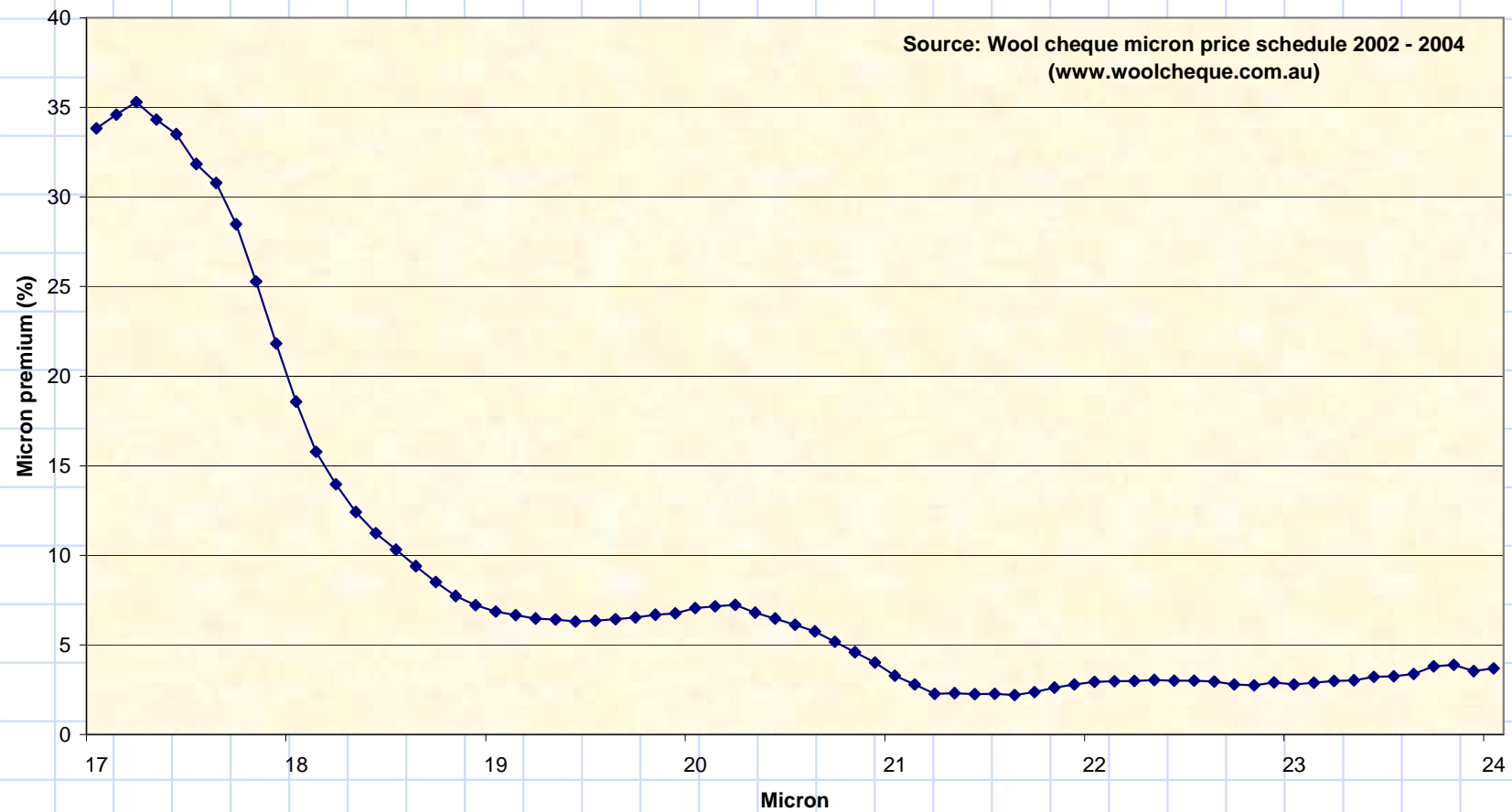
(From Safari et al 2005, LPS 92:271)

Combining wool traits in breeding objectives

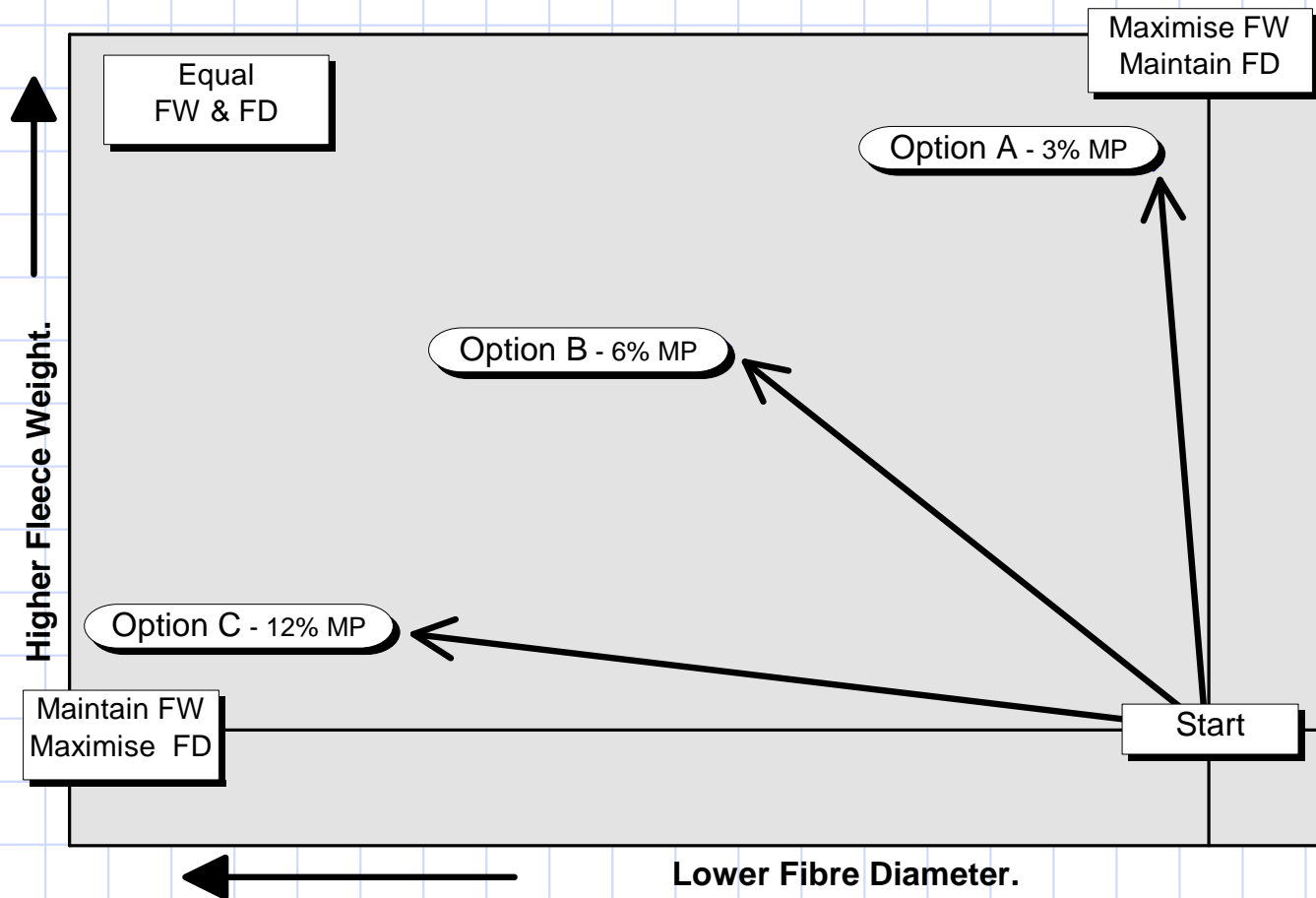
- ◆ Fleece weight – fibre diameter relationship is critical
- ◆ Wool quality traits included in objectives using *price premiums*:
 - 1 micron reduction in FD gives a 10% increase in price → **10% Micron Premium**
 - The price premium approach can be used for any wool quality trait (eg. staple strength, style)

What micron premiums exist?

Micron premiums between 2002 and 2004 (staple strength ≥ 21 Nkt)



Fleece weight – fibre diameter response under different micron premiums



Reproduction is lowly heritable, but highly variable

Trait	Heritability	CV (%)
Lambs weaned	0.07	63
Fertility	0.08	51
Litter size	0.10	38
Survival	0.03	47
Body weight	0.41	12

(From Safari et al 2005, LPS 92:271)

Reproduction genetic correlations

	Lambs weaned	Fertility	Body weight
Fertility	0.73		
Body weight	0.33	0.40	
Scrotal size	0.20	0.20	0.60

(From Safari et al 2005, LPS 92:271)

Breeding for disease resistance

◆ Major diseases of sheep:

- Gastrointestinal roundworms (WEC)
- Fleece rot and fly strike
- Foot rot
- Johne's disease

◆ Breeding for parasite resistance has been demonstrated in research flocks:

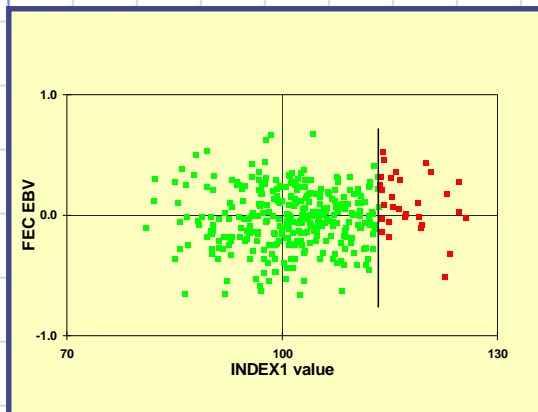
- CSIRO and WA Agriculture selection lines

Disease resistance is difficult to include in breeding programs

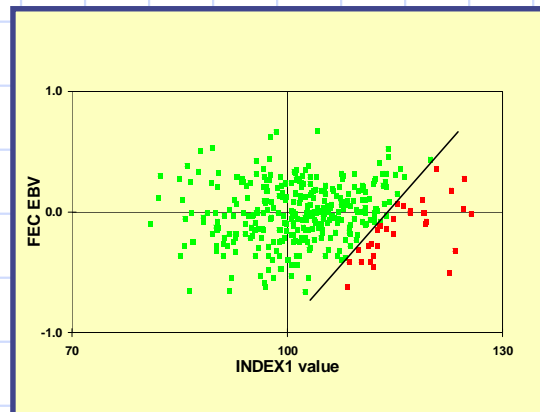
- ◆ Hard to measure production losses
- ◆ Breeders reluctant to expose animals to disease
- ◆ Difficult to analyse parasite resistance data:
 - Trait distributions not normal
 - Different species of parasite across flocks
 - Different challenge history
- ◆ Value of correlated traits and gene markers

Using desired gains indexes for worm resistance

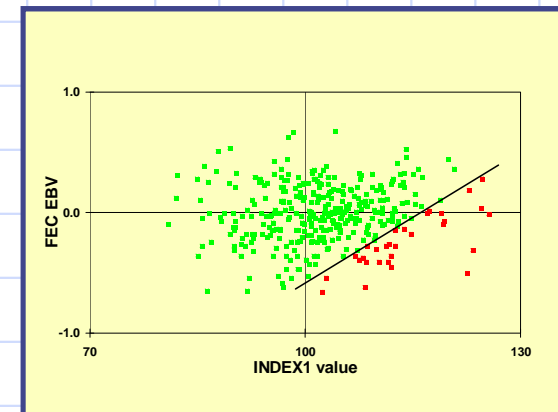
Index



WORM50



WORM70



- Selection on a production index (INDEX) and on worm resistance (FEC EBV) can be made independently
- Alternatively, an index including worm resistance can be calculated with moderate (WORM50) or high (WORM70) emphasis on resistance

The development of breeding objectives

- ◆ Woolplan in the 1980's attempted to provide objectives to industry:
 - Too prescriptive, poor adoption
- ◆ Rampower in the 1990's:
 - Industry standard objectives (3, 6, 12 MP)
 - Emphasis on indexes customised for individual breeders
- ◆ Sheep Object software to develop customised indexes:
 - To be delivered through SGA

Genetic evaluation

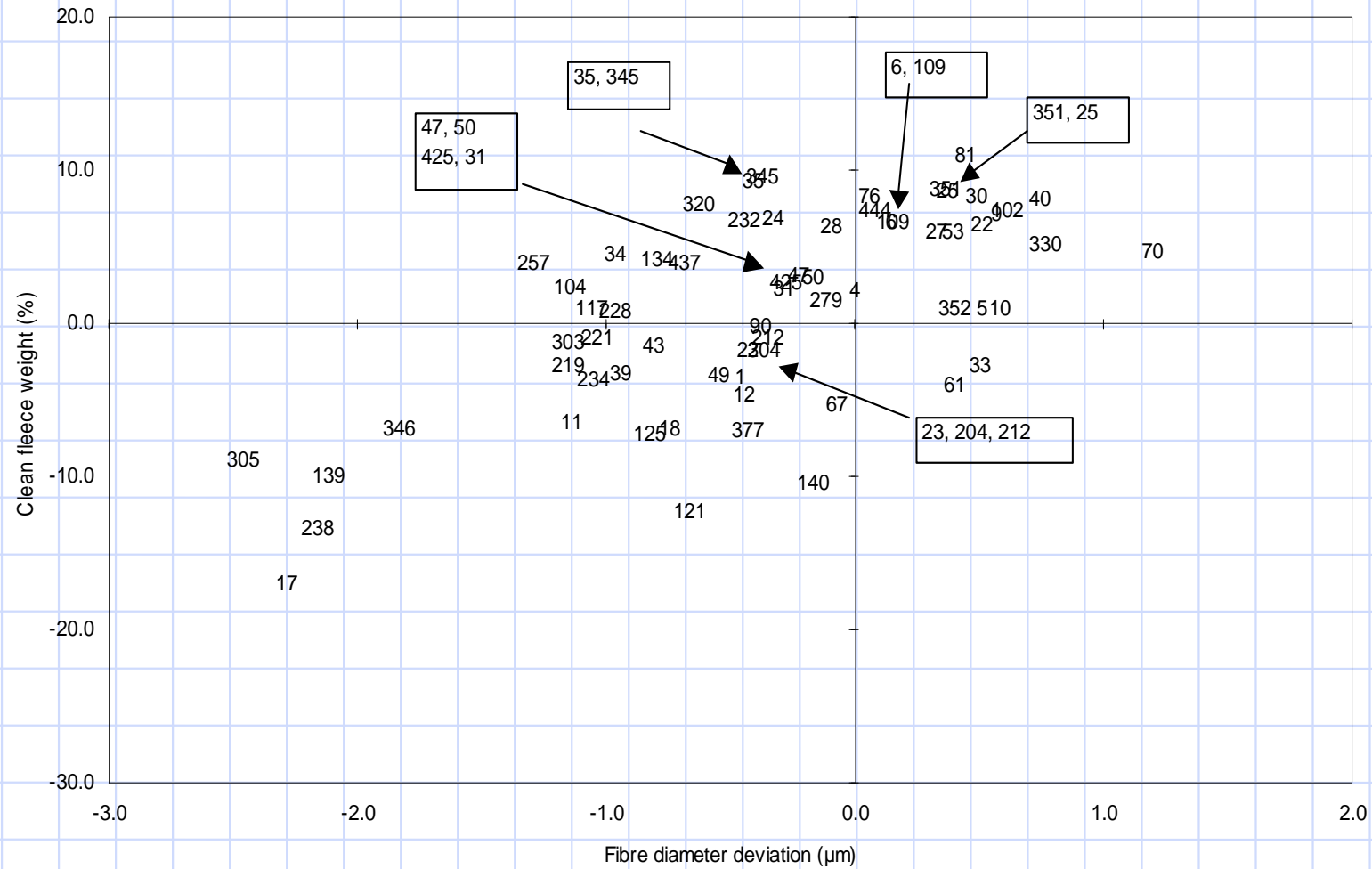
◆ Across flock comparisons:

- Wether trials
- Central test sire evaluation (CTSE)
- On-farm progeny testing, across-flock BLUP, Sheep Genetics Australia (SGA)

Wether trials

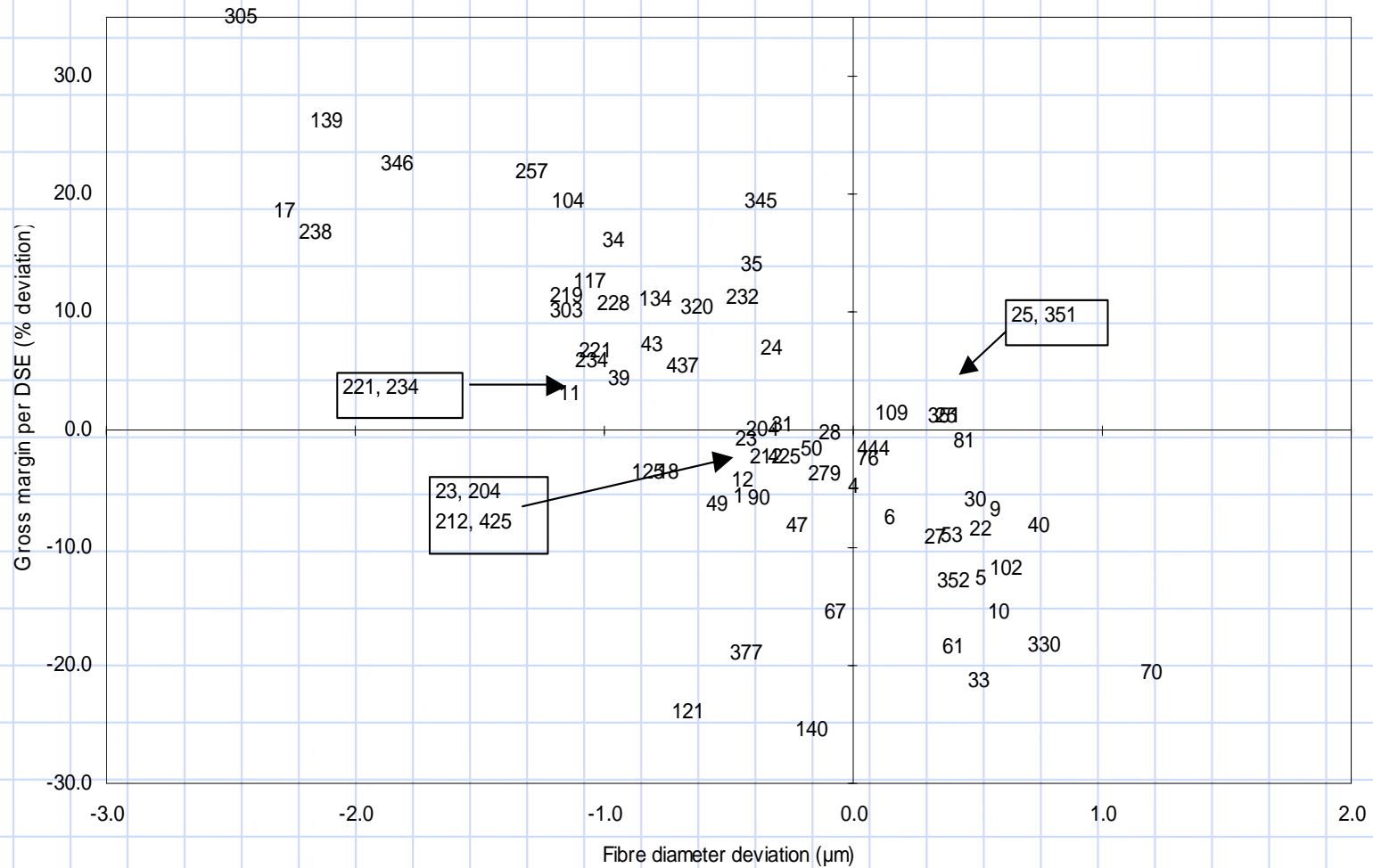
- ◆ Large differences between flocks:
 - Production traits → profitability
- ◆ An aid to commercial growers:
 - Compare current and potential ram sources
- ◆ A valuable resource:
 - Comparing up to 200 ram breeding flocks

Wether trial bloodline comparison data



Source: Advanced Breeding Services

Wether trial bloodline comparison data



Source: Advanced Breeding Services

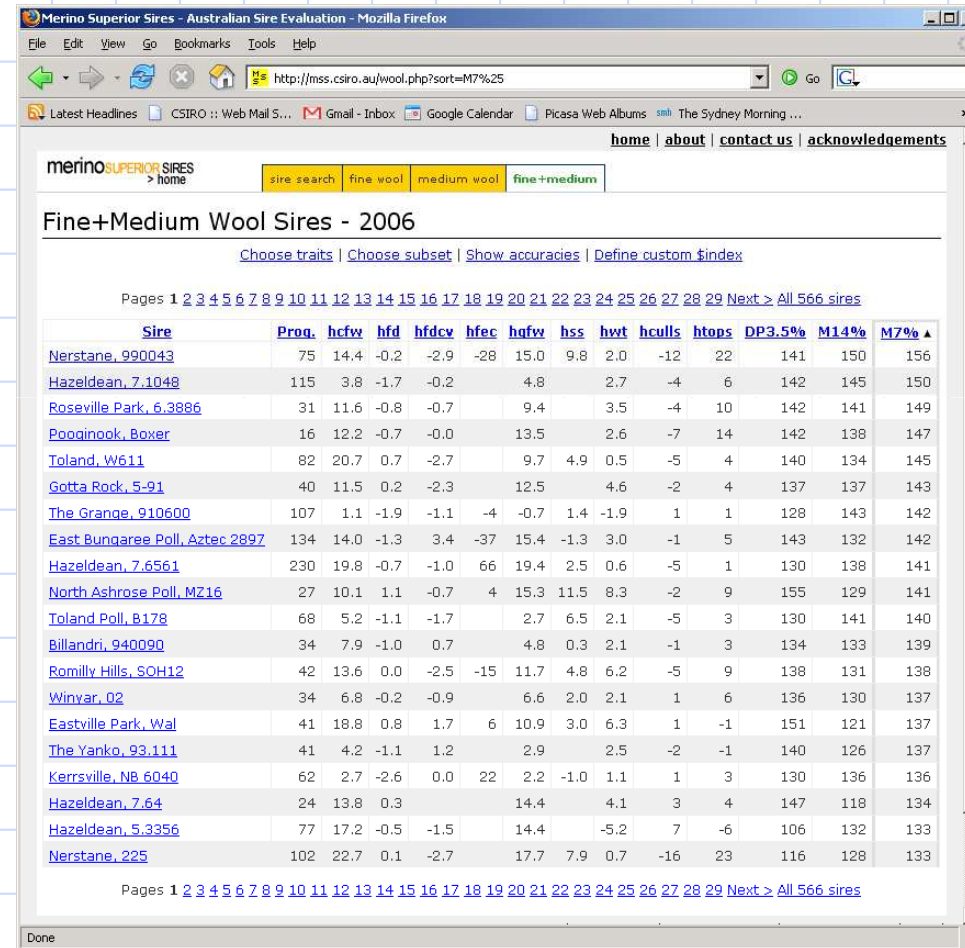
Limitations of wether trials

- ◆ Commercial flocks representing studs:
 - Time lag (10-20 years?)
- ◆ No information on breeding goals and genetic trends

Central test sire evaluation (CTSE)

- ◆ Independent progeny testing of industry sires
- ◆ Linked sites across Australia testing around 100 sires annually
- ◆ Measure progeny for a range of measured and visual traits
- ◆ Merino Superior Sires report

Top performing sires are used widely



Merino Superior Sires - Australian Sire Evaluation - Mozilla Firefox

http://mss.csiro.au/wool.php?sort=M7%25

home | about | contact us | acknowledgements

merino SUPERIOR SIRES > home

sire search fine wool medium wool fine+medium

Fine+Medium Wool Sires - 2006

[Choose traits](#) | [Choose subset](#) | [Show accuracies](#) | [Define custom \\$index](#)

Pages 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 Next > All 566 sires

Sire	Proq.	hcfw	hfd	hfdcv	hfec	hafw	hss	hwt	hculls	htops	DP3.5%	M14%	M7%
Nerstane, 990043	75	14.4	-0.2	-2.9	-28	15.0	9.8	2.0	-12	22	141	150	156
Hazeldean, 7.1048	115	3.8	-1.7	-0.2		4.8		2.7	-4	6	142	145	150
Roseville Park, 6.3886	31	11.6	-0.8	-0.7		9.4		3.5	-4	10	142	141	149
Pooginook, Boxer	16	12.2	-0.7	-0.0		13.5		2.6	-7	14	142	138	147
Toland, W611	82	20.7	0.7	-2.7		9.7	4.9	0.5	-5	4	140	134	145
Gotta Rock, 5-91	40	11.5	0.2	-2.3		12.5		4.6	-2	4	137	137	143
The Grange, 910600	107	1.1	-1.9	-1.1	-4	-0.7	1.4	-1.9	1	1	128	143	142
East Bungaree Poll, Aztec 2897	134	14.0	-1.3	3.4	-37	15.4	-1.3	3.0	-1	5	143	132	142
Hazeldean, 7.6561	230	19.8	-0.7	-1.0	66	19.4	2.5	0.6	-5	1	130	138	141
North Ashrose Poll, M216	27	10.1	1.1	-0.7	4	15.3	11.5	8.3	-2	9	155	129	141
Toland Poll, B178	68	5.2	-1.1	-1.7		2.7	6.5	2.1	-5	3	130	141	140
Billandri, 940090	34	7.9	-1.0	0.7		4.8	0.3	2.1	-1	3	134	133	139
Romilly Hills, SOH12	42	13.6	0.0	-2.5	-15	11.7	4.8	6.2	-5	9	138	131	138
Winvar, 02	34	6.8	-0.2	-0.9		6.6	2.0	2.1	1	6	136	130	137
Eastville Park, Wal	41	18.8	0.8	1.7	6	10.9	3.0	6.3	1	-1	151	121	137
The Yanko, 93.111	41	4.2	-1.1	1.2		2.9		2.5	-2	-1	140	126	137
Kerrsville, NB 6040	62	2.7	-2.6	0.0	22	2.2	-1.0	1.1	1	3	130	136	136
Hazeldean, 7.64	24	13.8	0.3			14.4		4.1	3	4	147	118	134
Hazeldean, 5.3356	77	17.2	-0.5	-1.5		14.4		-5.2	7	-6	106	132	133
Nerstane, 225	102	22.7	0.1	-2.7		17.7	7.9	0.7	-16	23	116	128	133

Pages 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 Next > All 566 sires

Done

<http://mss.csiro.au>

Pro's and con's of CTSE

◆ Pro's:

- Independent comparison run under strict guidelines
- Run by breeders
- Data structure useful in combining on-farm data

◆ Con's:

- Limited number of sires compared
- Progeny testing time lag

On-farm across-flock evaluation

- ◆ The future of genetic evaluation for Merinos
- ◆ Began with Merino Benchmark
- ◆ Merino Genetic Services (MGS)
- ◆ Now replaced by Sheep Genetics Australia

Sheep Genetics Australia

(<http://www.sheepgenetics.org.au>)

- ◆ Launched October 2005
- ◆ Merging of several databases, including on-farm and CTSE data
- ◆ Merino analysis is MERINOSELECT:
 - Currently including around 1 million animals

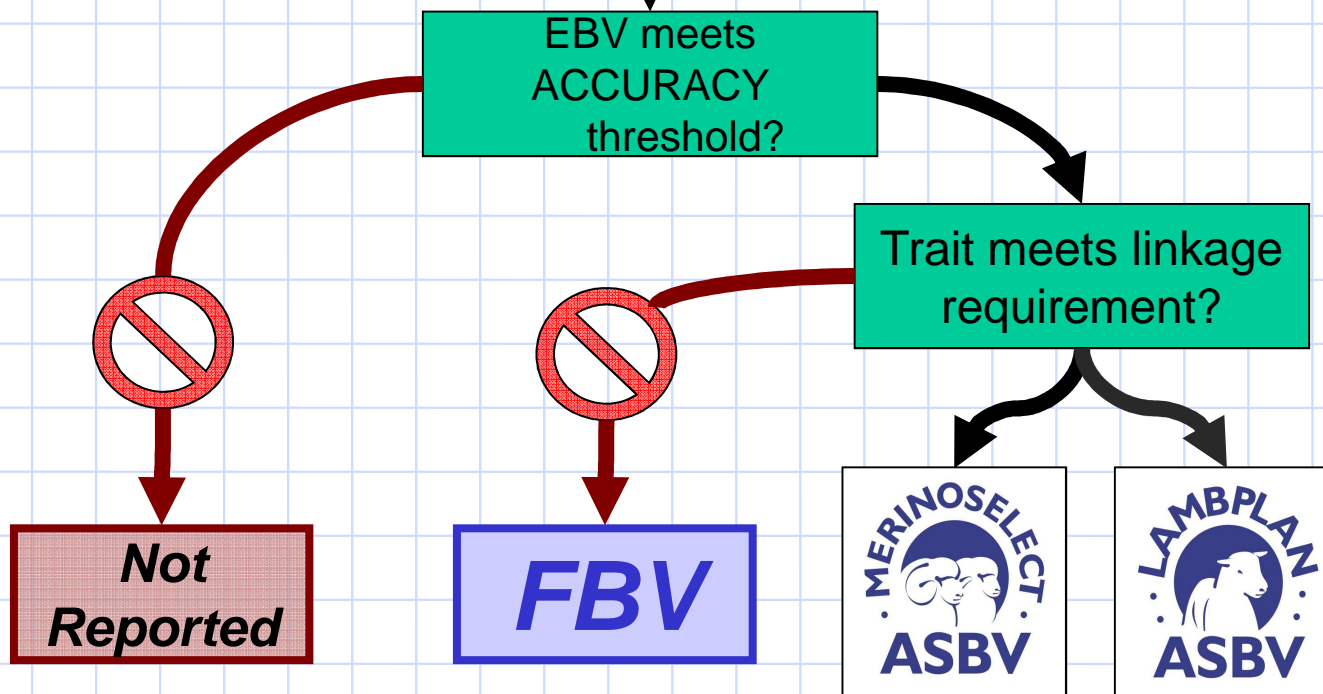
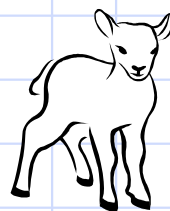
MERINOSELECT

- ◆ Data integrity underpinned by QA guidelines
- ◆ Data analyses run fortnightly:
 - Testing of flock linkage
 - BLUP analysis using OVIS
- ◆ Reporting using a common language:
 - Australian Sheep Breeding Values (ASBV) or Flock Breeding Values (FBV)
 - Standardised trait definition

MERINOSELECT breeding values

Age	Carcase		Wool		Health	Reproduction	
	Weight	FAT & EMD	Weight	Quality	WEC	Scrotal Circ.	No. lambs born and weaned Maternal Weaning Weight
Birth	✓						
Weaning	✓				✓		
Post Weaning	✓	✓			✓	✓	
Yearling	✓	✓	✓	✓	✓	✓	
Hogget	✓	✓	✓	✓	✓	✓	
Adult	✓		✓	✓			✓

ASBV versus FBV

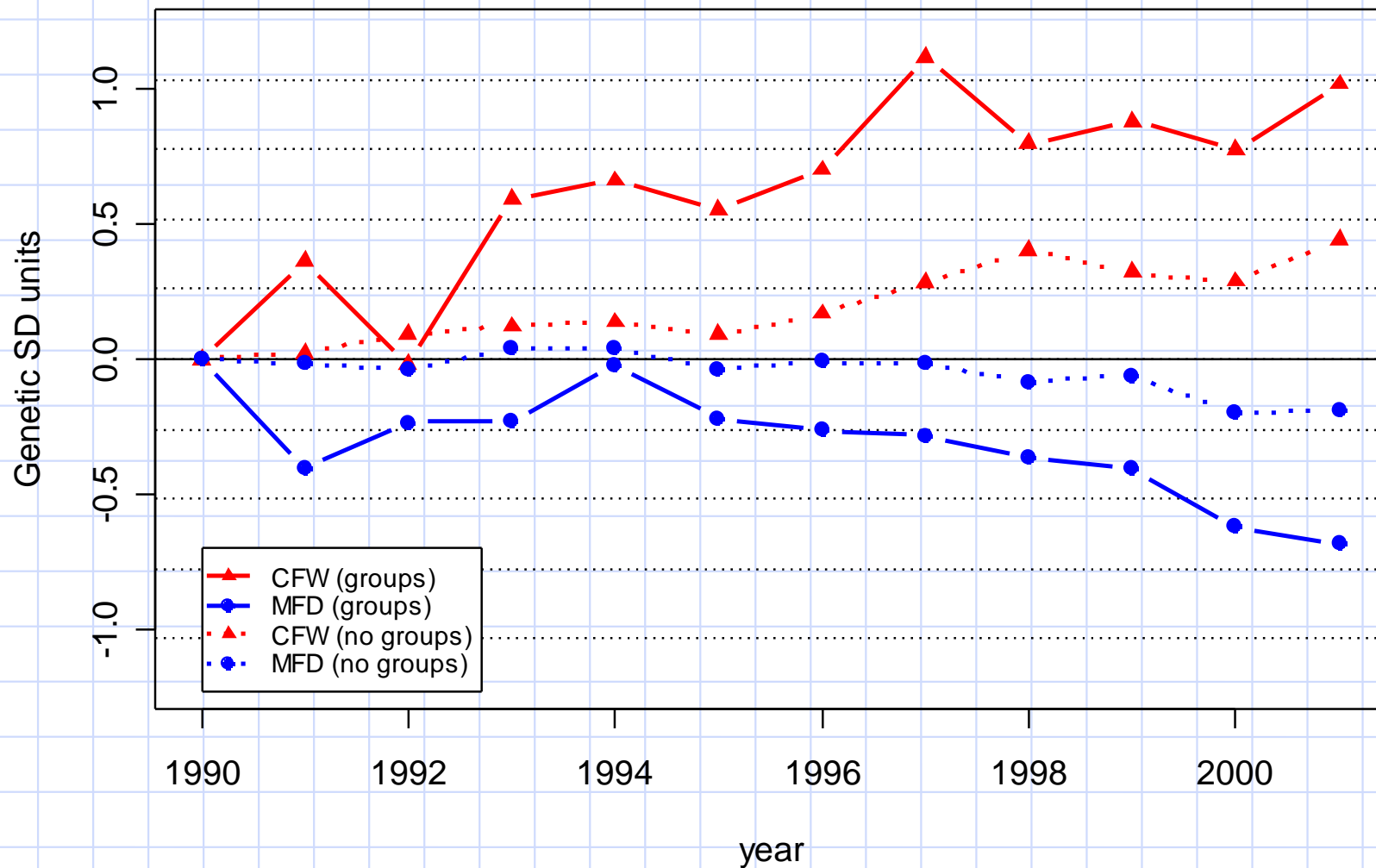


Genetic groups are a feature of the MERINOSELECT analysis

◆ Flock – time period genetic groups:

- Flock groupings to account for the wide range in merit within the Merino breed for many traits
- Time period groupings within flocks to help estimate genetic trends where pedigree is sparse (often sire only)

Time pedigree groups improve estimation of trends in a flock with sire only pedigree



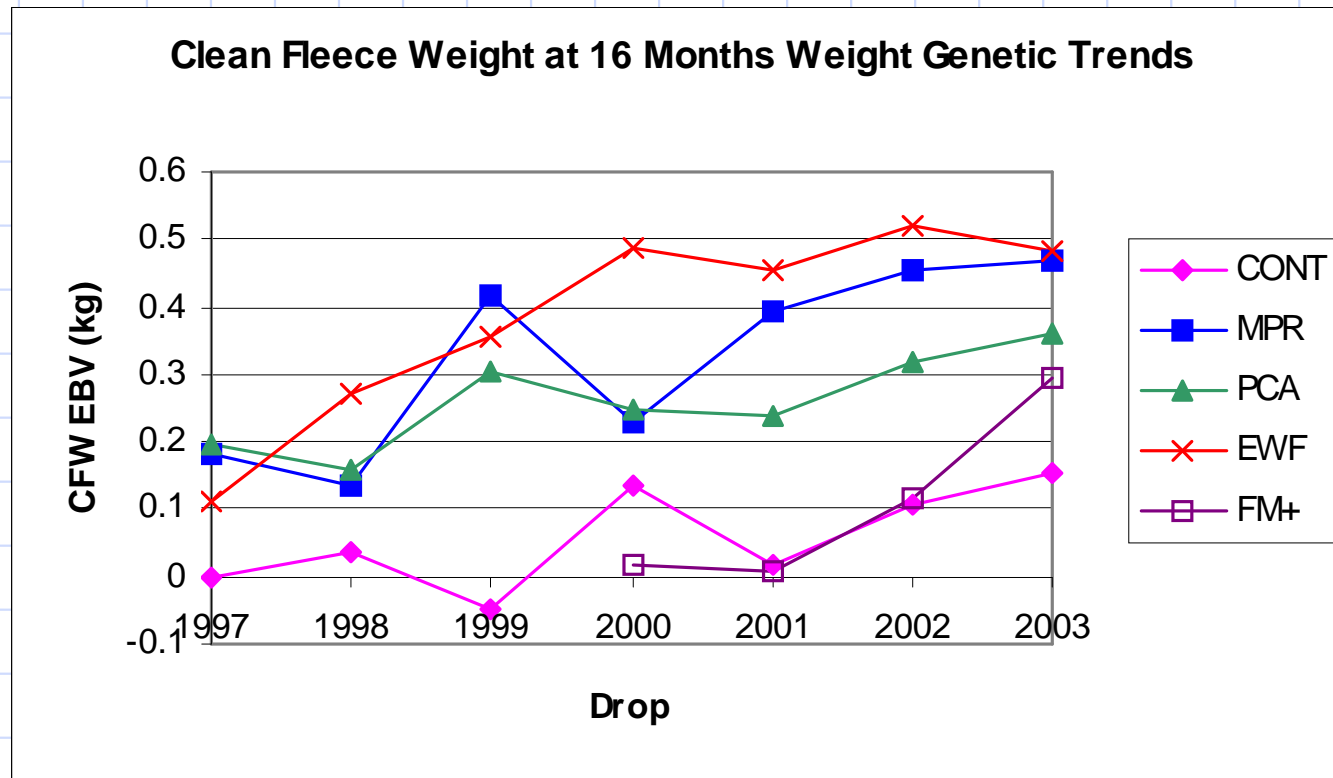
Breeding programs

- ◆ Breeding goals based on improved productivity are generally accepted
- ◆ There are diverse views on how to attain these goals:
 - Traditional visual assessment
 - Measurement based programs
 - Skin based programs
(eg. <http://www.srswool.com>)

The SARDI Merino Selection Demonstration Flocks (SDF)

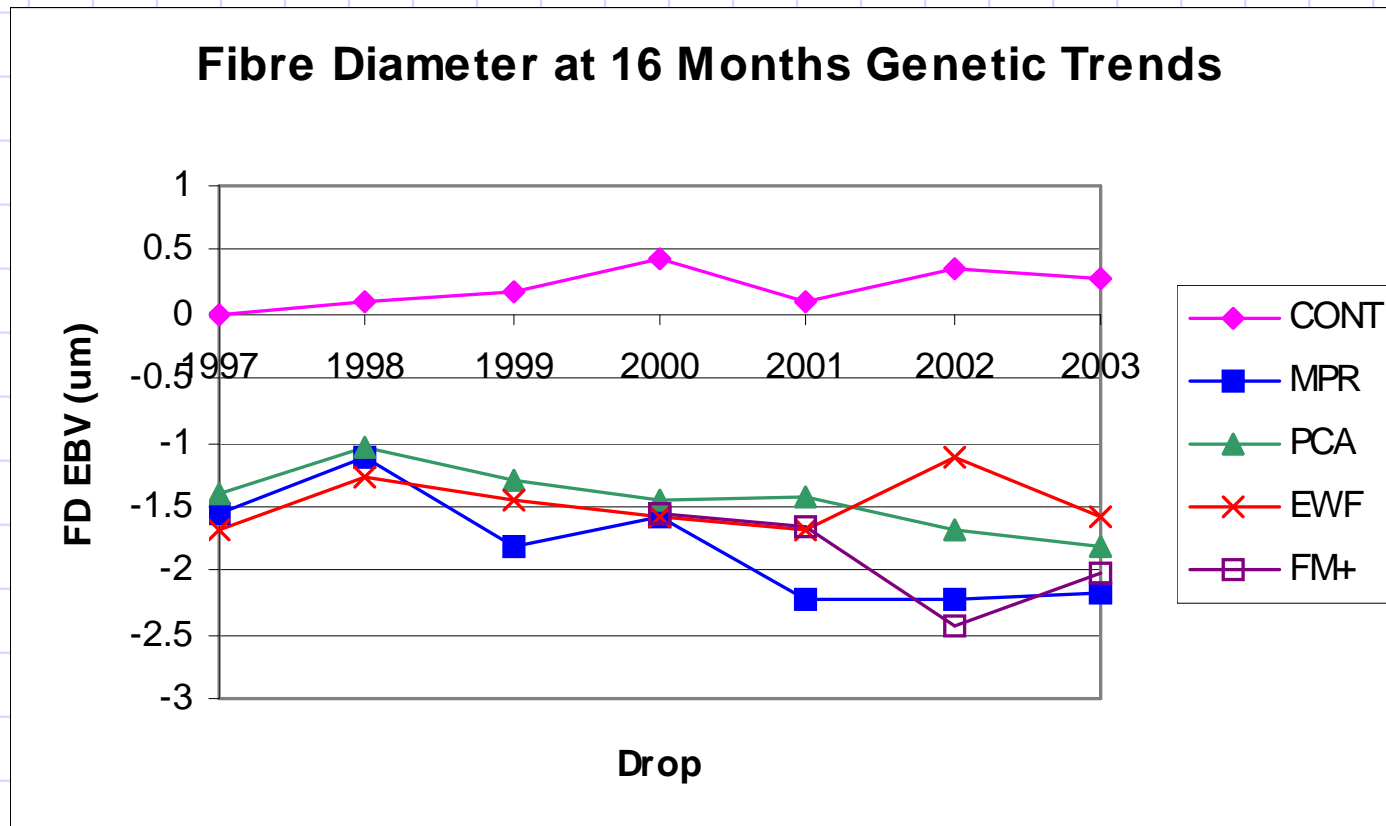
- ◆ Five selection flocks:
 - Control (CON)
 - Measured performance (MPR)
 - Visual assessment by sheep classers (PCA)
 - Elite wool / SRS (EWF)
 - Meat Merino (FM+)
- ◆ Selection by industry participants (breeders, classers etc), to a common breeding goal

CFW response in SDF selection lines



Source: Brien, F.D. Kemper, K.E., Hebart, M.L., Jaensch, K.S., Grimson, R.J. and Smith, D.H. (2005) in Merino Selection Demonstration Flocks, Newsletter Number 9, April 2005, pp 41 – 45.

MFD response in SDF selection lines



Source: Brien, F.D. Kemper, K.E., Hebart, M.L., Jaensch, K.S., Grimson, R.J. and Smith, D.H. (2005) in Merino Selection Demonstration Flocks, Newsletter Number 9, April 2005, pp 41 – 45.

Hogget fleece value (\$ / head) in the 2002 drop SDF progeny (3yr prices)

Flock	Rams	Ewes
CON	40.15	37.01
MPR	58.38	51.05
PCA	55.14	45.79
EWf	50.73	45.34
FM+	58.99	48.67

Source: Ramsay et al. (2004) Merino Selection Demonstration Flocks, Newsletter No. 8, March 2004, pp. 4 – 30.

Key messages - 1

◆ Traits of importance for Merinos:

- Fleece weight – fibre diameter relationship
- Price premium approach to including wool quality traits
- Reproduction traits lowly heritable but highly variable
- Breeding for disease resistance is possible
- Desired gains approach to combine resistance with production traits
- Growing importance of growth and carcass traits

Key messages - 2

- ◆ Large variation between ram breeding flocks for production traits:
 - Usefulness of wether trial data, particularly for commercial growers
- ◆ Development of across flock evaluation leading to MERINOSELECT
- ◆ Alternative breeding philosophies:
 - Common goals, different approaches to animal selection

Thank you!

