AWI Breech Strike R&D Technical Update
Maritime Museum, Sydney
12th July 2016

Jen Smith
CSIRO Agriculture and Food

Breeding for Breech Strike Resistance

Australian Wool Innovation Limited

Re-cap

- Selective breeding is a good alternative because it is minimal intervention
- The trouble with disease traits:
  - We need indirect selection criteria
- Previously reported on subsets of data, this is ‘final iteration’ with all data included

Objectives

1. Evaluate potential indirect selection criteria for breech flystrike ✓
2. Develop industry best practice guidelines for including breech strike resistance in Merino breeding programs ✓
3. Make preliminary estimates of heritability and correlations between breech and production traits – the tools to estimate genetic gain ✓




Australian Wool Innovation Limited

How long will it take?

Response to selection is dependent upon…

- Which traits we use
- Amount of existing variation
- Heritability
- Correlations among traits

Trial Outcomes

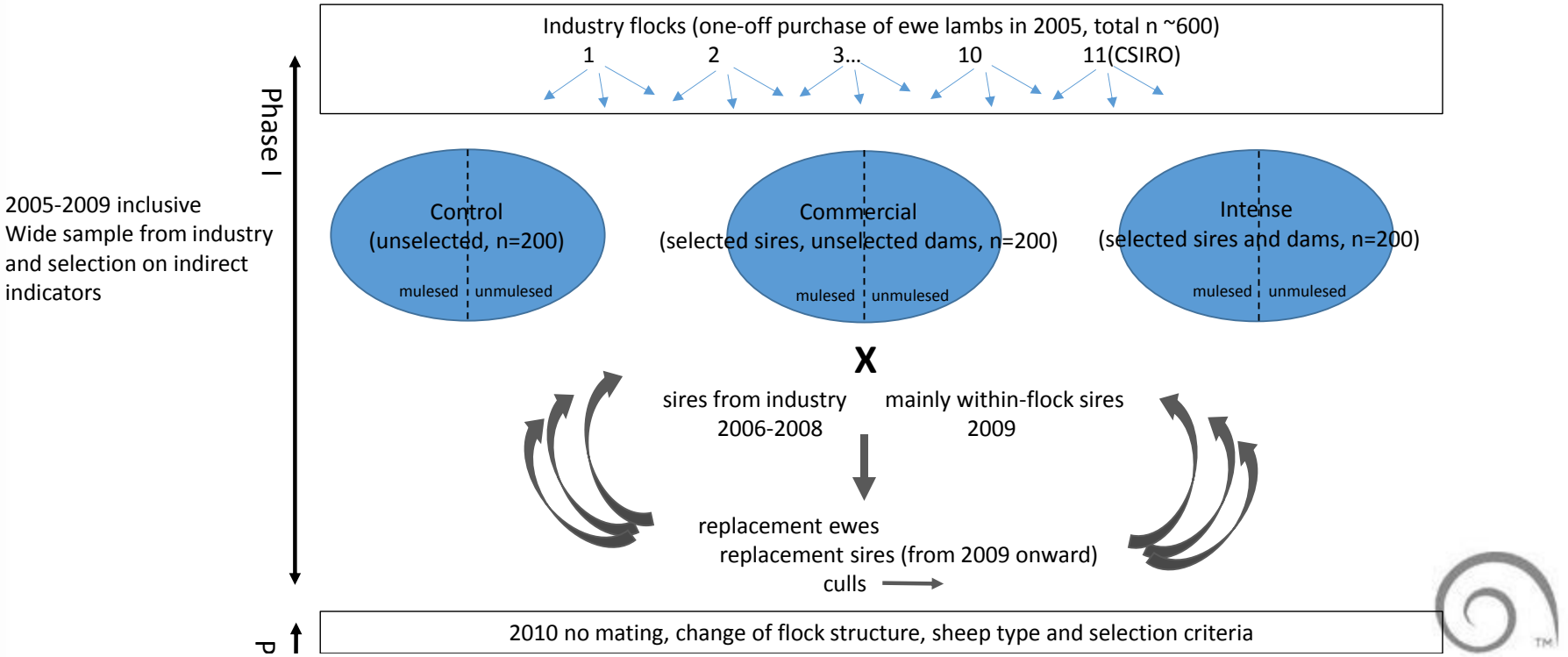
- How many traits in the breeding objective
- Relative ‘weighting’ on those traits
- Selection intensity
- Generation interval
- Use (or not) of outside genetics

Differs between breeders

Australian Wool Innovation Limited

Design, Phase I

CSIRO, Armidale fine wool sheep, summer rainfall environment
DAFWA, Mt Barker medium wool sheep, Mediterranean environment

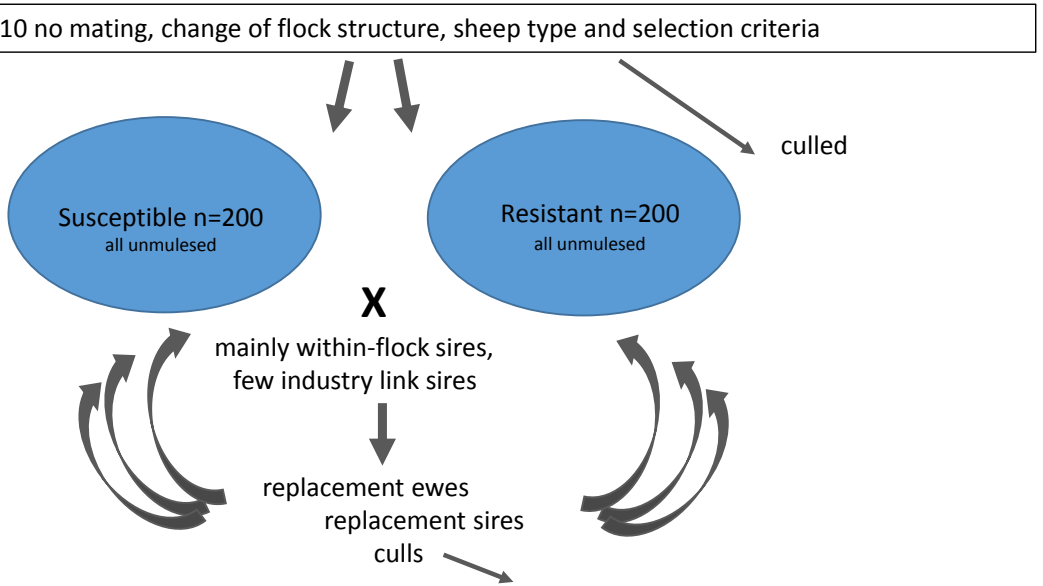


Design, Phase II

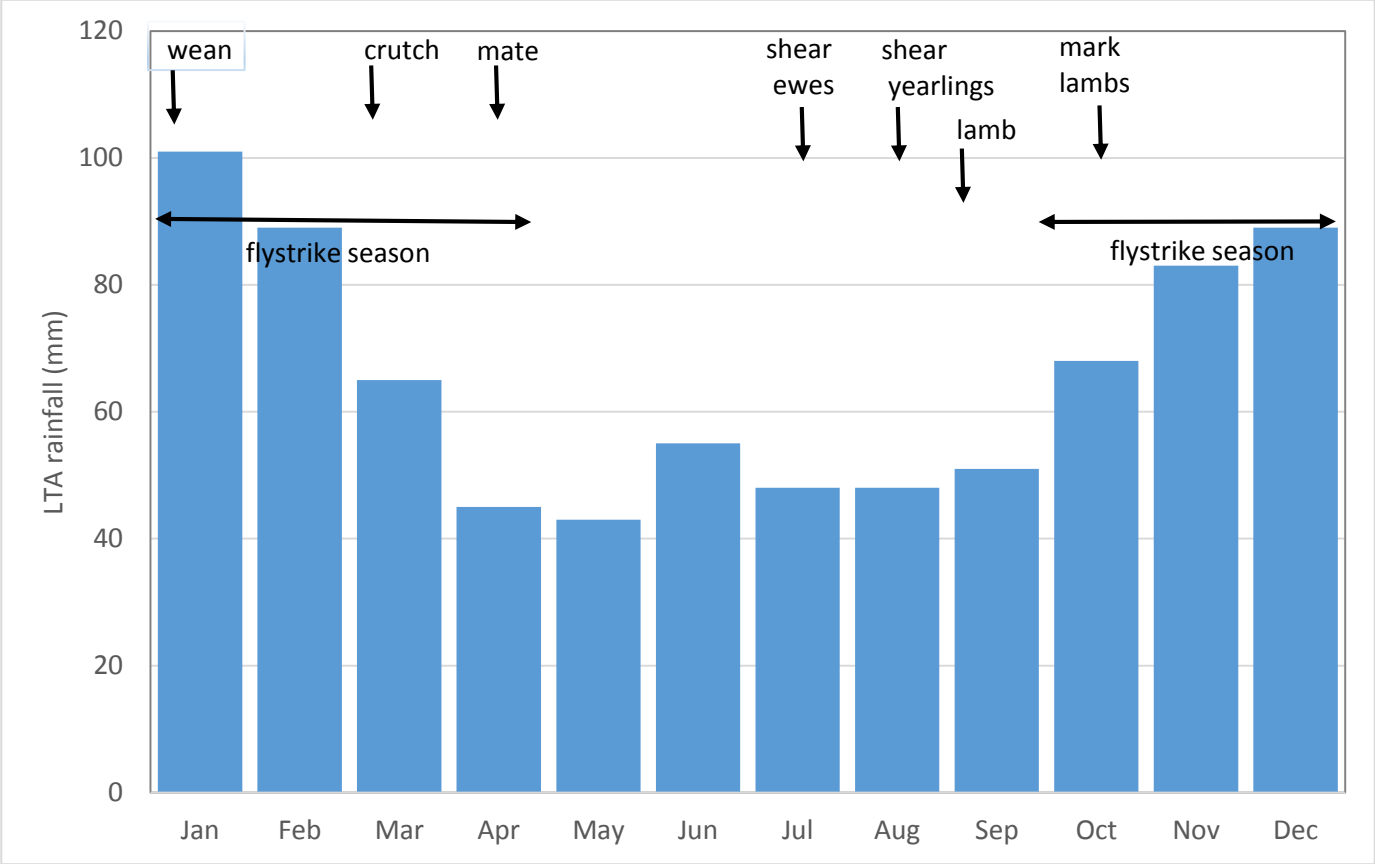
Design changed for Phase 2

Phase II

2011-2015 inclusive
Target to fine/superfine type and selection on breech flystrike

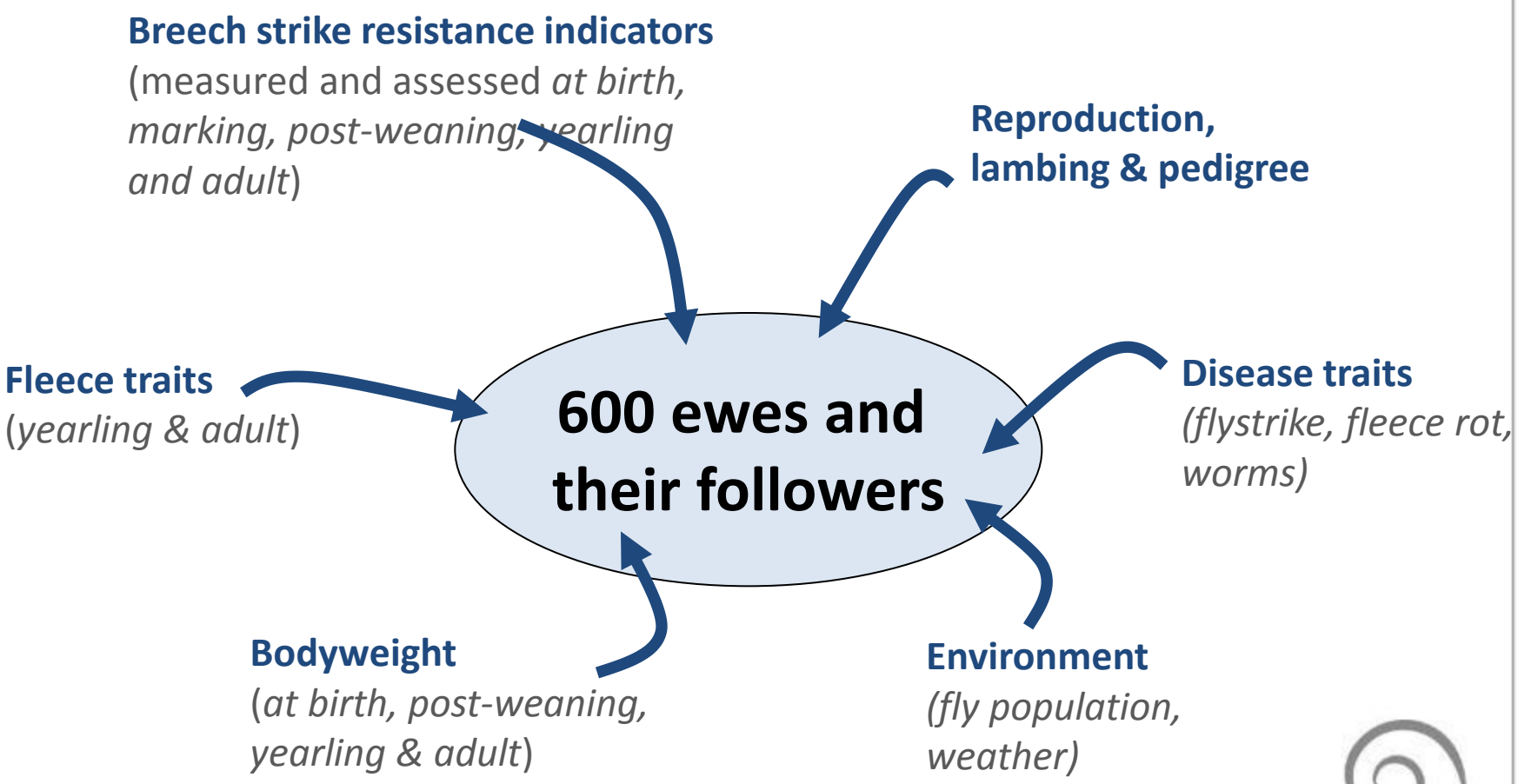


Annual calendar



awi
Australian Wool Innovation Limited

What got recorded



Flystrike recording

- No ‘whole flock’ preventative treatment (except at marking)
- Sheep checked at least 3 times per week
- Fly season is governed by frost incidence (Oct-Apr inclusive)
- Body strikes recorded separately
- All classes of sheep for as long as they remained in flock
  - Weaners, hogget ewes and rams, breeding ewes, sires

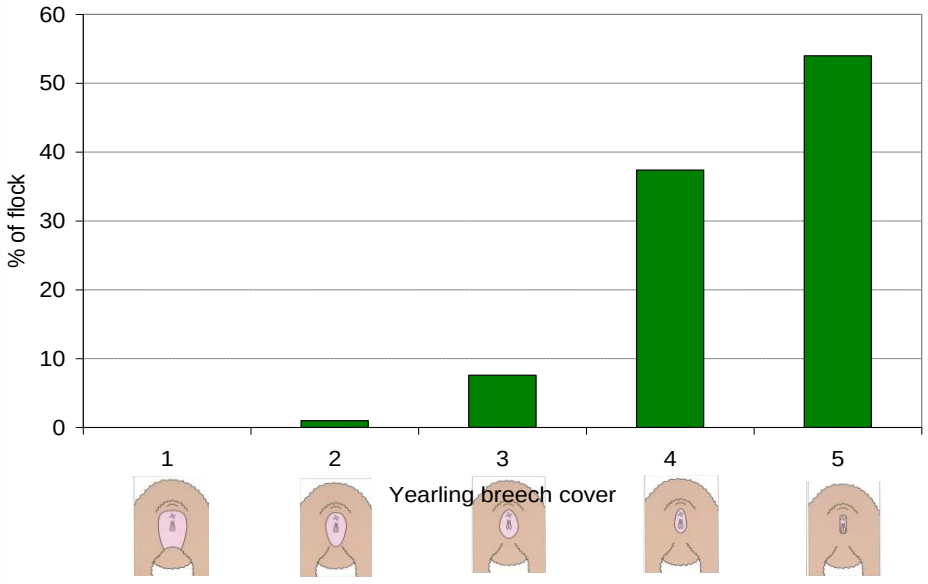
Australian Wool Innovation Limited

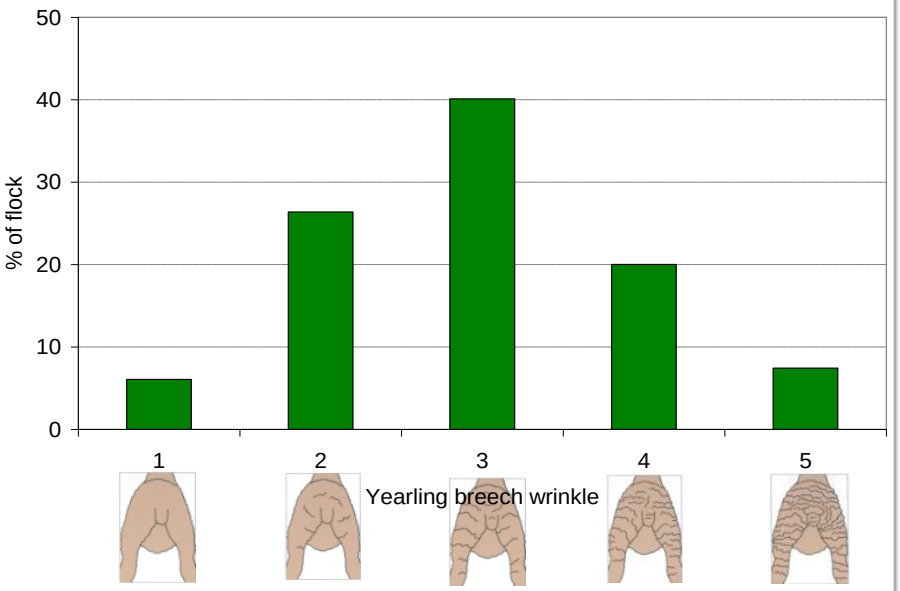
Results

Australian Wool Innovation Limited

Breech cover and breech wrinkle

Distribution in unselected, unmulesed population





Sheep had high wrinkle and high cover

awi
Australian Wool Innovation Limited

Flystrike

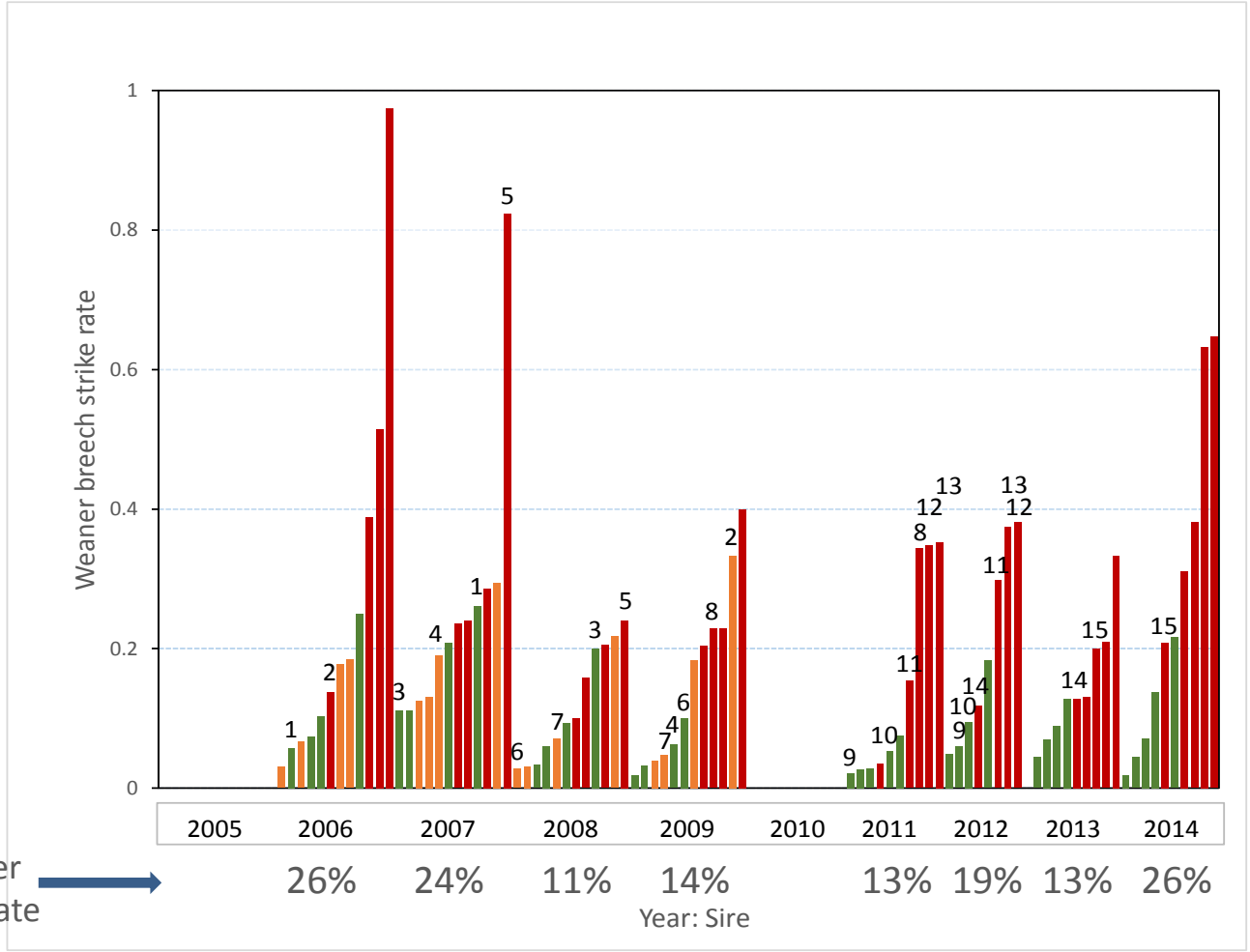
- Rates vary with year (climate), overall ~20% weaner breech strikes
- Weaners most susceptible

Across years	Weaners	Yearling ewes	Adults
Ave BRSTR	18.6%	9.9%	10.9%
Range BRSTR	11.4 – 25.8%	2.1 – 25.1%	1.8 – 23.3%

- Females more likely to be struck than males
- Body strikes up to 5-6% in Phase I (due to use of sires not suited for high summer rainfall but had good breech traits)
- Body and Breech strike not correlated

Australian Wool Innovation Limited

Sire group differences in breech flystrike



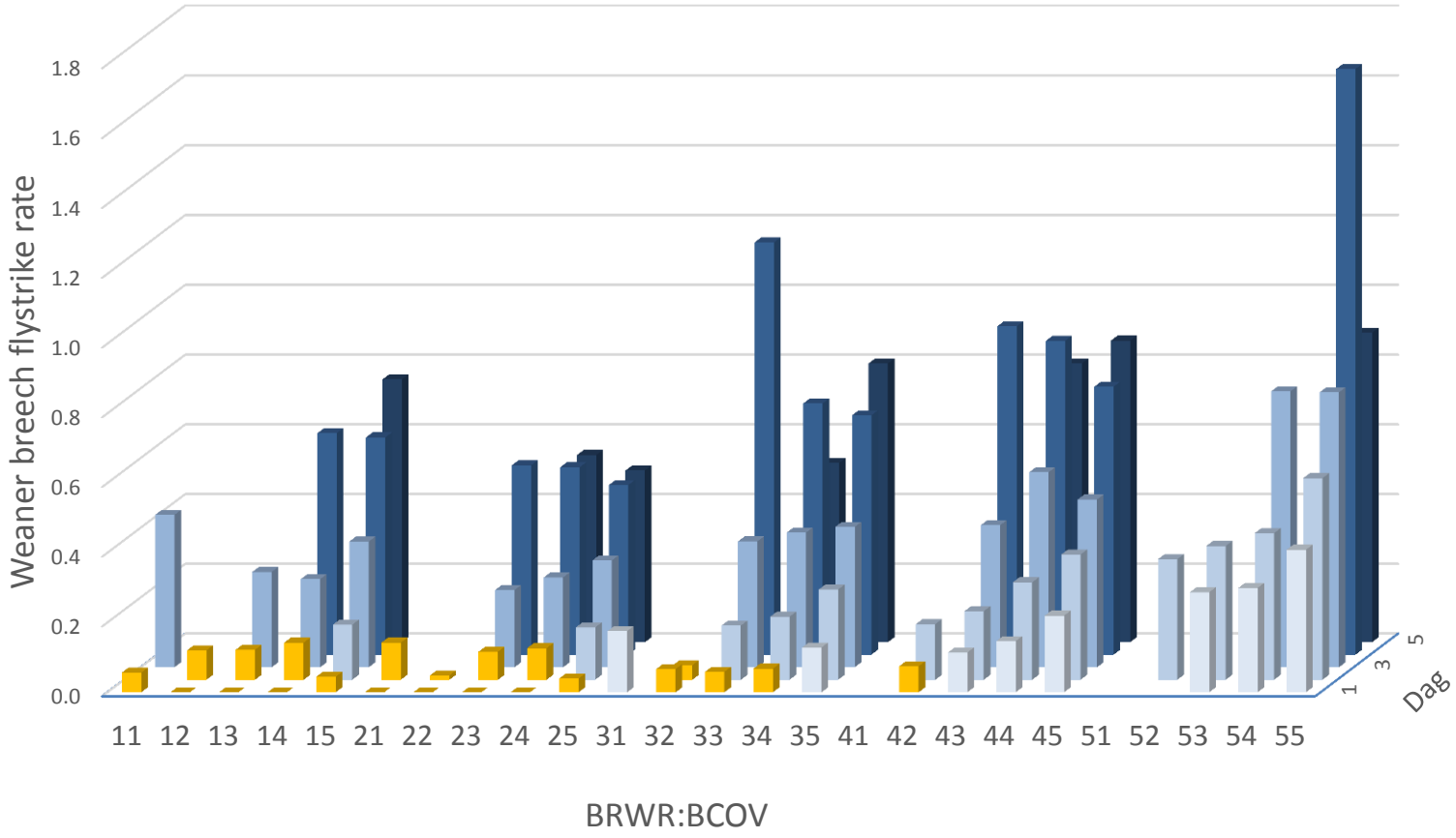
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Average weaner breech strike rate		26%	24%	11%	14%		13%	19%	13%	26%
Rainfall during flystrike season (mm)	565	558	602	581	569	575	685	475	346	441

LTA annual rainfall ~800mm, LTA for flystrike season rainfall 540 (~70%)

awi Australian Wool Innovation Limited

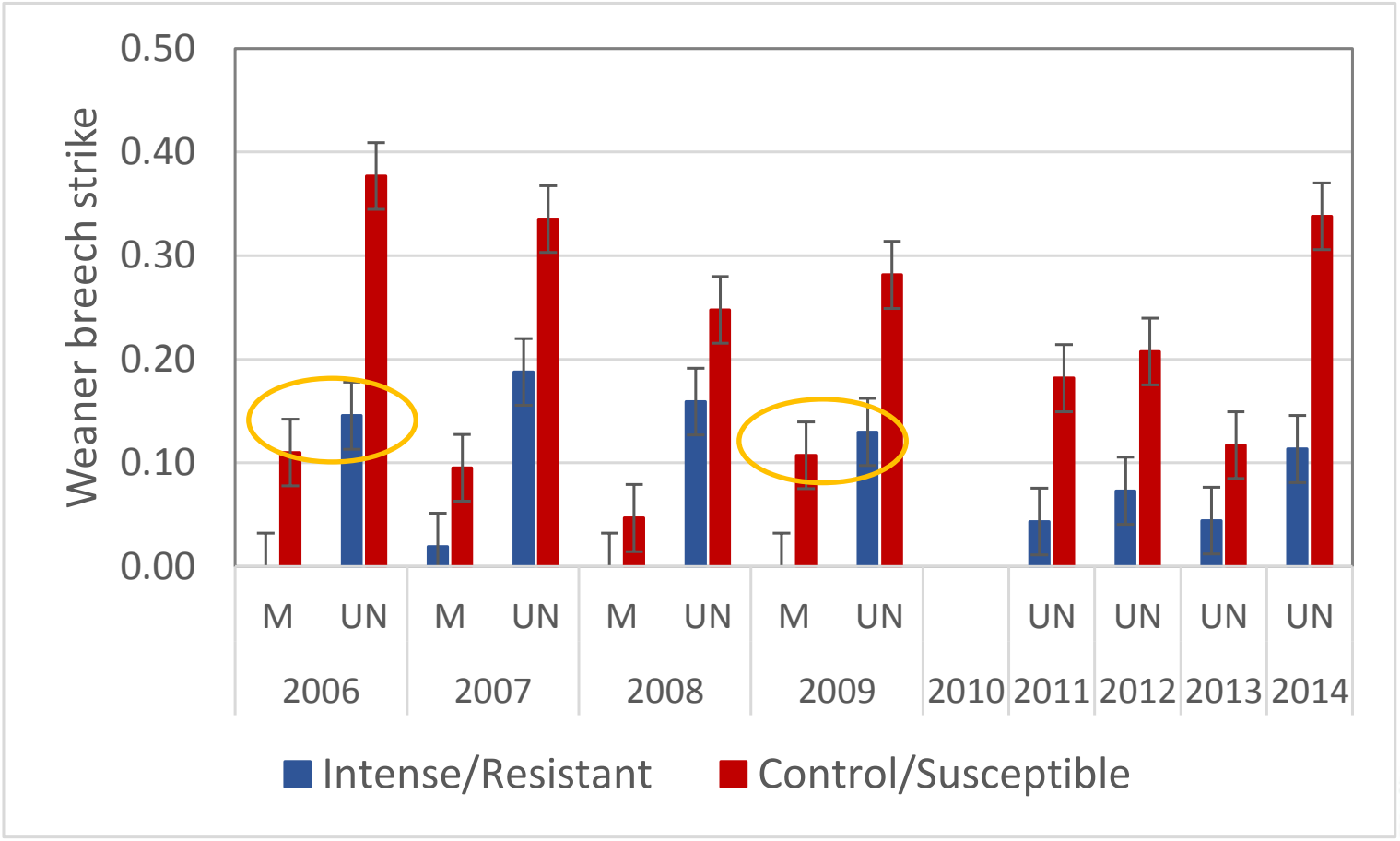
Flystrike risk with indicator traits

Gold columns where flystrike rate similar to mulesed animals



Australian Wool Innovation Limited

Weaner breech strike (2006 – 2014)



In some years unmulesed resistant sheep had similar strike rates to mulesed controls

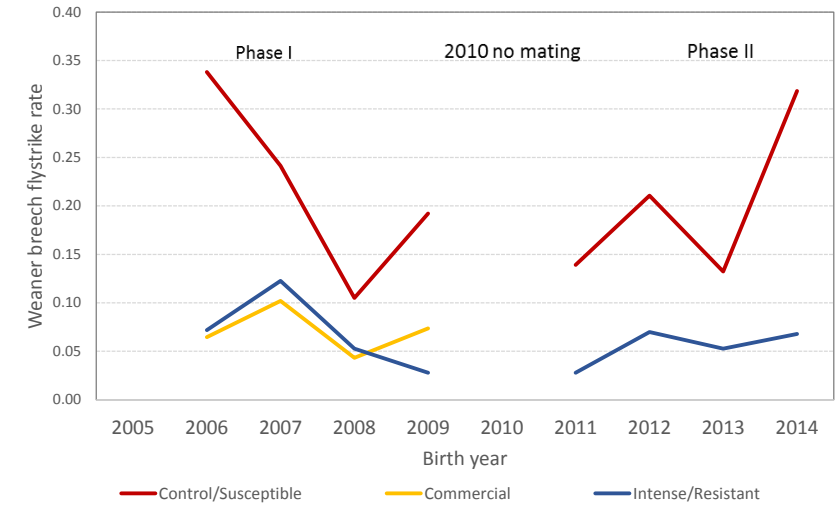
Mulesed resistant sheep very low strike rates

Breech flystrike

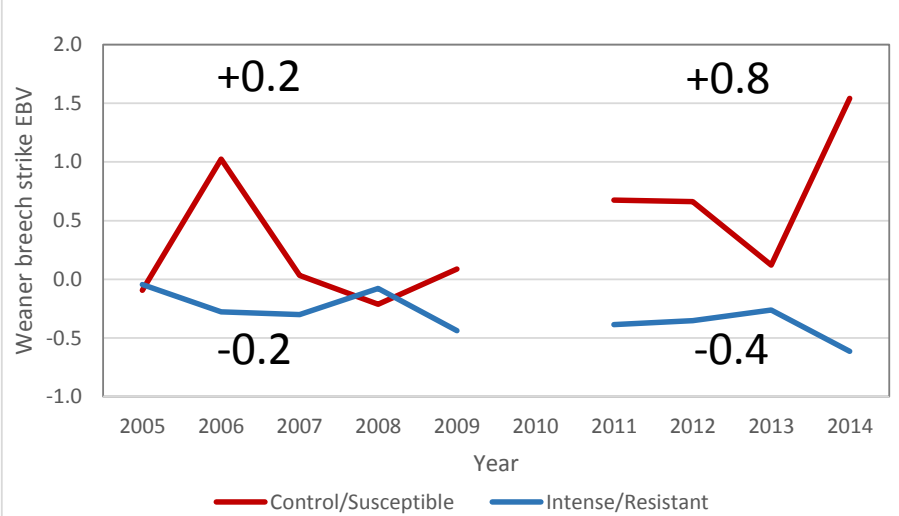
Individual sires had large impact on trends in some years

Low strike years harder to get accurate assessments

Phenotypic trend



Genetic trend



Raw mean breech flystrike (%)

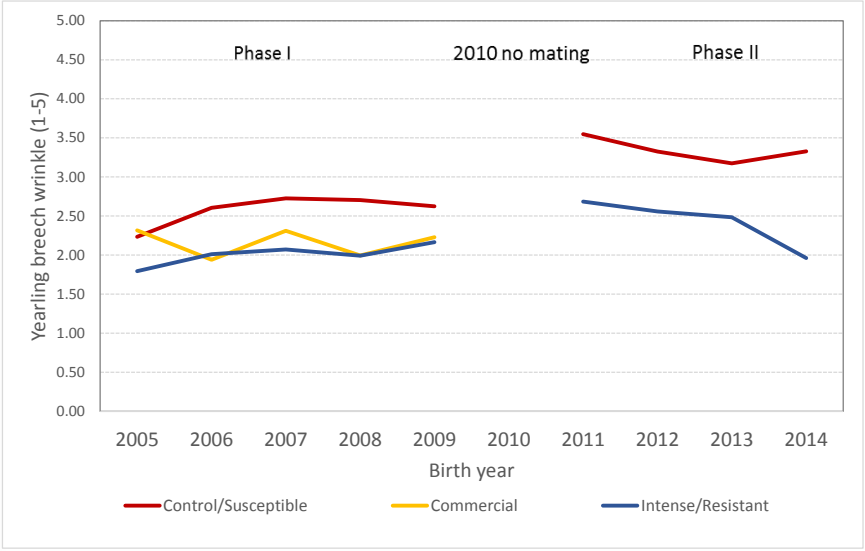
	Mulesed	Unmulesed
Phase I (Control & Intense)	6%	31%
	Intense/Resistant	Control/Susceptible
Phase I (mulesed & unmulesed)	10%	33%
Phase II (all unmulesed)	8%	30%

There was no 2010 drop

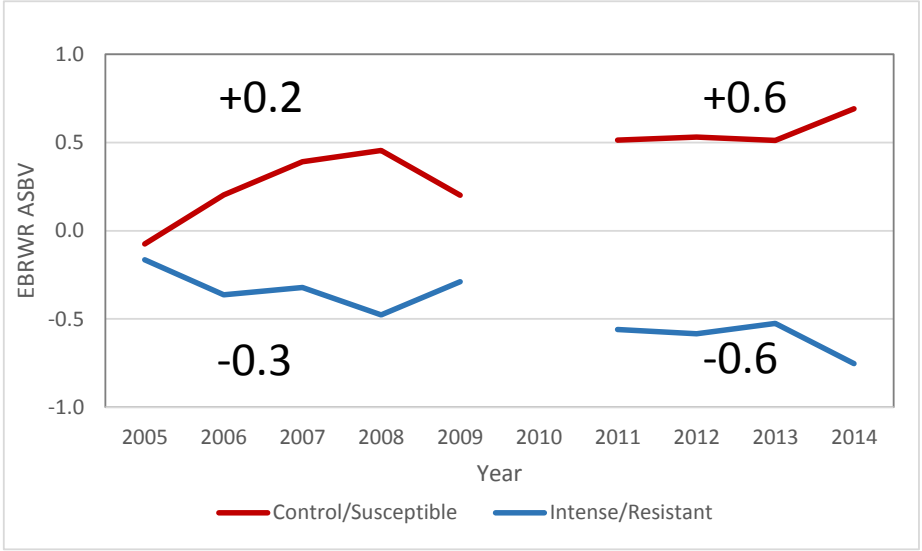
Breech wrinkle

For phase 2 classed out sheep not suited to high summer rainfall , impacted on phenotype

Phenotypic trend



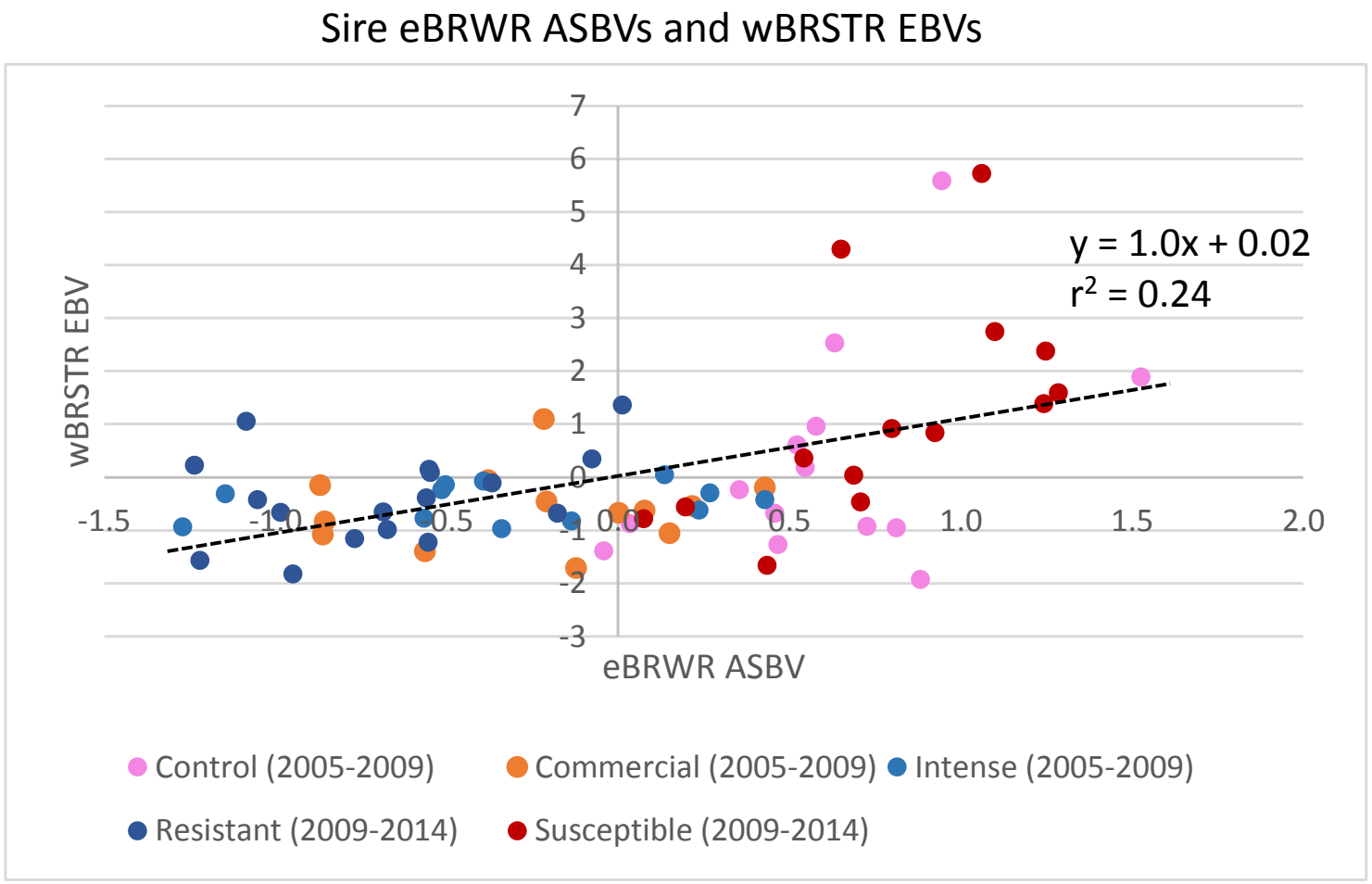
Genetic trend



Raw mean breech wrinkle score

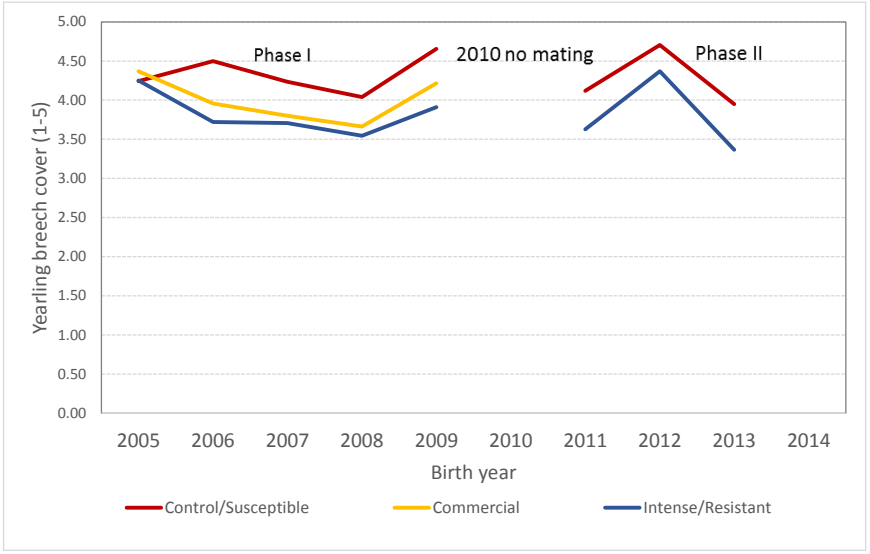
	Mulesed	Unmulesed
Phase I (Control & Intense)	1.9	2.6
	Intense/Resistant	Control/Susceptible
Phase I (mulesed & unmulesed)	2.0	2.6
Phase II (all unmulesed)	2.4	3.3

Breech wrinkle and breech strike

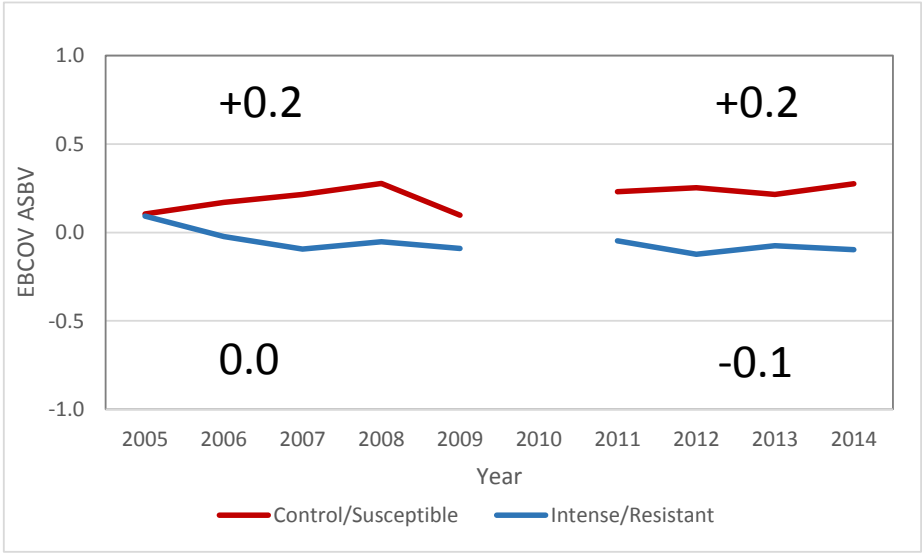


Breech cover

Phenotypic trend



Genetic trend



Raw mean breech cover score

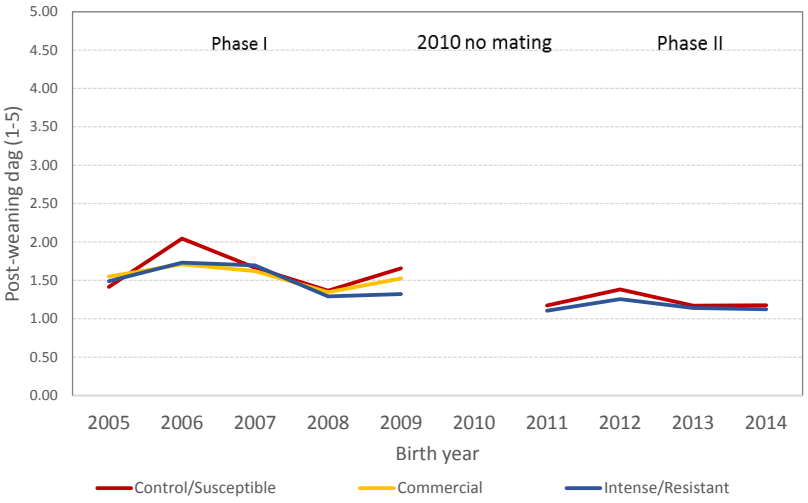
	Mulesed	Unmulesed
Phase I (Control & Intense)	3.9	4.3
	Intense/Resistant	Control/Susceptible
Phase I (mulesed & unmulesed)	3.8	4.3
Phase II (all unmulesed)	3.8	4.3

awi
Australian Wool Innovation Limited

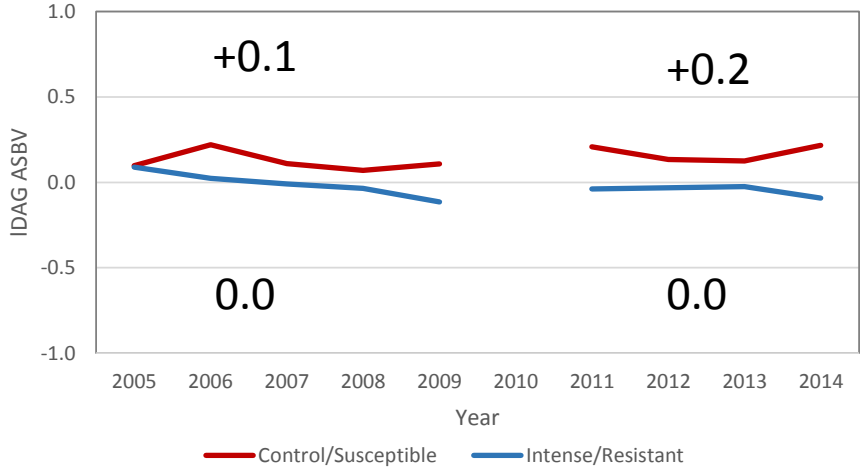
Dag

Armidale is a low dag environment

Phenotypic trend



Genetic trend



Raw mean dag score

	Mulesed	Unmulesed
Phase I (Control & Intense)	1.5	1.7
	Intense/Resistant	Control/Susceptible
Phase I (mulesed & unmulesed)	1.6	1.8
Phase II (all unmulesed)	1.2	1.3

awi
Australian Wool Innovation Limited

Key candidate traits

Trait	Variable	Heritable	Correlated with breech strike
Breech wrinkle	✓✓✓ 0.66	✓✓✓ 0.36	✓✓ 0.47
Breech cover	✓✓ 0.37	✓✓ 0.24	✓✓ 0.35
Crutch cover	✓✓ 0.38	✓✓✓ 0.37	✓ 0.28
Dag	✓✓ 0.37	✓ 0.16	✓✓✓ 0.81
Urine	✓✓ 0.39	✓✓ 0.22	✓ 0.06

Based on the genetic parameters estimated for the Armidale flock the genetic gain in breech strike would be greater if the selection criterion was either BRWR and or DAG rather than BRSTR itself (in general agreement with the WA data).

awi™
Australian Wool Innovation Limited

Fixed effects on wrinkle

Effects of birth-rearing type and age-of-dam

Singles ~ ½ score more wrinkly than twins
Adult dam ~ ¼ score more wrinkly than maiden

Australian Wool Innovation Limited

Breech flystrike genetic parameters

Trait	V_p	Weaner	Yearling	Adult
Weaner	0.21	***0.18 (0.03)***	0.29	0.22
Yearling	0.09	0.92	***0.16 (0.03)***	0.33
Adult	0.61	0.40	0.26	***0.26 (0.05)***

Heritability bolded

Combine trait all ages Vp = 0.13 and Heritability 0.20 (0.03)

awi
Australian Wool Innovation Limited

Genetic correlations, breech and production traits

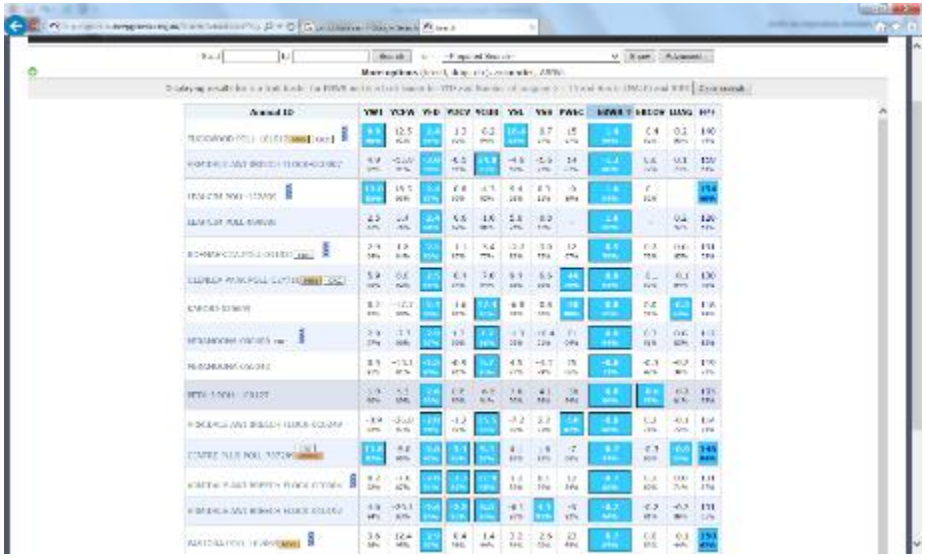
Correl'n between Wrinkle & Fleece Weight similar to correl'n between Fleece Weight & FD

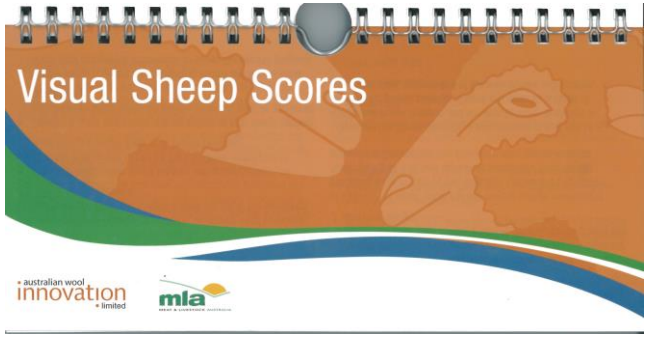
	Breech wrinkle	Breech cover	Dag	Breech strike
Body weight	✓ (-0.25)	✓ (-0.42)	✓ (-0.23)	~
Greasy fleece weight	✘ (0.36)	✓ (0.11)	✓ (-0.21)	~
Clean fleece weight	✘ (0.27)	✓ (0.11)	✓ (-0.20)	~
Yield	✓ (-0.18)	~	~	✓ (-0.12)
Fibre diameter	~	✘ (-0.14)	✘ (-0.22)	✘ (-0.25)
CV fibre diameter	✓ (0.37)	~	✓ (0.30)	✓ (0.31)
Fibre curvature	~	~	~	~
Staple length	✓* (-0.36)	✘ (0.17)	~	✓ (-0.16)
Staple strength	~	~	✓ (-0.22)	✓ (-0.17)

✓ = favourable ~ = neutral ✘ = unfavourable

Implications and implementation in industry

- Industry standards for assessing wrinkle, wool cover, dags, urine stain etc.
- Added to, and modified with considerable input from these projects
- ASBVs for breech wrinkle, breech cover and dag in 2009.
- Those ASBV's remain relevant, possible further traits as ASBV's?





awi
Australian Wool Innovation Limited

How industry uses breech traits

Stud
(2% of sheep)

Performance recorded

- Record breech traits on ewes and rams for ASBVs
- Include breech traits in selection decisions (within-flock selection)
- Purchase sires/semen with ASBVs (across flock selection)

- Multi-trait index incorporating breech traits (yet to come)

Commercial
(98% of sheep)

'Traditional'

- Cull flock ewes on visual assessment of indirect indicators
- Cull sheep that get flystruck
- (Can purchase semen or rams with ASBVs for breech traits)

awi
Australian Wool Innovation Limited

Where we're at

- Changing wrinkle and cover by 1-1.5 units gives effect similar to mulesing
- In 10yrs demonstrated gains in breech flystrike resistance almost as good as mulesing (low dag environment)
  But, we used everything at our disposal
  a) initial buy in of selected dams
  b) across flock selection of sires esp. in early years
  c) within flock selection predominantly on breech traits
- Industry can not change so quickly as there are many more traits in the breeding objective
- Industry has to deal with
  a) unfavourable relationships between breech traits and production traits
  b) no real price premium for unmulesed wool

awi
Australian Wool Innovation Limited

Take home message

1. This works, but no single simple ‘recipe’ for every grower
2. Rate of response will be different in every flock
3. Choice of indirect selection criteria will vary with sheep/wool type, production system and environment (climate)
4. Like any selective breeding, gains are cumulative and permanent
5. Selective breeding is a useful tool in the IPM tool-kit

(and whether its at the top or bottom of the tool-kit, is up to the individual)

Australian Wool Innovation Limited

*This publication is based on information presented at the Australian Wool Innovation Limited (**AWI**) National Wool Research and Development Technical Update on Breech Flystrike Prevention held on 12th July 2016. Some information in this publication has been contributed by one or more third parties and licenced to AWI, and AWI has not verified whether this information is correct.*

This publication should only be used as a general aid and is not a substitute for specific advice. Any reliance on the information contained in this publication is done at your own risk and to the extent permitted by law, AWI and any third party contributors exclude all liability for loss or damage arising from the use of the information in this publication.

AWI gratefully acknowledges the funds provided by the Australian government to support research, development and marketing of Australian wool.