Introduction of a genetic evaluation for longevity in Tyrol Mountain sheep

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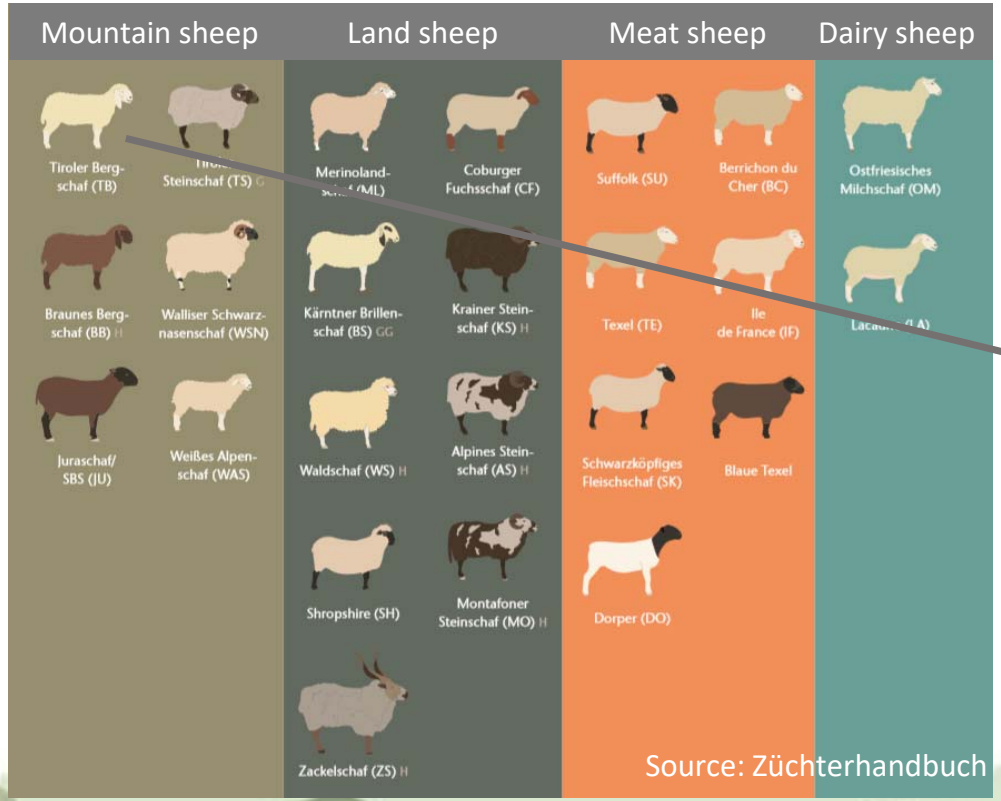
Sheep breeding in Austria



- Approx. 400,000 sheep,
  > 16,000 farms
  25% herdbook animals
  23 breeds (8 gene conservation)

Tyrol Mountain

- **Non-seasonal** mountain sheep breed
- Approx. 15,200 herdbook ewes (>0.5yrs)
- Focus on lamb production, landscape management, and conservation grazing
- **Genetic evaluation since 2017**
  → main dates Jan/Jun
  → plus weekly updates
  if change in reliability > 5% or new individual performance

Complex	Trait	Relative weight	
Fitness	Age at first lambing	3.0	**100**
	Lambing interval	26.8	
	Lambs born	35.0	
	Lambs born alive	20.2	
	Lambs born paternal	10.0	
	Lambs born alive paternal	5.0	

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Longevity related trait missing

Aim

Definition of a **longevity related trait** that can be implemented in routine genetic evaluation based on **linear models**

Approach

- 5 **cumulative periods** from the first lambing onwards
- Traits are the **number of lambings** in periods,
  i.e. 1, 2, 3, 5 and 8 years after the first lambing
- Last unfinished period of animals alive considered by extrapolating expected performance, all other periods subsequently set to missing Brotherstone et al. (1997)
- Following Venot et al. (2013) for beef cattle

Model

- **Fixed effects:** age at first lambing, year-month and herd
- **Random effects**: herd-year and animal genetic
- **Variance component estimation**:

  Between 12,935 (period 8) and 22,383 (period 1) ewes

  Pedigree 41,135 animals

  VCE6 (Groeneveld et al., 2008)

Results: Overview

Period (yrs)	N	$\bar{x}$ no. of lambings	SD	Min	Max
1	22 383	1.75	0.46	1	3
2	21 332	2.67	1.01	1	5
3	19 890	3.36	1.53	1	7
5	17 454	4.20	2.38	1	10
8	12 935	4.48	2.90	1	15

Results: Overview

Period (yrs)	N	$\bar{x}$ no. of lambings	SD	Min	Max
5	17 454	4.20	2.38	1	10
8	12 935	4.48	2.90	1	15

In higher periods, number of lambings somewhat lower than in other non-seasonal breeds –
Alpine grazing – management decision?

Results: Genetic parameters

Period (yrs)	1	2	3	5	8
1	**0.034 (0.01)**				
2		**0.063 (0.01)**			
3			**0.089 (0.01)**		
5				**0.128 (0.01)**	
8					**0.140 (0.01)**

Results: Genetic parameters

Period (yrs)	1	2	3	5	8
1					
3				0.128 (0.01)	
8					0.140 (0.01)

h^2 increase markedly with increasing period (similar to other mountain sheep breeds, e.g. Jura and Brown Mountain)

Results: Genetic parameters

Period (yrs)	1	2	3	5	8
1	**0.034 (0.01)**	0.97 (0.04)	0.92 (0.06)	0.86 (0.06)	0.81 (0.02)
2		**0.063 (0.01)**	0.99 (0.01)	0.97 (0.02)	0.96 (0.03)
3			**0.089 (0.01)**	0.99 (0.01)	0.99 (0.01)
5				**0.128 (0.01)**	0.99 (0.01)
8					**0.140 (0.01)**

Heritabilities on diagonal, genetic correlations on off-diagonal

Results: Genetic parameters

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1	**0.034 (0.01)**	0.97 (0.04)	0.92 (0.06)	0.86 (0.06)	0.81 (0.02)
2		**0.063 (0.01)**	0.99 (0.01)	0.97 (0.02)	0.96 (0.03)

High genetic correlations between periods – periods at younger ages suitable predictors for no. of lambings later in life

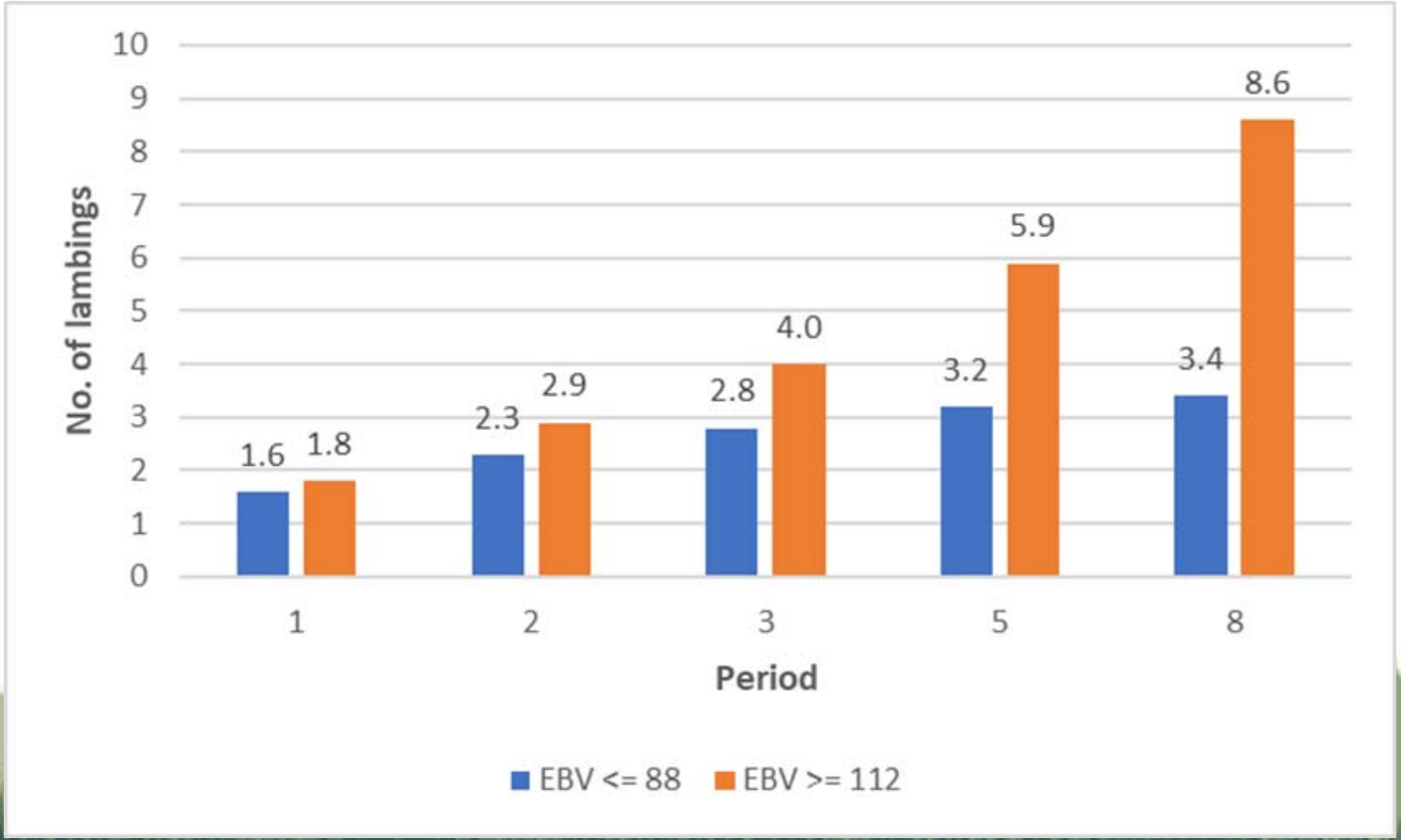
Routine genetic evaluation (MiX99 Development Team, 2022)

- EBVs **estimated** for **all periods**
- EBVs **published** for **period 3**
  - reliability ≥ 0.20
  - 100 ± 12 points/s_a
  - rolling base

- First **official EBVs** in June 2024
- Along with EBVs for **conformation traits** and introduction of **TMI** (rel. weight of longevity 30%)
- Currently **test runs** available

EBVs and number of lambings

daughters of rams with period 3 breeding values (EBV) of <= 88 and >=112



Conclusion and next step

- Trait is well suited representing longevity (“productive efficiency”)
- Next step

  → consideration of selected conformation traits as auxiliary traits, as soon as genetic correlations can be estimated reliably

Thank you for your attention!

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