GxE in organic and conventional production systems in Austrian Fleckvieh cattle

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Background (I)

- Front-runner in organic agriculture
  - ~20% of agricultural land
  - ~18% of all dairy cows
- Same breeding objectives for all breeders
  - Total merit index (38% milk, 18% beef, 44% fitness)
- Survey in 2012
  - Organic farmers weighted functional traits higher

Background (II)

- In both production systems (PS)
  - Improvement of genetics and management
- Organic dairy cows have a reduced milk performance of 14%
- Stricter regulations for organic
- Tremendous variety of PS

Background (III)

→ **Are the selected animals the best for different PS?**

→ **Existence of possible G x E?**

→ **Re-ranking of animals?**

Objectives (I)

- Investigation of G x E interactions for different PS
  - Milk kg
  - Persistency (**PERS**)
  - Functional longevity (**LONG**)
  - Somatic cell score (**SCS**)
  - Clinical mastitis (**CM**)
  - Milk fever (**MF**)
  - Early fertility disorders (**EFD**)
  - Cystic ovaries (**CO**)
  - Non-return rate 56 cows (**NR56**)
  - Interval from first to last insemination cows (**FLI**)

Objectives (II)

- Conduct an approximate multitrait 2-step procedure applied to yield deviations and de-regressed breeding values
- According to results recommendations for specific breeding programmes are given

Materials & methods

- Data basis
  - Austrian Fleckvieh cow population
  - Maximum 25% non-Fleckvieh-gene proportion
  - All 10 traits recorded
  - Born between 2004 and 2010
  - Known parents
- Organic (**Organic**) - conventional low (**ConL**) – conventional high (**ConH**)
- Grouping according to the herd-year-effect (**HYE**) for milk yield
  - Indicator for farm management

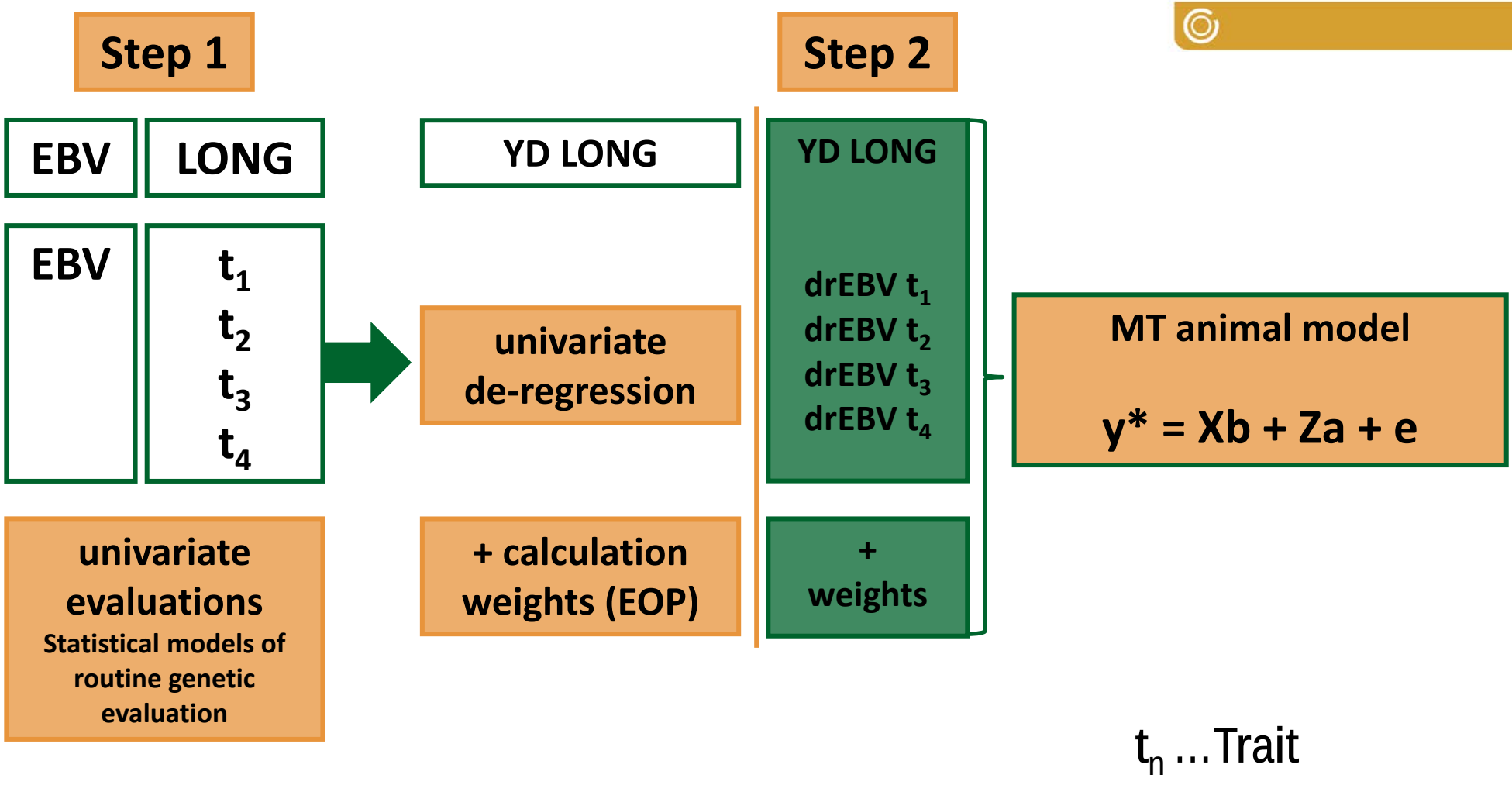
Summary of the production systems

	Organic	ConL	ConH
Animals (n)	14,503	25,000	25,000
Farms (n)	952	1,700	971
Range HYE (1st lact.)	3,154 – 8,446	3,003 – 5,428	6,436 – 8,480

Summary of the production systems

Trait	Organic	ConL	ConH
Milk kg (1st lact.)	5,668	5,466	7,624
LONG d	1,027	1,034	1,007
SCS	1.85	2.02	1.88
CM %	3.46	5.39	4.48
MF %	0.14	0.18	0.09
EFD %	2.58	3.10	2.95
CO %	2.34	4.41	3.42
NR56 %	69.2	67.9	64.1
FLI d	30.6	42.0	32.9

Approximate multitrait 2-step procedure



t_n ...Trait

Model for estimating G x E

- Bivariate linear animal model

$$y^* = Xb + Za + e$$

Threshold

Considerable G x E if $r_a < 0.80$

Results and Discussion (I)

	Organic - ConL	Organic - ConH	ConL - ConH
Milk kg	0.983[a]	0.973[a]	0.982[a]
PERS	0.990	0.993	0.956[a]

Results and Discussion (II)

	Organic - ConL	Organic - ConH	ConL - ConH
Milk kg	0.983[a]	0.973[a]	0.982[a]
PERS	0.990	0.993	0.956[a]
LONG d	**0.968**	**0.934**	**0.886**

Results and Discussion (III)

	Organic - ConL	Organic - ConH	ConL - ConH
Milk kg	0.983[a]	0.973[a]	0.982[a]
PERS	0.990	0.993	0.956[a]
LONG d	0.968	0.934	0.886
SCS	**0.962**	**0.941[a]**	**0.996**

Results and Discussion (IV)

	Organic - ConL	Organic - ConH	ConL - ConH
Milk kg	0.983[a]	0.973[a]	0.982[a]
PERS	0.990	0.993	0.956[a]
LONG d	0.968	0.934	0.886
SCS	0.962	0.941[a]	0.996
CM %	0.952	1.000	0.987
MF %	1.000	0.966	0.912
EFD %	1.000	1.000	0.936[a]
CO %	1.000	1.000	1.000

Results and Discussion (V)

	Organic - ConL	Organic - ConH	ConL - ConH
Milk kg	0.983[a]	0.973[a]	0.982[a]
PERS	0.990	0.993	0.956[a]
LONG d	0.968	0.934	0.886
SCS	0.962	0.941[a]	0.996
CM %	0.952	1.000	0.987
MF %	1.000	0.966	0.912
EFD %	1.000	1.000	0.936[a]
CO %	1.000	1.000	1.000
NR56 %	**0.991**	**0.890**	**0.936**
FLI d	**0.903**	**0.935**	**0.954**

Conclusions

- Applied procedure was **feasible**
- **High genetic correlations** between defined PS
- **Similar** production environments and farm managements
- **Slight** G x E for **milk yield**
- **Numerically** more pronounced for **functional longevity** and **non-return rate 56 cows,** but **not significantly different** from **unity**
- ***Different* breeding objectives** are currently ***not* needed**

Thank you for your attention!

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Number of AI bulls used in each PS

	Organic	ConL	ConH
Organic	1,569	1,275	1,164
ConL		1,808	1,349
ConH			1,660

Rank correlations between EBVs

	Organic-ConL		Organic-ConH		ConL-ConH	
	n	r	n	r	n	r
All animals	151.484	0.999	144.655	0.998	157.300	0.998
Animals with pseudo-Phenotypes	39.503	0.998	39.503	0.997	50.000	0.997
Sires	193	0.993	172	0.988	219	0.989

Almost no re-ranking of sires in different PS