A new approach to find aspects of GxE-Interactions in female Swiss Fleckvieh and Braunvieh cattle in conventional and organic farming systems in Switzerland

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Introduction

- 90% of dairy cows in Switzerland are artificially inseminated, it is the same ratio on conventional and on organic farms

- Most AI straws are from bulls originating from conventional farms

- Performance testing takes place mainly on conventional farms

- It is possible that genotype x environmental-interactions (GxE-I) exist between organic and conventional farming systems

- There are GxE-I-studies comparing bull breeding value rankings based on data from organic farms and from conventional farms

- So far, only few such GxE-I have been found; especially in functional traits

- No GxE-I calculations have been carried out for female animals so far

- Swiss organic farmers sometimes complain that breeding values don't correspond to phenotypic performances in organic environments

- This study compared breeding values and performances of dairy cows on organic and conventional farms in Switzerland

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Hypothesis

Breeding values of dairy cows on organic farms are less consistent with their phenotypic performances than breeding values of cows on conventional farms

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Methods

- The rankings of breeding values and of phenotypic performances of dairy cows were compared within the same herds (on the same farms) in Switzerland

- It was calculated how often rank matches occurred on organic farms and on conventional farms and whether the proportions of matches were different between organic and conventional farms

- Dataset: All Braunvieh (BV) and all Swiss Fleckvieh (SF) cows in 2016

- Included traits: milk kg, protein%, fat%, somatic cell count, persistency

- Only animals with breeding values with a coefficient of determination > 60% were included

- Only animals with lactation numbers 3 to 6 were included

- Only herds with at least 6 remaining animals were included

- For the BV breed, the data set was adjusted - by random removal of farms - so similar proportions of animals from organic and conventional farms were found in each altitude zone

Numbers of cows and distribution over altitude zones after removals

	Braunvieh:		**Swiss Fleckvieh:**	
	organic	conv.	organic	conv.
n (after removals)	**3'225**	**21'951**	**1'662**	**11'270**
Zones				
Tal / VAH	43.7%	49.0%	56.3%	56.3%
BZ 1	18.4%	18.8%	13.6%	19.6%
BZ 2	26.9%	22.4%	22.4%	16.5%
BZ 3/4	11.1%	9.8%	7.8%	7.5%
Alpine pasturing	24.2%	18.3%	17.6%	16.2%

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Results Braunvieh

Same rankings Breeding value and phenotype	organic, no. of animals	organic %	conventio-nal, no. of animals	Conventio-nal %	Chi-square-Test
Milk kg	597	18.5	3766	17.2	p= 0.058
Fat%	1032	32.0	6856	31.2	n.s.
Protein%	1024	31.8	7032	32.1	n.s.
SCC	280	8.7	1886	8.6	n.s.
Persistency	563	17.4	3841	17.5	n.s.
Milk kg (highest rank)	97	3.0	683	3.1	n.s.
Fat% (highest rank)	163	5.1	1266	5.7	n.s.
Protein% (highest rank)	180	5.5	1302	5.9	n.s.
SCC (highest breeding value, lowest phenotype)	160	4.9	998	4.6	n.s.
Persistency (highest rank)	75	2.4	557	2.5	n.s.
Milk kg (lowest rank)	116	3.6	702	3.2	n.s.
Fat% (lowest rank)	186	5.8	1246	5.7	n.s.
Protein% (lowest rank)	193	6.0	1258	5.8	n.s.
SCC (lowest breeding value, highest phenotype)	130	4.1	878	4.0	n.s.
Persistency (lowest rank)	79	2.5	575	2.7	n.s.

Results Swiss Fleckvieh

Same rankings Breeding value and phenotype	organic, no. of animals	organic %	conventional, no. of animals	conventional %	Chi-square-Test
Milk kg	536	22.8	2651	27.6	p<0.001
Fat%	635	38.3	4299	44.8	p<0.001
Protein%	605	36.4	4041	41.0	p<0.001
SCC	421	25.3	2792	29.0	p<0.01
Persistency	295	17.7	1978	20.6	p<0.01
Milk kg (highest rank)	46	2.8	303	3.1	n.s.
Fat% (highest rank)	82	5.0	500	5.2	n.s.
Protein% (highest rank)	79	4.8	463	4.8	n.s.
SCC (highest breeding value, lowest phenotype)	51	3.0	318	3.3	n.s.
Persistency (highest rank)	30	1.8	185	2.0	n.s.
Milk kg (lowest rank)	510	3.1	305	3.2	n.s.
Fat% (lowest rank)	77	4.7	464	4.8	n.s.
Protein% (lowest rank)	62	3.7	452	4.7	p= 0.079
SCC (lowest breeding value, highest phenotype)	47	2.8	308	3.2	n.s.
Persistency (lowest rank)	31	1.9	174	1.8	n.s.

Results of separate analyses within altitude zones

The results obtained within altitude zones are similar to the results of the whole populations in both breeds

Discussion

- The differences between Swiss organic farms and conventional farms in "rank matching" between breeding values and phenotypic performances are rather small

- However, they are much larger for the SF breed than for the BV breed

- This may have to do with the fact that on organic BV farms more "conventional" feeding conditions are maintained, while among organic SF farms there are many who practice full grazing and seasonal calving systems. It is therefore possible that the current breeding values for organic SF animals are less consistent with their phenotypic data than for organic BV animals

- It would be interesting to do the same calculations for functional traits, but the coefficients of determination for female animals are usually too low to be reasonably analysed

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