



## **Genetic analyses of ketosis and a newly developed risk indicator in Fleckvieh, Braunvieh and German Holstein**

*H. Hamann, A. Werner, L. Dale, P. Herold*

**Speaker: Pera Herold**





# Genetic analyses of ketosis and a newly developed risk indicator in Fleckvieh, Braunvieh and German Holstein

H. Hamann<sup>1</sup>, A. Werner<sup>2</sup>, L. Dale<sup>2</sup>, P. Herold<sup>1</sup>

<sup>1</sup> State Office for Geoinformation and Rural Development Baden-Württemberg, Germany

<sup>2</sup> Association for Performance and Quality Testing Baden-Württemberg, Germany

# Outline

1. **Goal and derivation of the KetoMIR index**
2. **Genetic analyses**
3. **Results**
4. **Conclusion**

# Goal and derivation of the KetoMIR index:

- **Modelling of ketosis risk via KetoMIR index**
- **Ketosis reference: Ketosis diagnoses registered in LKV-Baden-Württemberg health monitoring project GMON**
  - **1000 dairy farms**  
**primarily herd management tool**
- **Variables:**
  - **Standardized MIR spectra available from January 2012 (Bentley & Foss, from November 2012 Bentley only) from regular milk analysis**
    - **Indirect usage by via MIR based components (standard milk recording components, fatty acids, minerals, acetone, BHB, citrate)**
  - **Environmental factors (Days in milk, breed, calving number)**



**Grelet et al.**



# Goal and derivation of the KetoMIR index:

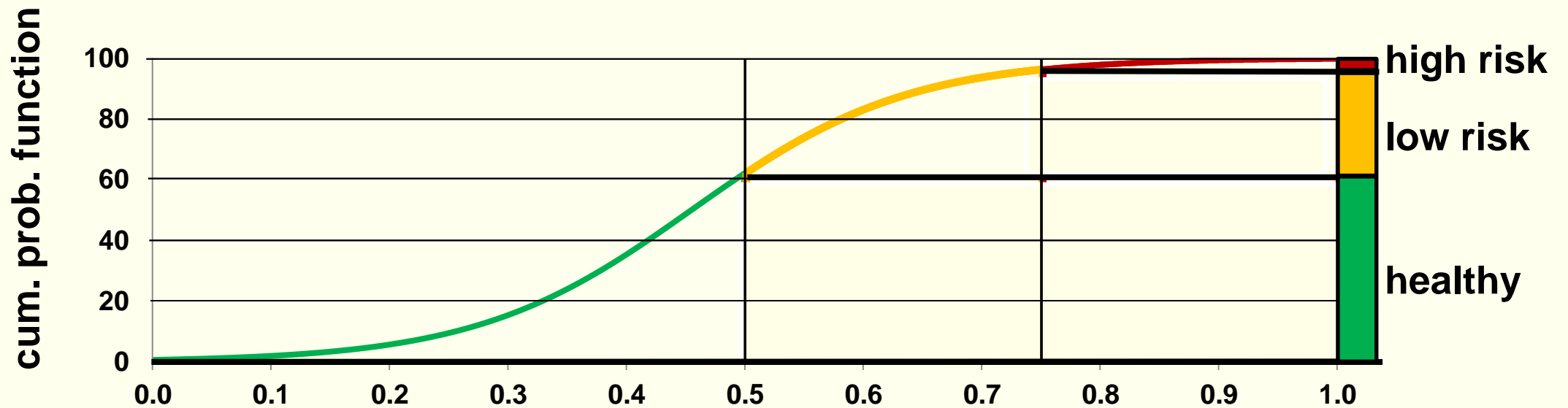
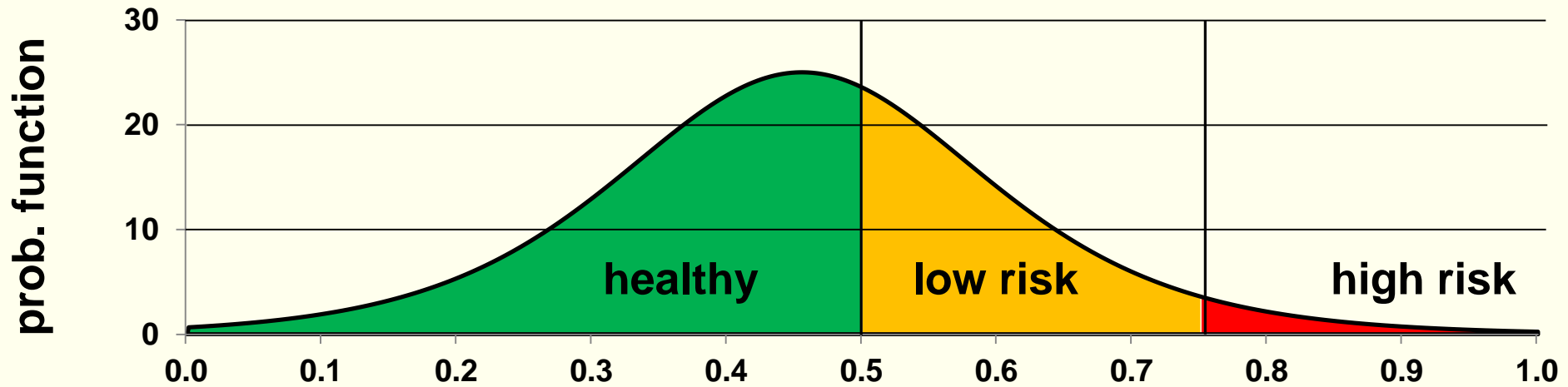
## KetoMIR index:

based on logistic regression  
numeric range between 0 and 1  
partition in three classes

„healthy“:	0.00	-	0.50
„low risk“:	0.50	-	0.75
„high risk“:	0.75	-	1.00

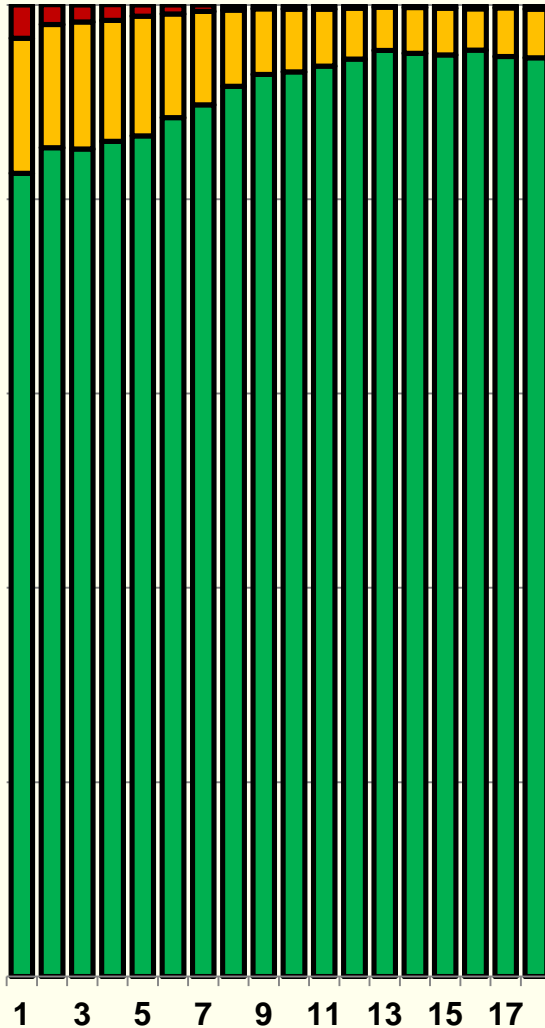
	Calibration set (n=109.479)	Validation set (n=2.966)
Sensitivity:	0.70	0.72
Specificity	0.86	0.84

# Probability functions of the KetoMIR index and derivaton of KetoMIR classes

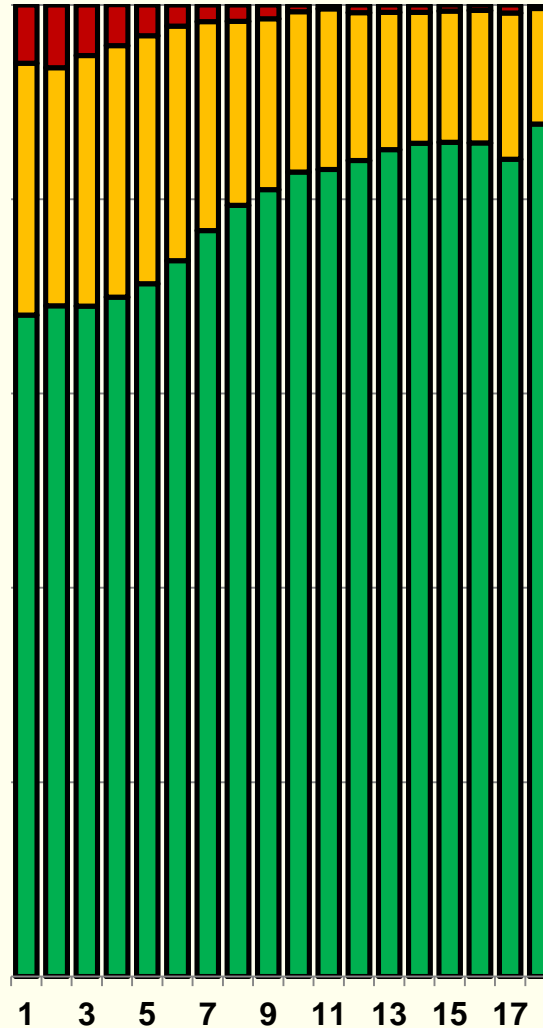


# Distribution of KetoMIR classes for breeds and weeks in milk

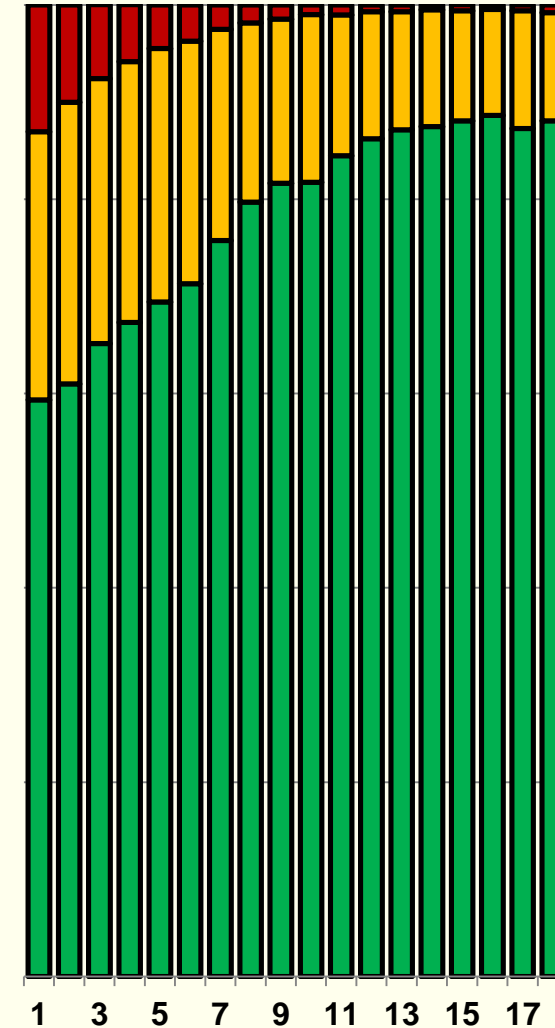
**Fleckvieh (Dual purpose Simmental)**



**Braunvieh (German Brown)**



**Deutsch Holstein (German Holstein)**



- high risk
- low risk
- healthy

**Weeks in milk**

# Genetic analyses:

**Can the KetoMIR index be used as auxiliary trait in breeding programmes?**

- **Is the KetoMIR index (classes) heritable?**
- **How is the KetoMIR index genetically related to ketosis?**
- **(How is the KetoMIR index genetically related to other traits of interest?)**



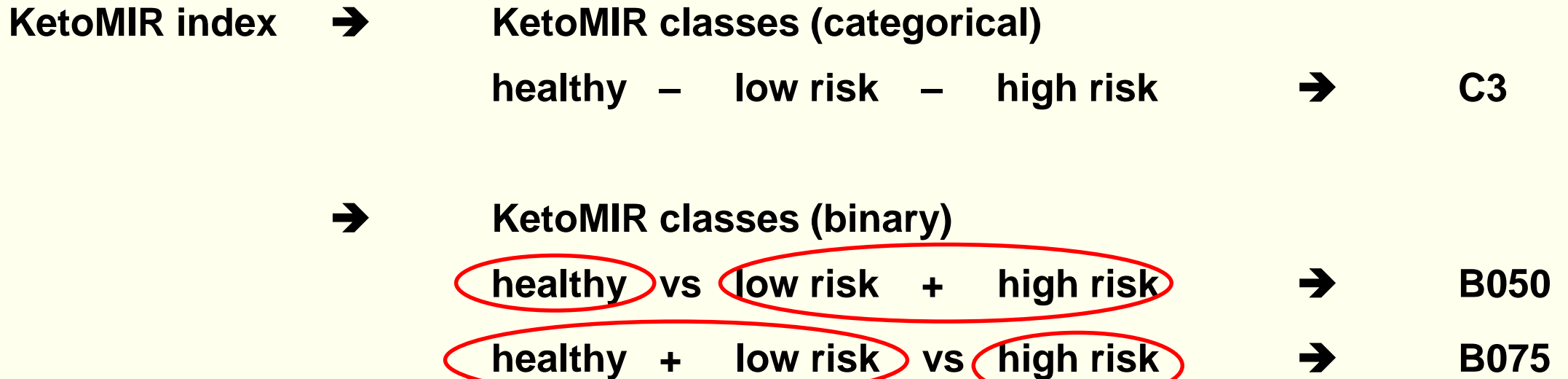
# Genetic analyses:

## Data:

Fleckvieh:	37.846	lactations with information for the first three test day records (analysed separately or as average)
Braunvieh:	15.771	
Deutsch Holstein:	31.425	

## Repeatability model (within breed):

HYS, lactation number, days in milk, permanent environmental effect, animal effect



# Genetic analyses:

Is the KetoMIR index (classes) heritable?

**Heritabilities for the KetoMIR index, categorical and binary classes**

**Fleckvieh (Dual purpose Simmental)**

TD	Index	C3	B050	B075
1	0.22	0.09	0.09	0.02
2	0.22	0.04	0.05	0.01
3	0.30	0.04	0.05	0.01
∅	0.30	0.08	0.08	0.01

**Braunvieh (German Brown)**

TD	Index	C3	B050	B075
1	0.23	0.11	0.09	0.02
2	0.28	0.08	0.09	0.01
3	0.34	0.11	0.11	0.01
∅	0.33	0.11	0.10	0.00

**Deutsch Holstein (German Holstein)**

TD	Index	C3	B050	B075
1	0.24	0.13	0.12	0.04
2	0.28	0.12	0.12	0.02
3	0.39	0.13	0.13	0.01
∅	0.34	0.15	0.14	0.03

# Genetic analyses:

How is the KetoMIR index genetically related to ketosis?

**Genetic correlations between ketosis (clinical) and the KetoMIR index and categorical classes**

TD	Fleckvieh		Braunvieh		Deutsch Holstein	
	Index	C3	Index	C3	Index	C3
1	1.000	1.000	0.749	1.000	0.438	0.522
2	1.000	1.000	0.376	0.368	0.045	0.122
3	1.000	1.000	0.070	-0.194	0.052	-0.065
Ø	1.000	1.000	0.240	0.153	0.319	0.445

# Genetic analyses:



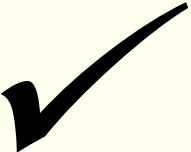
How is the KetoMIR index genetically related to other traits of interest?

## Genetic correlations between KetoMIR index and traits for milk components

	TD	Fleckvieh	Braunvieh	Deutsch Holstein
Fat content	1	0.024	-0.077	0.002
	2	-0.280	-0.416	-0.262
	3	-0.294	-0.460	-0.339
	Ø	-0.194	-0.370	-0.190
Protein content	1	-0.661	-0.765	-0.663
	2	-0.665	-0.709	-0.718
	3	-0.557	-0.613	-0.686
	Ø	-0.630	-0.680	-0.655
Fat-protein-ratio	1	0.468	0.463	0.385
	2	0.152	0.108	0.187
	3	0.055	-0.117	0.053
	Ø	0.239	0.143	0.212

# Genetic analyses:

Can the KetoMIR index be used as auxiliary trait in breeding programmes?

- Is the KetoMIR index (classes) heritable? 
- How is the KetoMIR index genetically related to ketosis? 
- How is the KetoMIR index genetically related to other traits of interest? 

# Conclusion:

**Data collecting as a matter of the routine milk analyses**

**Requirements for breeding value estimation are given**

**Establishment of a breeding value evaluation for the KetoMIR index**

- based on a single test day record**
- based on the average of several test day records**

**Calculation of economic weights**

**Cross validation based on breeding values**



**Thank you for your attention!**

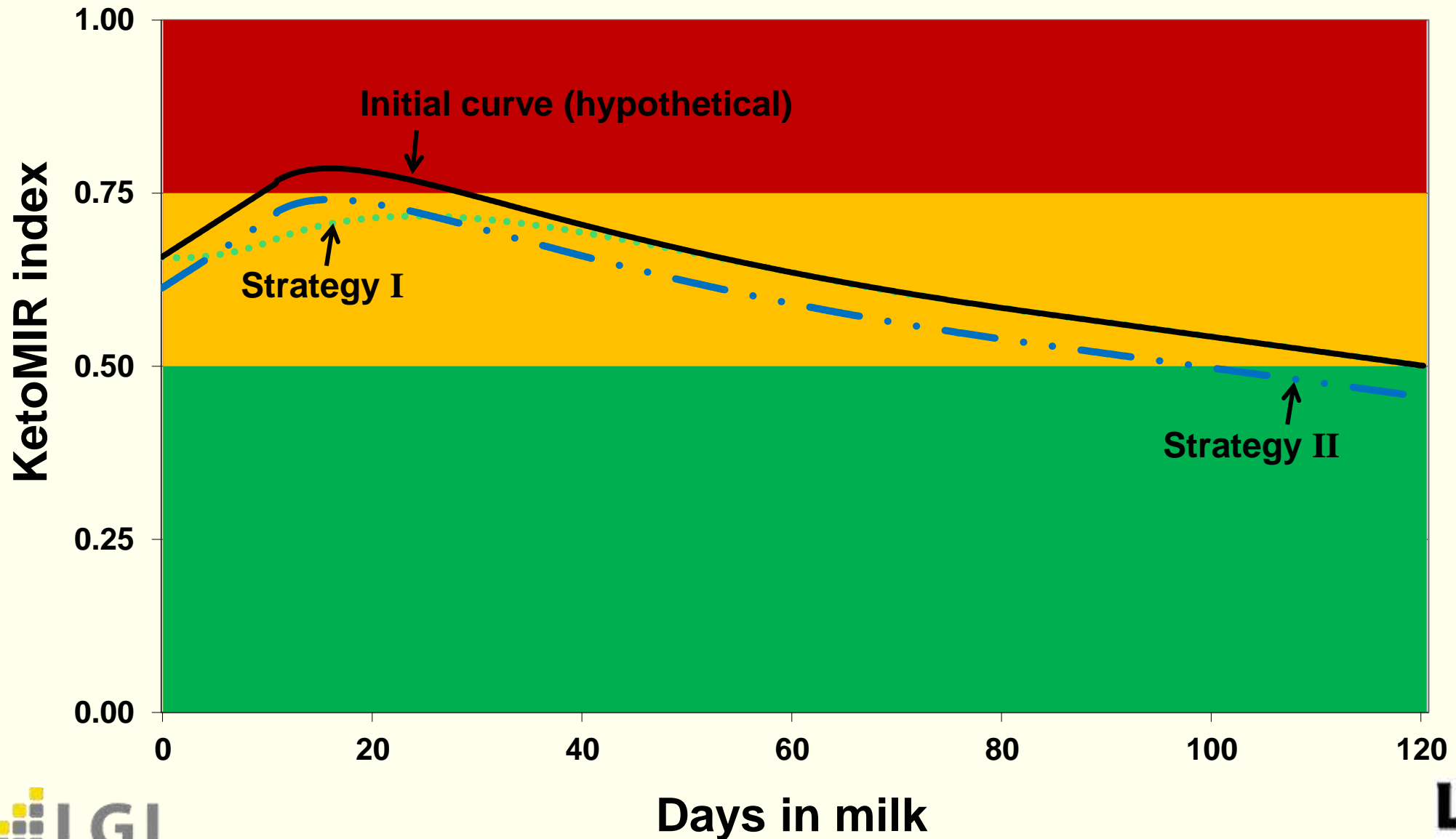
# Breeding strategies:

## Selection against ketosis liability:

- based on a single (first) test day record (strategy I)  
„breaking“ the peaks in the KetoMIR curve
- based on the average of several test day records (strategy II)  
„lowering“ the general level of the KetoMIR curve



# Breeding strategies



# Genetic analyses:

How is the KetoMIR index genetically related to other traits of interest?

## Genetic correlations between KetoMIR index and traits for milk components

	TD	Fleckvieh	Braunvieh	Deutsch Holstein
Milk yield	1	0.414	0.525	0.190
	2	0.251	0.354	0.195
	3	0.160	0.207	0.274
	Ø	0.276	0.394	0.200
SCS	1	0.412	0.386	0.391
	2	0.343	0.307	0.279
	3	0.417	0.402	0.266
	Ø	0.401	0.402	0.307