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Air leakage in LactoCorder milk flow curves – an indicator trait for temperament?

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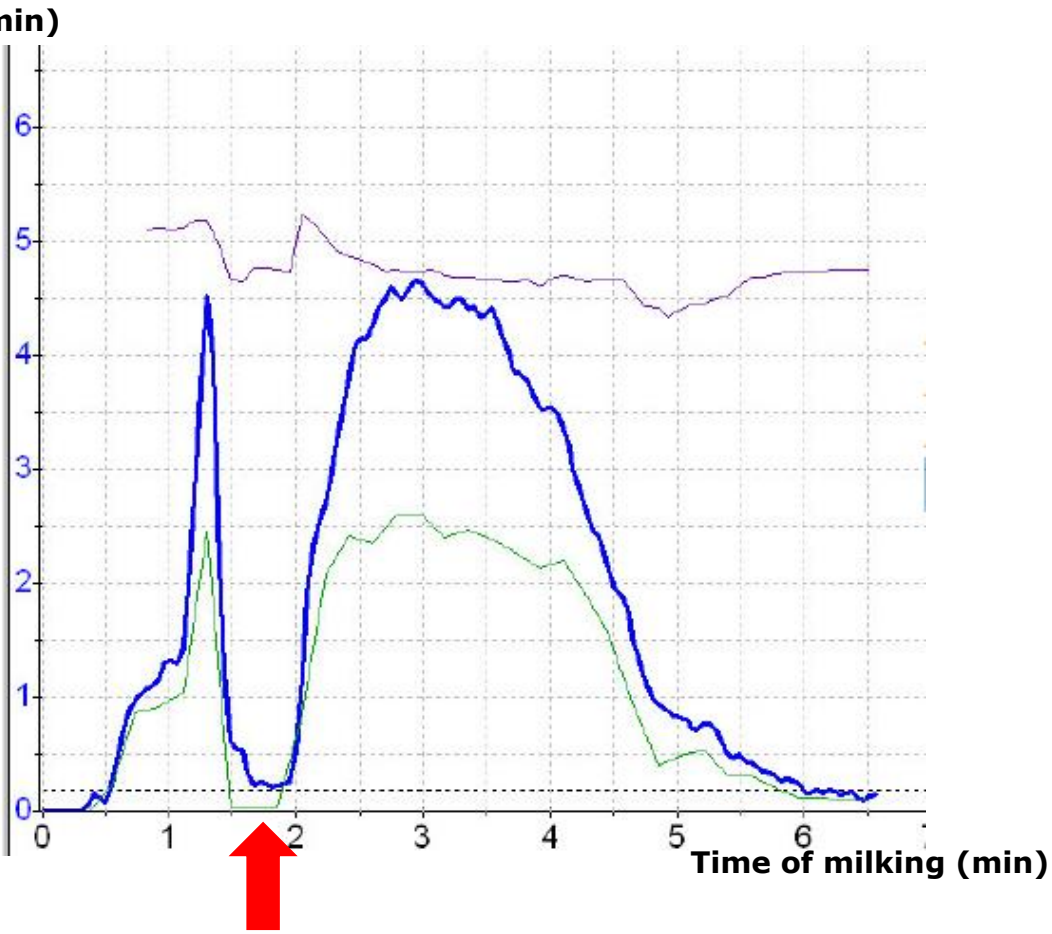
LactoCorder milk flow curve with air leakage

LactoCorder®



Air leakage = abrupt air ingress in the plateau or decline phase

(0/1 = reduction of the milk flow to zero)

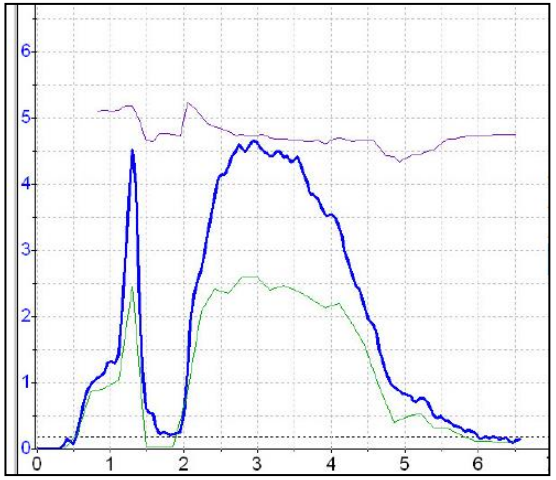
Air leakage: an indicator trait for temperament?

Assumption:

Air leakage is caused by nervous animals knocking off the milking cluster and is of possible use as an indicator trait for temperament

- objective measurement (vs. subjective classification)
- large amount of data available

- induced by incorrect milking routine, technical deficiencies, disturbance in the herd, morphology or the udder,….



Air leakage: an indicator trait for temperament?

Analysis of:

- environmental effects and repeatability
- the relationship with udder traits
- the genetical background

Data Material

Fleckvieh cows with type trait and temperament classification and milk flow curves (1. lactation, classified in Bavaria since 2009)

- **LactoCorder milk flow curves**

- **temperament classification by farmers**

0 = normal	89.8%	
1 = nervous	7.3%	of the classified cows
2 = very nervous	2.9%	

- **udder type traits (linear scoring 1–9 points)**

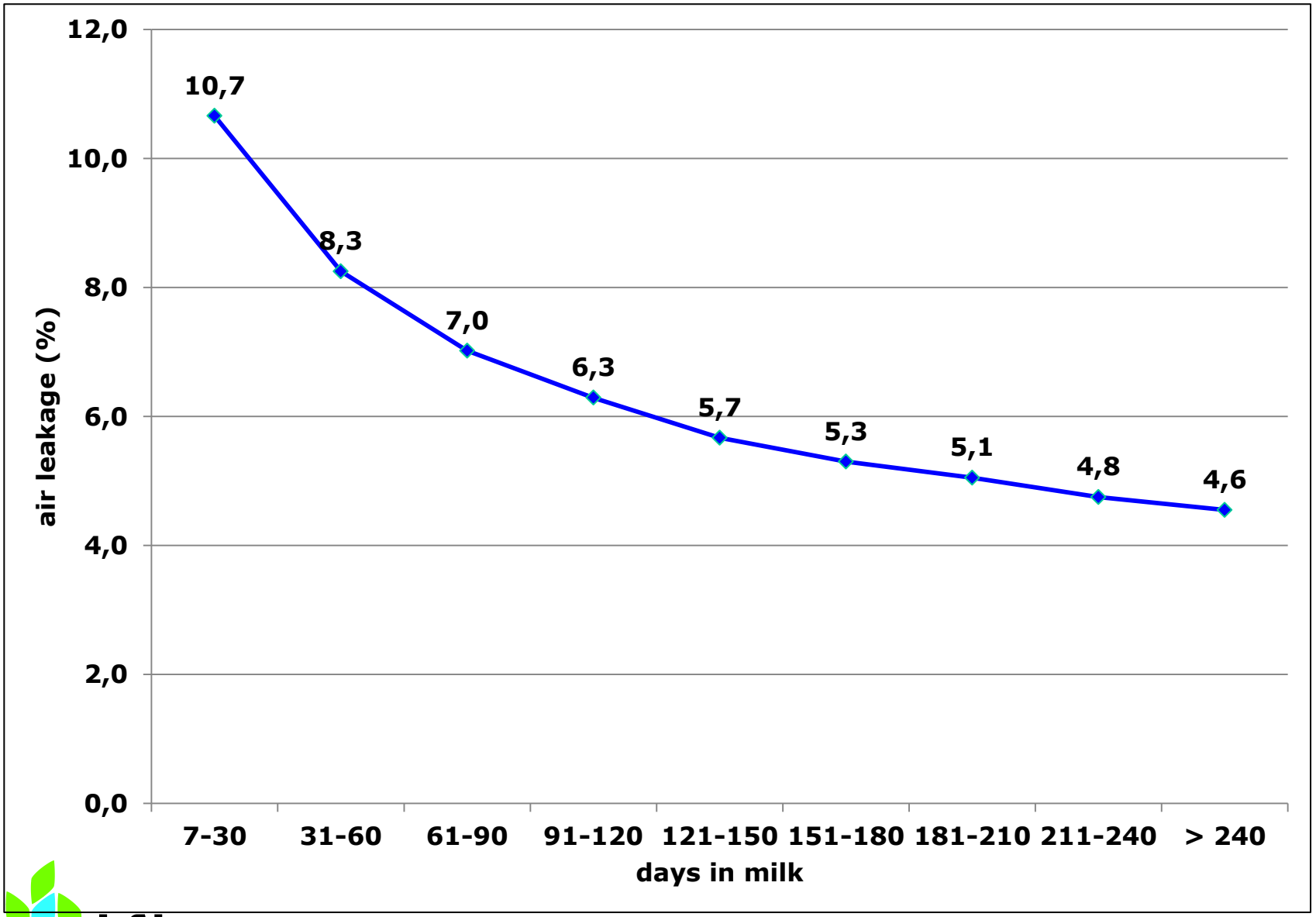
  • fore udder length • rear udder length • udder depth • udder support • teat diameter
  • teat length • fore udder attachement • front teat placement • rear teat placement

  • overall udder score (68-93 points)

Data Material

- Analysis of development of air leakage and repeatability measurements (random samples)
  - 191,170 cows with 2,019,066 first lactation milk flow curves
- analysis of variance for air leakage at first milk recording
  - 85,921 cows from 2,938 herds (at least 20 cows per herd)
- estimation of genetic parameters at first milk recording
  - 41,922 cows from 1,086 herds (at least 30 cows per herd)

Development of air leakage within lactation



Measurements of repeatability from random samples

Trait		Animals	air leakage (%)	Repeatability (%)
1. milk recording				
July	morning/evening	5,050	14.6	**21,6**
December	morning/evening	6,175	8.7	**19,7**

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July	morning/evening	5,050	14.6	**21,6**
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2. milk recording				
July	morning/evening	6,587	11.7	**21,5**
December	morning/evening	8,001	6.6	**20,6**

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July morning/evening	6,587	11.7	**21,5**
December morning/evening	8,001	6.6	**20,6**
1. / 3. milk recording	6,040	10.5 / 6.4	**9,3**
1. / 5. milk recording	9,501	10.6 / 5.3	**5.5**

Measurements of repeatability from random samples

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1. / 3. milk recording	6,040	10.5 / 6.4	**9,3**
1. / 5. milk recording	9,501	10.6 / 5.3	**5.5**
all milk recordings	4,886 66,016 Obs.	6.2	**10.3**

Target variable air leakage at first milk recording

- Preliminary studies showed the highest additive genetic variance in the beginning of the lactation.

Target variable:

Air leakage at first milk recording

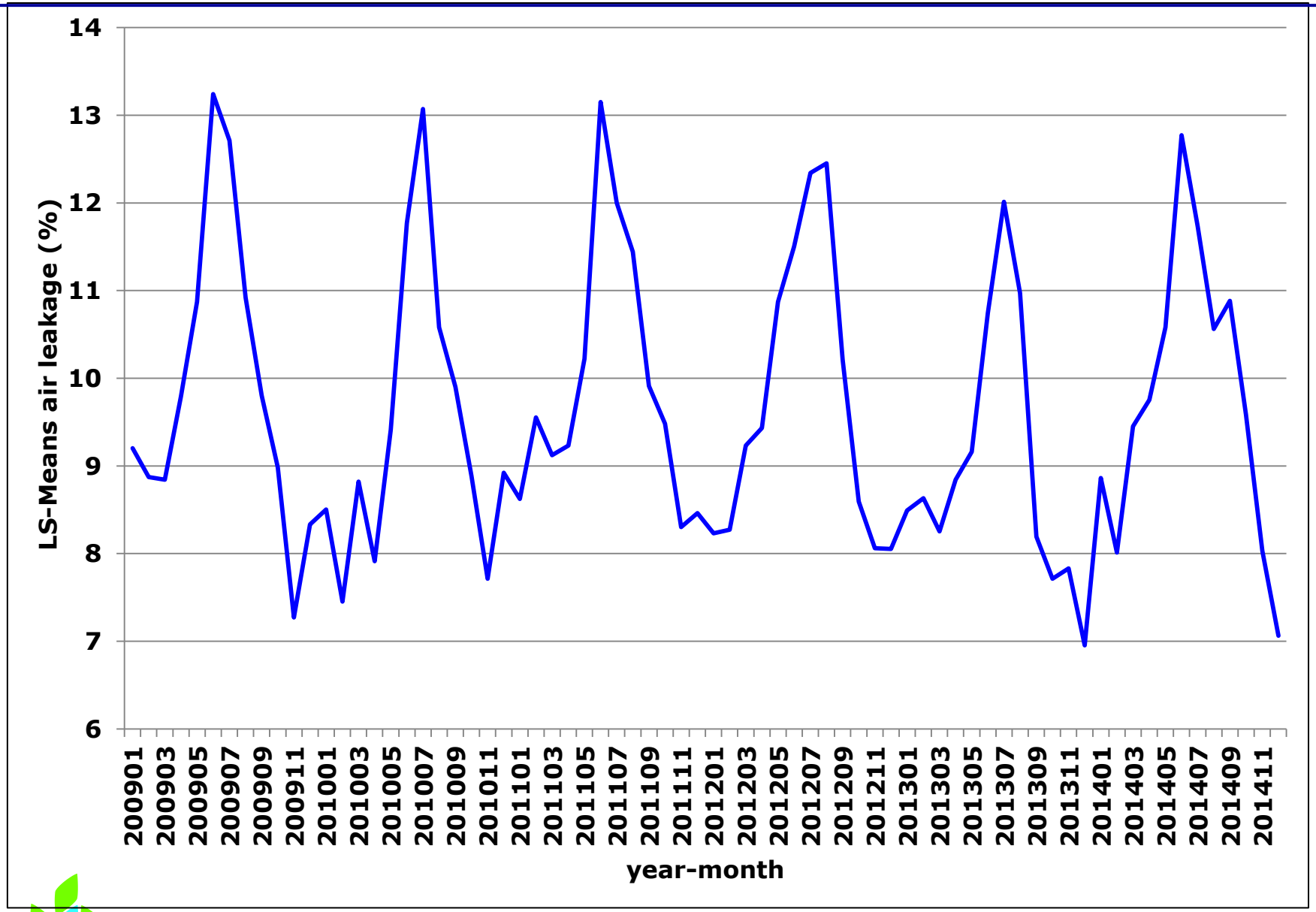
- 64.6 % 7 – 30 days in milk
- 35.4 % 31 – 60 days in milk

- Ø air leakage: 9.4 %

Results of ANOVA

Effect	significance
Distance from calving	P < 0.001
Year-month	P < 0.001
Daytime of milking	P < 0.001
Herd	P < 0.001
Age at first calving	n.s.

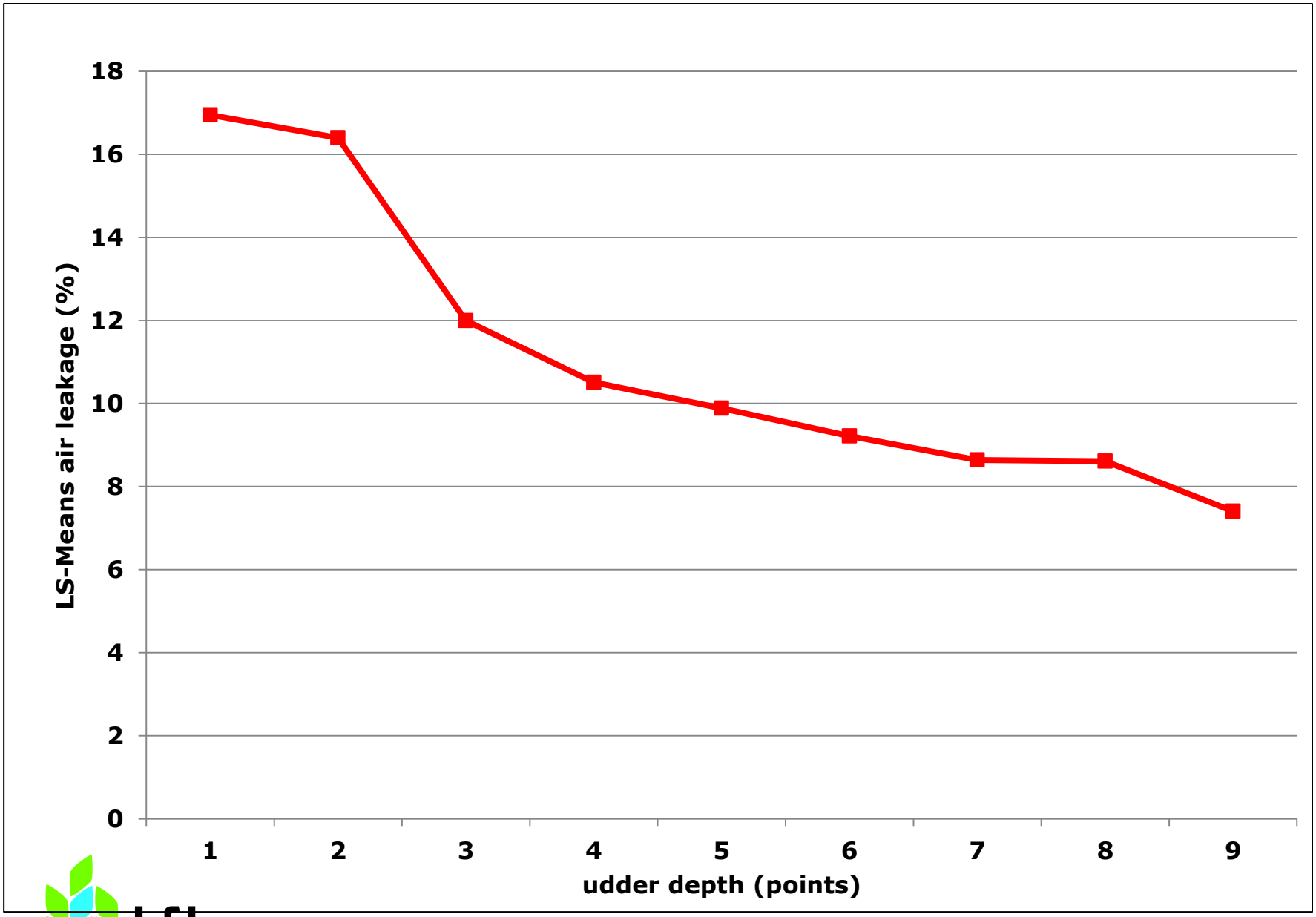
Year-month effect



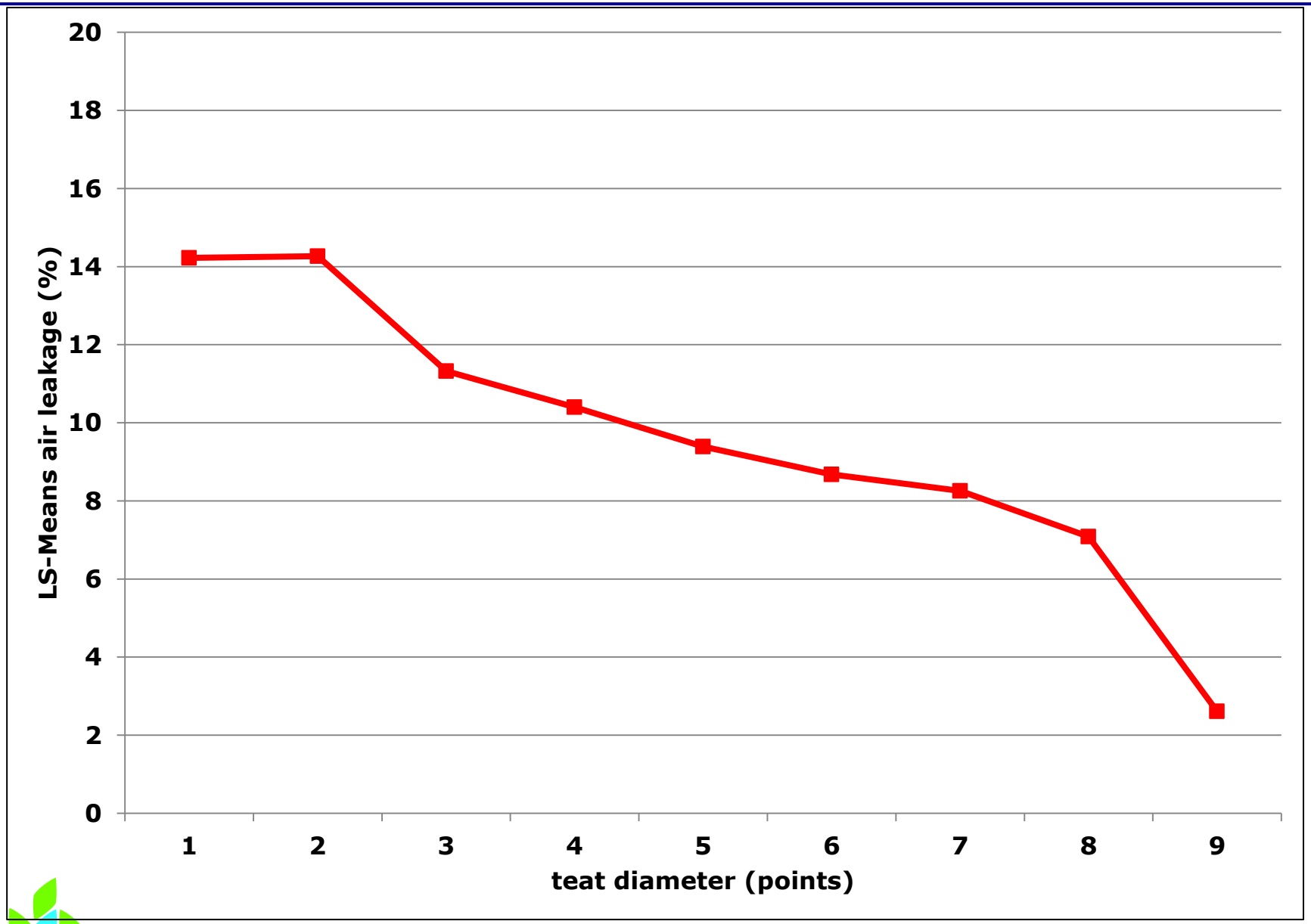
Results of ANOVA

Effect	significance
Distance from calving	P < 0.001
Year-month	P < 0.001
Daytime of milking	P < 0.001
Herd	P < 0.001
Age at first calving	n.s.
Front Teat placement	P < 0.001
Teat diameter	P < 0.001
Udder depth	P < 0.001
Udder support	P < 0.01
rear teat placement	P < 0.01
Teat length	P < 0.01
Fore udder attachement	P < 0.05
Fore udder length	n.s.
Rear udder length	n.s.

Relationship between air leakage and udder depth



Relationship between air leakage and teat diameter



Results of ANOVA

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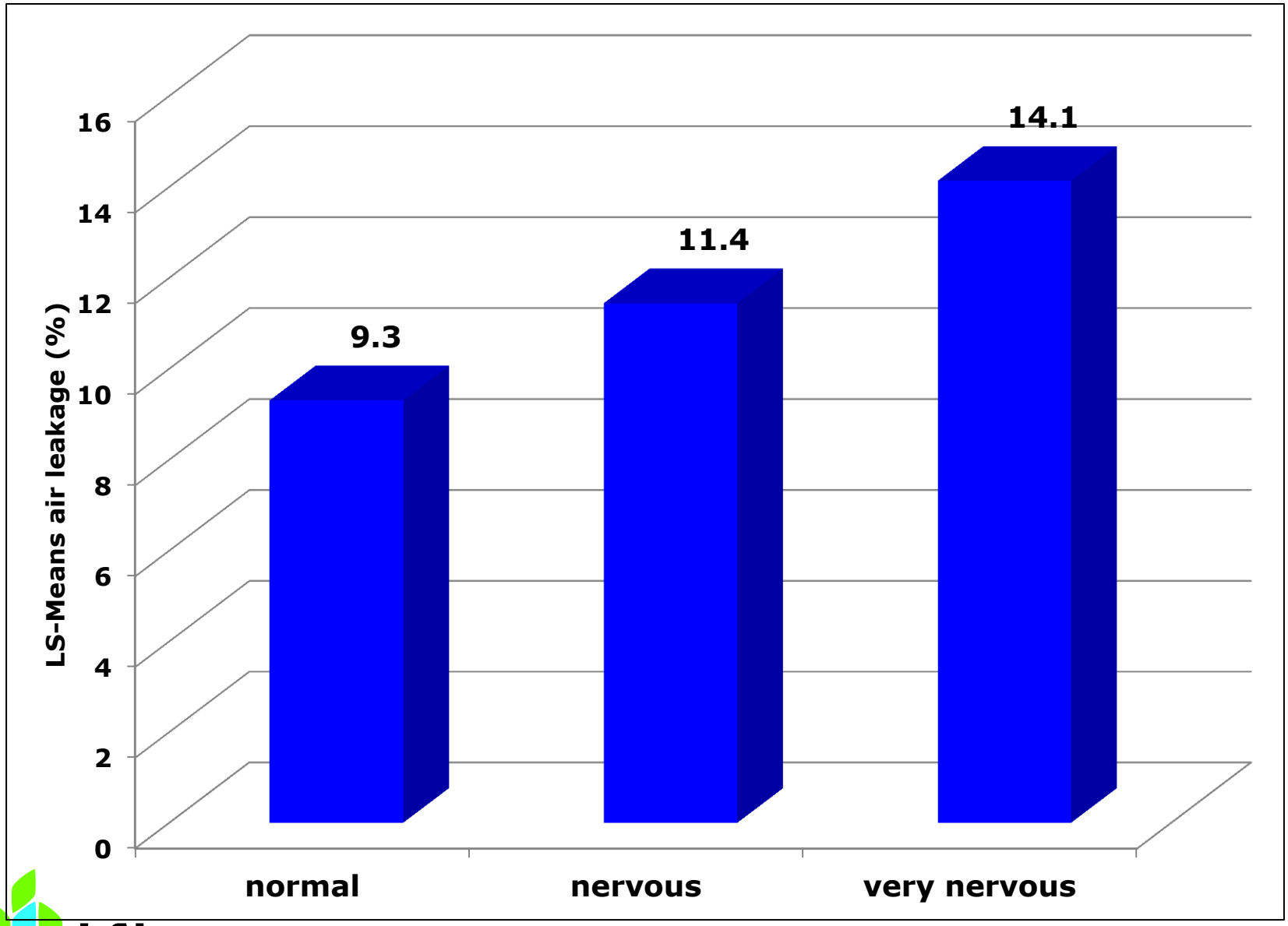
Distance from calving	P < 0.001
Year-month	P < 0.001
Daytime of milking	P < 0.001
Herd	P < 0.001
Age at first calving	n.s.
Front Teat placement	P < 0.001
Teat diameter	P < 0.001
Udder depth	P < 0.001
Udder support	P < 0.01
rear teat placement	P < 0.01
Teat length	P < 0.01
Fore udder attachement	P < 0.05
Fore udder length	n.s.
Rear udder length	n.s.
Temperament	P < 0.001

Relationship between air leakage and temperament classification



Estimation of genetic parameters

- **Effects in the model**

  Distance from calving (1,2)
  Year-month (1, … 84)
  Daytime of milking (1,… 10)
  Herd (1,… 1,086)
  Age at first calving

- **Estimations were done with DMU**

Heritability estimation

- **Air leakage linear model:** **0.0187** ± 0.0049

- **Air leakage threshold model:** **0.0715** ± 0.0511

⇨ heritability on the underlying normal distribution scale:

$h^2_{obs} = h^2_{lia} z^2 = (p / (1 - p))$ **0.0236** ± 0.0169

- temperament classification: **0.0533** ± 0.0081

Estimation of genetic correlations with air leakage

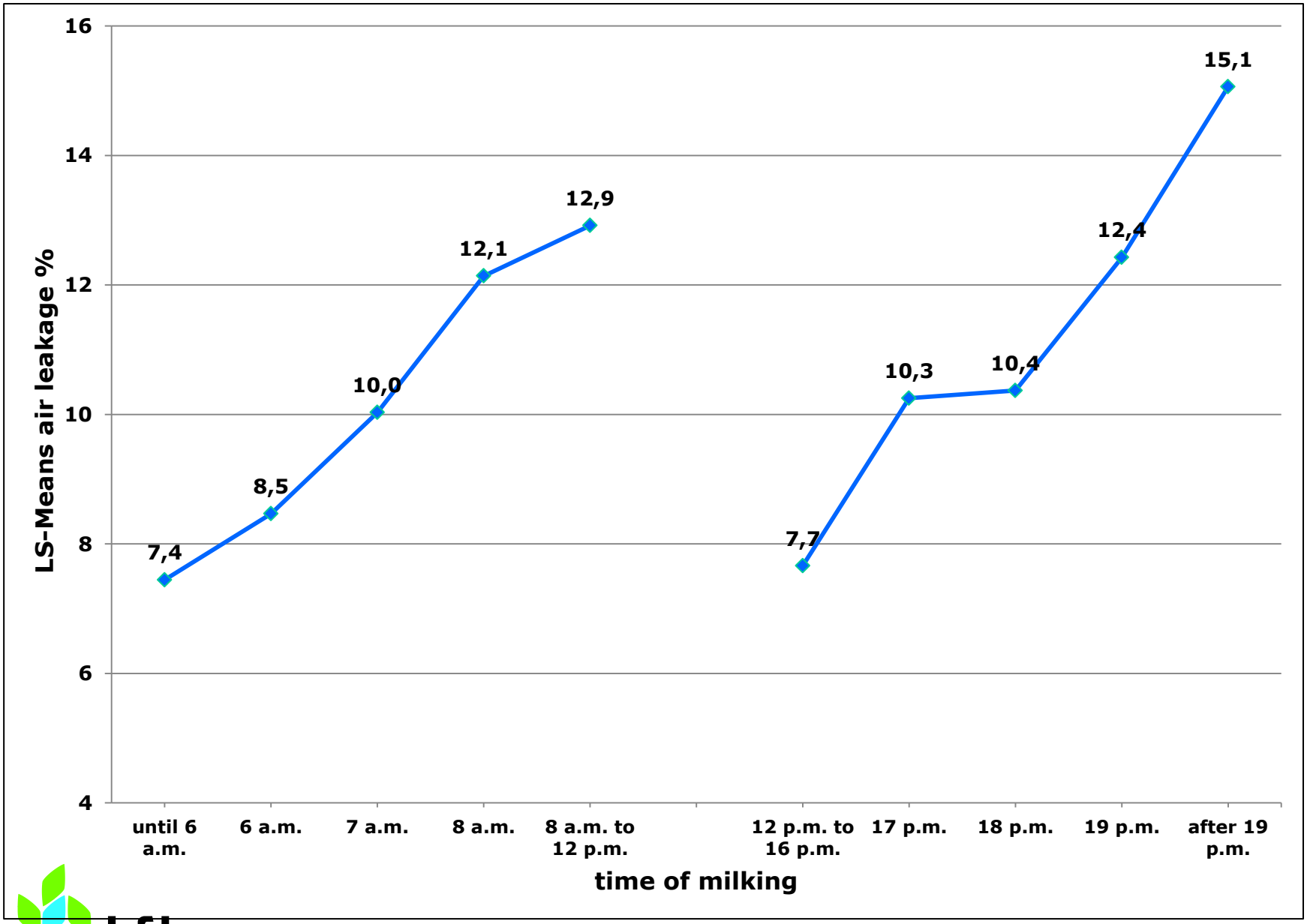
Trait	r_g	SE
Temperament classification	**0.436**	0.137
Overall udder	**-0.324**	0.085
Front Teat placement	**-0.306**	0.081
Teat diameter	**-0.293**	0.080
Udder depth	**-0.273**	0.090
Udder support	**-0.092**	0.105
rear teat placement	**-0.070**	0.079
Teat length	**-0.056**	0.091
Fore udder attachement	**-0.187**	0.103
Fore udder length	**0.043**	0.102
Rear udder length	**0.223**	0.083
Milkability	**-0.221**	0.078
Milk yield	**0.123**	0.106

Summary and Conclusions

- Air leakage has a low repeatability
- Air leakage is influenced by different environmental effects
- Influence of udder conformation on air leakage => discern effects of behaviour and morphology
- Low heritability estimates
- Intermediate genetic correlation with temperament classification

⇨ **Mutivariate breeding value estimation using air leakage may be an option to improve BVE for temperament**

Effect of daytime of milking



Development of phenotypic and genetic variance within lactation