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# Analysis of factors influencing lifetime performance, lifetime effectivity and length of productive life of dairy goats

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# Introduction



## Aims:

- 1.) Investigation of effects on:
    - milk production traits
    - lifetime performance/ lifetime effectivity
    - length of productive life
  - 2.) Genetic analysis of influencing factors
- Development of a breeding value or an index for lifetime performance/ lifetime effectivity

# Introduction



<b>Lifetime performance:</b> Milk yield within life (first day in milk - last record)	<b>Lifetime effectivity:</b> Milk yield per day of life (birth - last record)	↓ with consideration of the rearing and dry phase
<b>Length of productive life:</b> Number of days in milk (first day in milk - last record)	<b>Effectivity of length of productive life:</b> Milk yield per day of use (first day in milk - last record)	↓ without consideration of the rearing and with dry phase
<b>Milk yield per day in milk:</b> (first day in milk - last record)		↓ without consideration of the rearing and dry phase

(Eilers: 2014, Wangler et al.: 2009)

# Introduction



## Extended milking:

Dairy goats are milked without kidding for up to two years.

(Moog et al. 2012)

## Altered lactation structure Example:

France	(Institute de l'Élevage: 2013)
Netherlands	(Govaerts und van Eekeren: 2011)
Austria	(Braunreiter: 2012)
Great Britain	(Mucha et al.: 2014)



## Challenge



## Prolonged lactations

Dairy goats, their lactations and production traits are not comparable



**Analysis of prolonged lactations in Bavaria and lactations  
with up to 720 milking days**

(Wolber et al. 2018)



## Milk recording data and pedigree data:

- Investigation period: 1988 - 2016
- Number of farms: 262
- Tested animals: 9 190 (7 726 German Fawn, 1 464 German White)

→ variance analysis and estimation of variance components

# Animals, Material and Methods



## Analysis of the data

### Model description variance analysis with SAS, 9.4: PROC MIXED

$$Y_{ijklmnopqrs} = \mu + BR_i + BY_j + FK_k + BT_l + PS_m + UC_n + FC_o + PC_p + EM_q + fat_r + far_s + e_{ijklmnopqrs}$$

$Y_{ijklmnopqrs}$  = Observation value

$\mu$  = Model constant

#### Fixed effects

$BR_i$  = Breed

$BY_j$  = Birth year

$FK_k$  = Class of the first kidding

#### Random effects

$fat_r$  = Father

$far_s$  = Farm

#### Fixed effects - averages within life

$BT_l$  = Birth type

$PS_m$  = Persistence, 2: 1

$UC_n$  = Urea content

$FC_o$  = Fat content

$PC_p$  = Protein content

$EM_q$  = Extended milking part within milking days

$e_{ijklmnopqs}$  = Residual error

# Results

## Performance results within the life and length of productive life

Groups		n Goats	Mkg/ day in milk		Length of productive life		performance increase (1:2)	
			LSM	SE	LSM	SE	LSM	SE
Age at first kidding	≤ 620 days	6 577	<b>3.00<sup>a</sup></b>	0.07	<b>1 029.07<sup>a</sup></b>	52.70	<b>1.11<sup>b</sup></b>	0.06
	> 620 days	2 613	<b>3.04<sup>b</sup></b>	0.07	<b>987.51<sup>b</sup></b>	52.89	<b>1.01<sup>a</sup></b>	0.06
Average from days in milk (lactations where extended milking)	0 %	5 586	<b>2.97<sup>a</sup></b>	0.07	<b>603.43<sup>a</sup></b>	51.99	<b>1.03<sup>a</sup></b>	0.06
	> 0 % - ≤ 50 %	1 322	<b>3.12<sup>c</sup></b>	0.07	<b>1 349.99<sup>d</sup></b>	54.75	<b>1.05<sup>ab</sup></b>	0.06
	> 50 % - < 100 %	1 496	<b>3.03<sup>b</sup></b>	0.07	<b>1 229.13<sup>c</sup></b>	54.66	<b>1.06<sup>bc</sup></b>	0.06
	100 %	786	<b>2.95<sup>a</sup></b>	0.07	<b>850.61<sup>b</sup></b>	55.87	<b>1.10<sup>c</sup></b>	0.06
n Goats			9 190				4 017	



# Animals, Material and Methods



## Analysis of the data

### Model description estimation of variance components with VCE 6.0.

$$Y_{ijklmno} = \mu + BR_i + FK_j + EM\_1_k + b + EM\_l_m + hby_n + a_o + e_{ijklmno}$$

$Y_{ijklmno}$  = Observation value

$\mu$  = Model constant

### Fixed effects

$BR_i$  = Breed

$FK_j$  = Class of the first kidding

$EM\_1_k$  = Fixed factor of extended milking in first lactation

$b_l$  = Linear regression coefficient

$EM\_l_m$  = Covariable: Days in milk within extended milking lactations (life)

### Random effects

$hby_n$  = Herd-birth year

$a_o$  = Permanent environmental effect of the animal

$e_{ijklmno}$  = Random Residual error

## Results

Length of productive life and effectivity / lifetime performance/  
lifetime effectivity/ Effectivity per day in milk (nGoats = 9 190)

	LPL	Mkg- LE	Mkg- LPE	Mkg- YD	Mkg- LTP
LPL	<b>0.16</b> (0.02)	0.71 (0.05)	-0.07 (0.08)	0.32 (0.06)	<b>0.90</b> (0.02)
Mkg-LE	0.51 (0.03)	<b>0.13</b> (0.01)	0.49 (0.06)	0.76 (0.04)	0.91 (0.02)
Mkg-LPE	<b>-0.18</b> (0.02)	0.48 (0.03)	<b>0.18</b> (0.02)	0.85 (0.03)	0.23 (0.06)
Mkg-YD	0.12 (0.02)	0.61 (0.02)	0.79 (0.03)	<b>0.16</b> (0.02)	0.56 (0.05)
Mkg-LTP	<b>0.85</b> (0.04)	0.80 (0.03)	0.23 (0.02)	0.42 (0.02)	<b>0.15</b> (0.01)

Mkg = Milk yield in kg

LPL = Length of productive life

LE = Lifetime effectivity

LPE = Effectivity of length of productive life

YD = Yield per day in milk

LTP = Lifetime performance

Additiv-genetic correlations ( $r_g$ , above diagonal) and phenotypic correlations ( $r_p$ , below diagonal) between production traits, heritabilities (highlighted in blue) and the estimation errors (SE) in brackets

# Conclusion and outlook



**Impact is significantly positive on:**

**Milk yield per day in milk and length of productive life**

→ Days in milk from extended milking lactations less than 50%

→ First kidding less than 620 days has a positive effect on the length of productive life and of the performance increase (1:2)

# Conclusion and outlook



**If the milk yield falls below a relevant level,  
a high lifetime performance is not an option!**

## **Breeding for optimal traits:**

- From an economic and ecological point:
  - balanced milk yield per day and milk ingredients
  - length of productive life and a high lifetime performance
- Development of a breeding value or index
  - weighting of production and functional traits

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H E R L C  
 E R L O  
**DAIRY GOATS IN ORGANIC FARMING**  
 L B N S  
 T U G POWER  
 H S E E Q  
 Y T V C U  
 I O E  
 S U S T A I N A B I L I T Y N  
 Y O C  
 M B R E E D  
 I  
 C  
 S



**THANKS.**

QUESTIONS?  
 REMARKS?

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