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# ON-FARM RECORDING OF NOVEL TRAITS – GENETIC PARAMETERS AND RECOMMENDATIONS

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# Overview

- On-farm data recording in project “Efficient Cow“
- Results on body weight (BW), body condition score (BCS) and lameness score (LSC)
- Results on claw health
- Results on metabolism
- Results on feed efficiency traits collected on-farm
- Lessons learned from on-farm-recording of novel traits

# Efficient cow project ( 2012-2016)

- Elaboration of **efficiency parameters**
- Evaluation of the **optimal body weight** to achieve the highest nutrient and energy efficiency
- Analyses of **genetic possibilities** to **improve** production efficiency
- Relationship between **efficiency** and **functional** traits
- Analyses of **environmental impact** of cattle production under Austrian conditions

# Approach – field data for novel traits

- **Preselection of farms** with higher degree of phenotype recording (AMS, health recording,..)
- **Distribution** of farms across different **production conditions** and levels of intensity in Austria
- Extended data recording on-farm on **170 farms in Austria** with app. 5,500 cows for one year (1.1.2014 – 31.12.2014)
  - 3,200 Fleckvieh (Simmental)
  - 1,200 Brown Swiss
  - 1,100 Holstein
- Comparison with data of limited number of cows from **research stations**

# Data recorded

- General information about farm (housing, feeding, ...)
- Recording of direct health data (veterinarian diagnoses)
- Documentation of claw trimming
- BHB (ß-hydroxybutyrate) test for ketosis
- Linear scoring of all cows across lactations
- At each time of milk recording in 2014
  - Body weight, body measures, body condition score, lameness scoring
  - diet and estimation of feed intake
  - Routine information about milk recording + MIR-spectra
- Austrian main breeds
  - Fleckvieh / Simmental (FL), Brown Swiss (BS), Holstein (HF)

# Observed data – Fleckvieh / Simmental

| | COWS | N | LACT 1 | LACT 2 | LACT ≥3 |
|---|---|---|---|---|---|
| WEIGHT | 3984 | 29,763 | 685 (±79) | 734 (±83) | 776 (±84) |
| WAIST | 3981 | 30,031 | 251 (±14) | 259 (±14) | 265 (±13) |
| CHEST | 3982 | 30,039 | 208 (±10) | 212 (±10) | 217 (±10) |
| MUSC 1-9 | 3977 | 29,866 | 5.58 (±1.21) | 5.72 (±1.33) | 5.89 (±1.4) |
| BCS 1-5 | 3981 | 30,044 | 3.32 (±0.52) | 3.33 (±0.55) | 3.37 (±0.62) |
| LAME 1-5 | 3981 | 29,768 | 1.13 (±0.43) | 1.2 (±0.52) | 1.42 (±0.77) |

# Body weight

- In Austria standard housing systems for dairy cows are without equipment for weighing routinely.

- During the observation period of the project “Efficient Cow”, all cows were weighed at each time of milk recording.

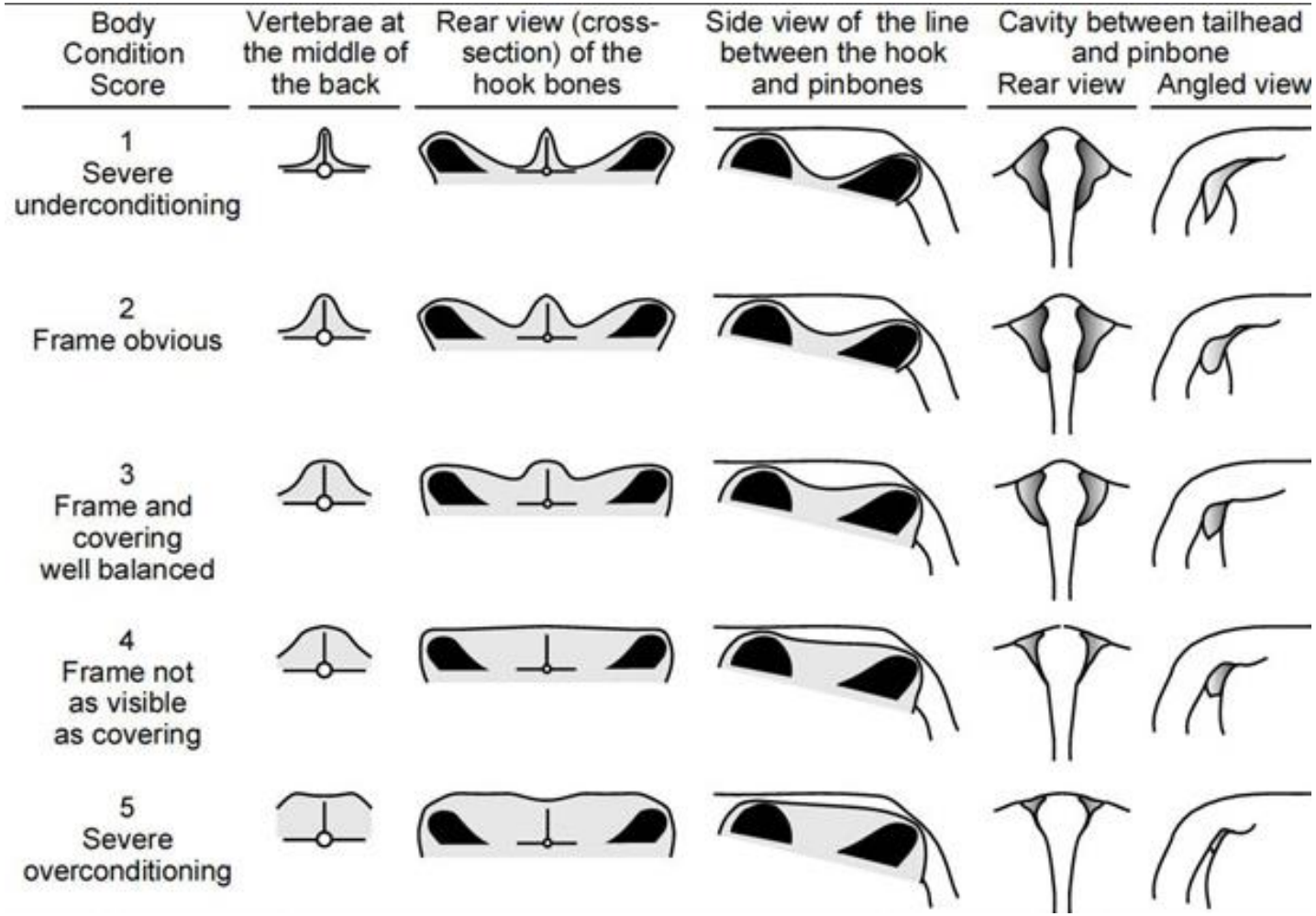
# Lameness score (Sprecher et al. 1997)

| | | |
|---|---|---|
| 1 | Normal | Stands and walks normally with flat back. Long confident strides. |
| 2 | Mildly Lame | Stands with flat back, arches when walks. Slightly abnormal gait. |
| 3 | Moderately Lame | Stands and walks with arched back. Short strides. |
| 4 | Lame | Arched back standing and walking. Favors certain legs. |
| 5 | Severely Lame | Constant arched back. Great difficulty moving. |

**Efficient Cow**: Lameness was recorded by trained staff from the milk recording organisations at each milk recording using the scoring system (Sprecher et al. 1997) with 1 = normal to 5 = severely lame.

# Body condition score (BCS)

(Edmonson et al. 1989)




Recorded at each milk recording by trained stuff.

BCS 1= severe underconditioning; BCS 5 = severe overconditioniong

# Test for subclinical ketosis

Cows within “Efficient Cow” tested at day 7 and day 14 after calving with ß-hydroxybutyrate (**BHB** µmol/l) milk test


- % of ketosis suspecious cows (>=100µmol/l) → 44 % !!
- % of ketosis suspecious cows (>=200µmol/l) → 14 % !!

# Feeding information and feed efficiency

- Recorded on animal basis at each milk recording (Ledinek et al. 2016)
- Feed intake estimated using the model of Gruber et al. (2004)
- Dairy cow rations and forage analyses were included
- Dry matter intake (**DMI**) and energy intake (**INEL**) was calculated for each day of milk recording for each cow
- Feed efficiency was calculated as:
  - **ECM_BWx**: energy corrected milk related to metabolic body weight
  - **ECM_DMI:** ECM related to feed intake
  - **LE_INEL:** lactation energy related to energy intake

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# Heritabilities and genetic correlations (Koeck et al. 2016) – Fleckvieh (Simmental)

| | Body weight | BCS | Lameness |
|---|---|---|---|
| **Body weight** | **0.44 (0.05)** | 0.39 (0.08) | 0.57 (0.13) |
| **BCS** | | **0.22 (0.03)** | 0.05 (0.15) |
| **Lameness** | | | **0.07 (0.02)** |

Heavier cows have an increased risk of lameness

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# Traits available for claw health

- Veterinarian diagnoses from routine health monitoring
- Claw trimming data
- Lameness scores (Sprecher et al. 1997) at each milk recording by trained stuff
  - LSC - overall lactation lameness score was calculated per cow and lactation taking the frequency of different severity cases into account. The score ranges between 0 and 4 (Burgstaller et al. 2016).
- Culling information

# Heritabilities and genetic correlations
(Fleckvieh Simmental)

| Trait | No Obs. | Mean | $h^2$ (se) | Comment |
|---|---|---|---|---|
| **Claw diagnoses (0/1)** | 6,427 | 0.016 | **0.025** (0.021) | 0.568 genetic correlation to LSC; 0.827 to claw trimming; 0,99 to culling |
| **LSC (0-4)** | 2,963 | 0.994 | **0.095** (0.092) | |
| **Claw trimming (0/1)** | 2,451 | 0.51 | **0.042** (0.013) | |
| **Culling (0/1)** | 9,666 | 0.005 | 0.007(0.006) | |

# Summary – novel traits claw health

- Lameness scores can be used as auxiliary traits for genetic improvement of claw health (depending on model and trait definition – heritability between 0.07 and 0.095
- Heritability based on claw trimming data lower than in most other studies (0.042) (reason could be that data were recorded from trained claw trimmers and farmers in this study)
- Heritabilities of veterinarian diagnoses low (0.025), but available on a wide range of animals in Austria; but it covers only severe cases)

**Different data sources related to claw health can be used**

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# Metabolic disorders

- ***Body condition score (BCS)***
  - Together with body weight
  - by trained technicians at each milk recording.
- ***Metabolic disorders***

  An issue of growing concern
  - veterinarian diagnoses
  - indicator traits for subclinical ketosis cases:
    - **Milk test** (Elanco) at day 7 and 14 after calving (determination of ß-hydroxybutyrate (**BHB**) concentrations).
    - **Body condition and fat-protein-ratio:**
      - **BCS1 and F:P1**
        BCS and fat-protein-ratio at the first recording after calving and
      - **BCS1DIFF**
        difference in BCS between the first and second recording after calving

# Heritabilities and genetic correlations

| Trait | No Obs. | Mean | $h^2$ (se) | Comment |
|---|---|---|---|---|
| **Metobolism vet. diagnoses (-100d) (0/1)** | 5670 | 0.048 | **0.028** (0.013) | 0.59 genetic correlation to ketotest; -0.55 genetic correlation BCS1; 0,56 genetic correlation to BCS1Diff |
| **Ketotest/Subcl. ketosis (0-2)** | 1,805 | 0.56 | **0.064** (0.026) | |
| **BCS1** | 2,491 | 3.331 | **0.161** (0.040) | |
| **BCS1DIFF** | 2,169 | -0.147 | **0.042** (0.026) | |
| **F:P1** | 7,187 | 1.281 | **0.138** (0.026) | |

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# Heritabilities and genetic correlations

| | ECM | BW | DMI | INEL | ECM_BWx | ECM_DMI | LE_INEL |
|---|---|---|---|---|---|---|---|
| **ECM** | **0.13** | -0.22 (0.10) | 0.66 (0.06) | 0.72 (0.06) | 0.88 (0.02) | 0.89 (0.02) | 0.89 (0.03) |
| **BW** | | **0.43** | 0.50 (0.07) | 0.40 (0.08) | -0.66 (0.06) | -0.57 (0.08) | -0.56 (0.08) |
| **DMI** | | | **0.18** | 0.99 (0.01) | 0.27 (0.10) | 0.24 (0.10) | 0.23 (0.11) |
| **INEL** | | | | **0.13** | 0.37 (0.10) | 0.33 (0.10) | 0.32 (0.11) |
| **ECM_BWx** | | | | | **0.18** | 0.97 (0.01) | 0.96 (0.01) |
| **ECM_DMI** | | | | | | **0.13** | 0.99 (0.01) |
| **LE_INEL** | | | | | | | **0.11** |

# Conclusions for practical implementation

- Data recording from about 5,300 cows under on-farm-conditions was a big challenge
- Recording of body weight was easier to handle than taking different body measures
- Body condition score and lameness score are interesting management tools but also usable for genetic evaluation
- Genetic correlation between ECM, DMI and BW from on-farm-data comparable to results from station-data
- Practical use of diet information would need also reliable information (especially on concentrates) and detailed information on mobilization
- Body weight has high impact on feed efficiency

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# Thank you!