DIFFERENCES IN GRAZING PREFERENCES, BEHAVIOUR AND PRODUCTION EFFICIENCY BETWEEN TWO CATTLE BREEDS

Nina H. Sæther
Differences in grazing preferences, behaviour and production efficiency between two cattle breeds

BLACKSIDED TRØNDER AND NORDLAND CATTLE
SIDET TRØNDERFE OG NORDLANDSFE
(STN)
Differences in grazing preferences, behaviour and production efficiency between two cattle breeds

NORWEGIAN RED
NORSK RØDT FE
(NRF)
LIST OF PAPERS

- **Paper I**
  

- **Paper II**
  

- **Paper III**
  

- **Paper IV**
  
  *Differences in energy balance and energy efficiency between an old endangered and a modern Norwegian dairy cattle breed in a traditional indoor feeding system.* Sæther, N.H., Havrevoll, Ø., Thuen, E. & Vangen, O. Accepted for publication in Acta Agriculturae Scand Section A.
OUTLINE

- Overall motivation
- Presentation of the two studied breeds
- Objectives
  - Why do farmers choose the old and endangered STN breed? (Paper I)

Differences between STN and NRF in
- production efficiency (Paper IV)
- grazing behaviour (Paper II)
- grazing preferences (Paper III)
MOTIVATION FOR THE STUDY

- A broad historical outline of Norwegian animal breeding
  - 1960s: seven native dairy breeds merged to one, NRF
  - 1970s: the six abandoned breeds almost forgotten
    NRF’s breeding programme intensifies
  - 1980s: a growing interest for the abandoned breeds
    • Official authorities
    • Farmers

- Why were the farmers interested in the abandoned breeds?
  - unique traits?
  - historical reasons?
Differences in grazing preferences, behaviour and production efficiency between two cattle breeds

SIX ABANDONED DAIRY BREEDS – WHY WAS STN CHOSEN?

- STN had
  - the biggest population
  - a breeding association

Best conditions for good data and test animals
NUMBER OF FIRST INSEMINATIONS WITH STN 1975-2008

First AI with STN

Year


1642  508  3602  0  500  1000  1500  2000  2500  3000  3500  4000

1997
### THE TWO STUDIED BREEDS

<table>
<thead>
<tr>
<th>Breed</th>
<th>STN</th>
<th>NRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin</td>
<td>Native</td>
<td>Native</td>
</tr>
<tr>
<td>Incidence</td>
<td>Endangered</td>
<td>97% of all dairy cows</td>
</tr>
<tr>
<td>Population size</td>
<td>1 000 cows</td>
<td>240 000 cows</td>
</tr>
<tr>
<td>Breeding goals</td>
<td>Pure breeding</td>
<td>Milk and meat yield</td>
</tr>
<tr>
<td></td>
<td>Avoidance of inbreeding</td>
<td>Health and fertility traits</td>
</tr>
<tr>
<td></td>
<td>Milk production</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Breed type</td>
<td></td>
</tr>
</tbody>
</table>
### DEVELOPMENT IN MILK YIELD AND MILK COMPOSITION

<table>
<thead>
<tr>
<th>Trait</th>
<th>Breed:</th>
<th>Year:</th>
<th>STN</th>
<th>NRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual milk yield, kg</td>
<td></td>
<td>1953</td>
<td>2 600&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3 600&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>4 200&lt;sup&gt;2&lt;/sup&gt;</td>
<td>7 100&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Fat content in milk, %</td>
<td></td>
<td>1953</td>
<td>4.1&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3.9&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>4.3&lt;sup&gt;2&lt;/sup&gt;</td>
<td>4.2&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Protein content in milk, %</td>
<td></td>
<td>nd</td>
<td>3.3&lt;sup&gt;2&lt;/sup&gt;</td>
<td>nd</td>
</tr>
</tbody>
</table>

| Genetic trends                |        |       | nd  | 0.63 kg/yr<sup>3</sup> |
| Protein yield 1978-1998       |        |       | nd  |                      |
| Fertility 1978-1998           |        |       | nd  | 0.14 %/yr<sup>3</sup> |
| Clinical mastitis 1990-1998   |        | nd    | -0.27 %/yr<sup>4</sup> |
COMENTS TO THE DEVELOPMENT IN PRODUCTION CAPACITY

- Different selection histories since the 1960s

- Genetic trends:
  - STN
    - unchanged genetic level for most traits?
  - NRF
    - increased production capacity
    - improved fertility
    - decrease in clinical mastitis
WHY DO FARMERS CHOOSE THE OLD AND ENDANGERED STN BREED? (Paper I)

- Survey asking farmers about
  - Motives for using STN
  - Expectations to STN
  - Experiences with STN

- A questionnaire to 1 722 farmers that had inseminated with STN 1987-1997

- Response rate: 25.6 % (441 answers)
  - 237 non-experienced STN farmers
  - 162 experienced STN farmers
NUMBER OF FIRST INSEMINATIONS WITH STN 1975-2008
RESULTS FROM THE QUESTIONNAIRE

● Motives for using STN
  - Conserving an alternative dairy breed: 70 %
  - Other motives: 50 %
  - Conserving a genetic resource: 45 %
  - Historical: 20 %
  - Challenging breeding strategy: 20 %
FROM THE QUESTIONNAIRE

● Expectations more or less = experiences

● Expectations to STN compared to NRF:
  - conformation:
    • lower live weight, nicer colour, more polled animals
  - production:
    • lower milk yield, higher fat and protein content in milk
    • higher culling age, easier heat detection
    • same health status
  - same net income
  - grazing:
    • less trampling damage to pastures
    • better on extensive pastures
THREE STUDIES TO TEST BREED DIFFERENCES

- Production study (Paper IV)
  - Traditional production traits
  - Energy balance
  - Energy efficiency

- Grazing studies on extensive pastures
  - Grazing behaviour (Paper II)
  - Grazing preferences (Paper III)
PRODUCTION STUDY (Paper IV)

- Overall design:
  - Comparing STN and NRF in the same herd
  - Ten cows in each group of breeds
    - three primiparous
    - seven multiparous
  - Week 1 - 44 of lactation, three indoor feeding seasons

- Recording frequencies:
  - Every week: Feed intake, milk yield, milk quality
  - Every month: Feed quality, live weight, body condition score
Differences in grazing preferences, behaviour and production efficiency between two cattle breeds

**CHOICE OF FEEDING SYSTEM AND FEED INTENSITY**

- **Feeding system**
  - Perfect setting: Total mixed ration
  - Chosen feeding system:
    - roughage ad lib
    - restricted amount of concentrates

- **Feeding intensity**
  - Goal: *The same level of feed concentration and nutrition level according to live weight and level of production*

  - STN: 3 700 kg milk 440 kg live weight
  - NRF: 6 700 kg milk 540 kg live weight
CHOICE OF FEEDING INTENSITY

- STN:
  - 65 % of NRF’s production level
  - 80 % of NRF’s live weight

- Milk production requires 2/3 of utilized energy, maintenance requires 1/3 (Korver, 1988)

- STN was given 60 % of NRF’s level of concentrates

- Roughage quality
  - 0.81 Feed Unit Milk/kg dry matter
Differences in grazing preferences, behaviour and production efficiency between two cattle breeds

EFFECTS AND TRAITS

EFFECTS
- Breed
- Lactation number (1, 2)
- Test month (1-18)
- Lactation month (1-11)
- Breed x lactation month
- Random effect of cow

TRAITS
- Feed intake
- Milk yield
- Milk quality
- Live weight
- Live weight change
- Body condition score (1=very thin, 5=very fat)
- Energy balance and energy efficiency parameters
ABBREVIATIONS

- **Mj** = mega joule
- **NE_l** = net energy for lactation
- **ME** = metabolizable energy

Differences in grazing preferences, behaviour and production efficiency between two cattle breeds.
ENERGY BALANCE AND ENERGY EFFICIENCY

- **Energy Balance =**
  \[ \text{NE}_i \text{ from feed intake} - (\text{NE}_i \text{ in produced milk} + \text{NE}_i \text{ required for maintenance}) \]

- **Gross energy efficiency =**
  \[ \frac{\text{NE}_i \text{ in produced milk}}{\text{MJ ME from feed intake}} \]

- **Partial energy efficiency for lactation \((k_l) =\)**
  \[ \frac{\text{NE}_i \text{ in produced milk}}{\text{MJ ME available for milk production}} \]

\(^1\text{MJ ME available for milk production} = \)
\[ \text{MJ ME from feed intake} - \text{MJ ME required for maintenance} +/\- \text{MJ ME body tissue gain or loss} \]
### RESULTS – PRODUCTION AND ENERGY EFFICIENCY

<table>
<thead>
<tr>
<th>Trait</th>
<th>N</th>
<th>Breed</th>
<th>Lact. no.</th>
<th>Test month</th>
<th>Lact. month</th>
<th>Breed x lact. month</th>
<th>cow</th>
<th>STN</th>
<th>NRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME intake (MJ/day)</td>
<td>624</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td></td>
<td>104</td>
<td>161</td>
</tr>
<tr>
<td>Energy corrected milk (kg/day)</td>
<td>887</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>-</td>
<td>**</td>
<td></td>
<td>11.3</td>
<td>22.6</td>
</tr>
<tr>
<td>Milk fat (%)</td>
<td>913</td>
<td></td>
<td></td>
<td>**</td>
<td>**</td>
<td>-</td>
<td>**</td>
<td>4.33</td>
<td>4.22</td>
</tr>
<tr>
<td>Milk protein (%)</td>
<td>913</td>
<td>**</td>
<td></td>
<td>**</td>
<td>**</td>
<td>-</td>
<td>**</td>
<td>3.40</td>
<td>3.17</td>
</tr>
<tr>
<td>Live weight (LW), kg</td>
<td>172</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>-</td>
<td>**</td>
<td></td>
<td>439</td>
<td>561</td>
</tr>
<tr>
<td>LW change, kg/day</td>
<td>103</td>
<td></td>
<td></td>
<td>**</td>
<td>**</td>
<td>-</td>
<td></td>
<td>0.32</td>
<td>0.41</td>
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<tr>
<td>Body condition score</td>
<td>188</td>
<td>*</td>
<td></td>
<td>**</td>
<td>**</td>
<td>*</td>
<td>**</td>
<td>2.80</td>
<td>2.59</td>
</tr>
<tr>
<td>Energy balance, MJ NE_i</td>
<td>94</td>
<td></td>
<td></td>
<td>**</td>
<td>**</td>
<td>-</td>
<td></td>
<td>-6.8</td>
<td>-12.7</td>
</tr>
<tr>
<td>Gross energy efficiency</td>
<td>612</td>
<td>**</td>
<td>*</td>
<td>**</td>
<td>**</td>
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<td>**</td>
<td>0.39</td>
<td>0.48</td>
</tr>
<tr>
<td>Partial energy efficiency</td>
<td>63</td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td>-</td>
<td></td>
<td>0.70</td>
<td>0.72</td>
</tr>
</tbody>
</table>

**1%, * 5%, - = not significant
RESULTS FROM PAPER IV

- NRF had significantly:
  - higher live weight
  - higher daily ME intake
  - higher milk yield
  - lower protein content
  - better gross energy efficiency

- No breed differences for
  - Live weight change
  - Energy balance
  - Partial energy efficiency for lactation

- Discrepancy
  - Negative energy balance live weight gain
 COMMENTS ON RESULTS FROM PAPER IV

• Discrepancy between
  - Negative energy balance
  - Live weight gain & positive body condition score

• WHY?
  - Measurements?
  - Calculations?
  - Feed evaluation system?
COMMENTS ON RESULTS FROM PAPER IV

• No breed difference:
  – Energy balance
  – Partial energy efficiency for lactation

• WHY?
  – No breed differences?
  – Lack of genetic variance in metabolism efficiency?
  – OR…
### RESULTS – PRODUCTION AND ENERGY EFFICIENCY

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<td>**</td>
<td>*</td>
<td>2.80</td>
<td>2.59</td>
<td></td>
</tr>
<tr>
<td>Energy balance, MJ (5\text{NE}_1)</td>
<td>94</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>-</td>
<td>-</td>
<td>-6.8</td>
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</tr>
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<td>-</td>
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</tr>
</tbody>
</table>

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COMMENTS ON RESULTS FROM PAPER IV

- No breed difference:
  - Energy balance
  - Partial energy efficiency for lactation

- WHY?
  - No breed differences?
  - Lack of genetic variance in metabolism efficiency?
  - Prediction parameters eliminate genetic variation?
THREE STUDIES TO TEST BREED DIFFERENCES

- Production study (Paper IV)
  - Traditional production traits
  - Energy balance
  - Energy efficiency

- Grazing studies on extensive pastures
  - Grazing behaviour (Paper II)
  - Grazing preferences (Paper III)
BREED DIFFERENCES IN
GRAZING BEHAVIOUR & GRAZING PREFERENCES

- Motivated by the two breeds’ different selection histories:
  
  - The resource allocation theory (Beilharz, 1993):
    ”animals with high production capacity have lower activity level than animals with low yielding capacity”
EXTENSIVE PASTURES IN THIS STUDY

- Semi-natural mountain grasslands
  - species rich grasslands\(^1\)
  - linked to summer farming\(^1\)
  - developed through centuries\(^2\)

- Motivation:
  - 30 % of the Norwegian red listed species depend on semi-natural grasslands\(^3\)
  - strong decline in summer farming – the grasslands are endangered\(^1\)
  - need special management – GRAZING\(^1\)

\(^{1}\)Norderhaug & Ihlse (2003)
\(^{2}\)Bryn et al (2001)
\(^{3}\)Directorate for nature management (1994)
## STUDY SITES

<table>
<thead>
<tr>
<th></th>
<th>Valdres</th>
<th>Skåbu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meters above sea level</td>
<td>1000</td>
<td>935</td>
</tr>
<tr>
<td>Number of recorded species</td>
<td>73</td>
<td>103</td>
</tr>
<tr>
<td>Dominating species</td>
<td>More common</td>
<td>Common &amp; base demanding</td>
</tr>
<tr>
<td>Bed rocks</td>
<td>Less base &amp; nutrititious rich</td>
<td>Base &amp; nutrititious rich</td>
</tr>
<tr>
<td>Distribution of vegetation types</td>
<td>Dryer and less uniformed</td>
<td>More humid and uniformed</td>
</tr>
<tr>
<td>Maped areas</td>
<td>18 km²</td>
<td>8 km²</td>
</tr>
<tr>
<td>Herd density in the area</td>
<td>Three other herds</td>
<td>None</td>
</tr>
</tbody>
</table>
## THE STUDIED HERDS ON THE SUMMER FARMS

<table>
<thead>
<tr>
<th></th>
<th>Valdres</th>
<th>Skåbu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd size</td>
<td>11 (5 STN, 4 NRF)</td>
<td>14 (6 STN, 3 NRF)</td>
</tr>
<tr>
<td>Mean age</td>
<td>5.6 years old</td>
<td>4.5 years old</td>
</tr>
<tr>
<td>Months since last calving</td>
<td>5.5 months</td>
<td>5.5 months</td>
</tr>
<tr>
<td>Mean walking distance per day</td>
<td>7.3 km</td>
<td>8.0 km</td>
</tr>
<tr>
<td>Milk production per year</td>
<td>STN: 4 500 kg, NRF: 5 800 kg</td>
<td></td>
</tr>
</tbody>
</table>
RECORDING PROCEDURES GRAZING BEHAVIOUR
(Paper II)

- Recording frequencies
  - Every 10 minutes, eight hours/day.
  - One week early summer
  - One week late summer
  - Three summers
TESTED TRAITS

- Traits
  - playing
  - lying
  - standing
  - walking
  - ruminating
  - drinking
  - grazing
Grazing Practice

- The cows were grazing all day, no fencing, indoor during night time
## RESULTS ALL TRAITS

<table>
<thead>
<tr>
<th>General activity</th>
<th>Time spent</th>
<th>Eating activity</th>
<th>Time spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playing</td>
<td>1.8 %</td>
<td>Ruminating</td>
<td>9.3 %</td>
</tr>
<tr>
<td>Lying</td>
<td>5.4 %</td>
<td>Grazing</td>
<td>87.6 %</td>
</tr>
<tr>
<td>Standing</td>
<td>57.8 %</td>
<td>Drinking</td>
<td>3.1 %</td>
</tr>
<tr>
<td>Walking</td>
<td>35.5 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 45 % of the time during 24 h cows are lying  
  (Løvendahl & Munksgaard, 2004)
- 50 % of day time cows are grazing (Albright & Arave, 1997)


High activity level
TESTED TRAITS

- **Traits**
  - playing
  - lying
  - standing
  - walking
  - ruminating
  - drinking
  - grazing

- **Effects**
  - Breed
  - Year/month/farm
  - Random effect of cow
  - Random effect of test day
RESULTS GRAZING ACTIVITIES

<table>
<thead>
<tr>
<th>Trait</th>
<th>N</th>
<th>Breed</th>
<th>Year/ month/ farm</th>
<th>Random effect of cow</th>
<th>Random effect of test day</th>
<th>Breed difference</th>
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<tbody>
<tr>
<td>playing</td>
<td>200</td>
<td>**</td>
<td>-</td>
<td>-</td>
<td>**</td>
<td>STN plays more</td>
</tr>
<tr>
<td>lying</td>
<td>348</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>-</td>
</tr>
<tr>
<td>standing</td>
<td>348</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>NRF stands more</td>
</tr>
<tr>
<td>walking</td>
<td>348</td>
<td>*</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>NRF walks more</td>
</tr>
<tr>
<td>ruminating</td>
<td>521</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>-</td>
</tr>
<tr>
<td>drinking</td>
<td>521</td>
<td>-</td>
<td>**</td>
<td>-</td>
<td>**</td>
<td>-</td>
</tr>
<tr>
<td>grazing</td>
<td>521</td>
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<td>**</td>
<td>**</td>
<td>STN walks more</td>
</tr>
<tr>
<td>ruminating</td>
<td>521</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>-</td>
</tr>
<tr>
<td>drinking</td>
<td>521</td>
<td>-</td>
<td>**</td>
<td>-</td>
<td>**</td>
<td>-</td>
</tr>
<tr>
<td>grazing</td>
<td>521</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>-</td>
</tr>
</tbody>
</table>

**1%, * 5%, - = not significant
BREED DIFFERENCES IN GRAZING BEHAVIOUR

- NRF stands more
- STN plays and walks more

- The resource allocation theory (Beilharz, 1993)
  "animals with high production capacity have lower activity level than animals with low yielding capacity"
DIFFERENT GRAZING PREFERENCES? (Paper III)
RECORDING PROCEDURES GRAZING PREFERENCES (Paper II)

- 49 faeces samples from individual marked cows
  
  STN  NRF
  Skåbu  14  14
  Valdres  10  11

- Analyzed for plant fragments by a micro histological method (Garcia-Gonzales, 1984)

- 29 plant and plant groups recorded
  - 15 tested for breed differences

- Vegetation maps over grazed areas (18 km² & 8 km²)

- GPS on the bell cow
# RESULTS

## GRAZING PREFERENCES

1Total grass = Deschampsia cespitosa, Deschampsia flexuosa, Festuca rubra ssp. Rubra, Festuca ovina, Festuca spp, Poa spp, Moli cer, Agrostis spp, Anthoxanthum odoratum, Phleum alpinum, Nardus stricta, Melica nutans, Alop gen, Graminae.

2Total Festuca = Festuca rubra ssp. Rubra, Festuca ovina, Festuca spp

\[
\% \text{ mean value} = \frac{\text{percentage of found fragments}}{\text{number of pastures}}
\]

<table>
<thead>
<tr>
<th>Species</th>
<th>Mean value %</th>
<th>Breed</th>
<th>Month</th>
<th>Farm</th>
<th>Farm x breed</th>
<th>Percentage of found fragments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>STN</td>
</tr>
<tr>
<td>Blueberry (blåbær) Vacc myr</td>
<td>0.99</td>
<td>-</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>1.84</td>
</tr>
<tr>
<td>Heather Call vul</td>
<td>2.13</td>
<td>-</td>
<td>-</td>
<td>**</td>
<td>-</td>
<td>1.93</td>
</tr>
<tr>
<td>Tufted hair grass Desch ces (sølvbunke)</td>
<td>25.54</td>
<td>-</td>
<td>-</td>
<td>**</td>
<td>-</td>
<td>26.99</td>
</tr>
<tr>
<td>Wavy hair-grass Desch flex (smyle)</td>
<td>15.08</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>-</td>
<td>15.00</td>
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<tr>
<td>Meadow grass Poa spp.</td>
<td>3.46</td>
<td>-</td>
<td>**</td>
<td>*</td>
<td>-</td>
<td>3.80</td>
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<tr>
<td>Bent grass (Agro spp.)</td>
<td>2.55</td>
<td>-</td>
<td>**</td>
<td>*</td>
<td>-</td>
<td>2.76</td>
</tr>
<tr>
<td>Matgrass (finnskjegg) Nardus stricta</td>
<td>3.82</td>
<td>-</td>
<td>-</td>
<td>**</td>
<td>*</td>
<td>5.08</td>
</tr>
<tr>
<td>Sedge species (starr) Carex spp.</td>
<td>8.36</td>
<td>-</td>
<td>-</td>
<td>**</td>
<td>*</td>
<td>8.39</td>
</tr>
<tr>
<td>Herbs</td>
<td>8.37</td>
<td>-</td>
<td>-</td>
<td>**</td>
<td>-</td>
<td>7.66</td>
</tr>
</tbody>
</table>

1Total grass = 76.13 ** | 77.68 **

2Total Festuca = 10.83 ** | 9.17

** 1 %, * 5 %,
- = not significant
CONCLUSION

- The cows mainly grazed grass species.

- Significant breed difference for *Nardus stricta* (Mat grass)

- Significant differences between the two summer farms for all plants and plant groups.

- No significant breed differences for any plant when farms tested separately, but some indications in Valdres (poorer bed rock)

- Genotype by environment interaction for four traits, strengthening the indications found in Valdres.
BREED DIFFERENCES IN GRAZING PREFERENCES?

Grass species

Sedge species (Carex spp)  

Matgrass (Nardus stricta)

Blueberry (Vaccinium myrtillus)
BREED DIFFERENCES IN GRAZING PREFERENCES

- Species and nutritious rich grasslands:
  - No breed differences

- Less species and nutritious rich grasslands:
  - Tendency:
    - The high yielding breed selects nutritious rich plants and vegetation types

- The resource allocation theory (Beilharz, 1993)
  - “animals seek nutrients according to their production level”
CONCLUSION

- From the questionnaire:
  - The farmers were concerned about conserving an alternative dairy breed.
  - The farmers expected the STN cows to milk less than NRF, and still give the same net income.
  - The farmers expected the STN cows to be better on extensive pastures than NRF.
CONCLUSION

- From the production study:
  - Significant breed differences:
    - milk yield
    - live weight
    - gross energy efficiency:
  - No significant breed differences
    - Energy balance
    - Energy efficiency
CONCLUSION

- From the grazing studies
  - The STN had higher activity than NRF
  - NRF seemed to select more of the nutritious rich plants and vegetation types than STN when grazing less species and nutritious rich grasslands
FINAL CONCLUSION

The breeds have different selection history –

- NRF - documented genetic change for
  - Milk yield
  - fertility
  - mastitis

- STN no information on genetic change for any traits
FINAL CONCLUSION

The study gives new information about what effect selection for higher production has on traits relevant for extensive and marginal production systems.

The lack of breed difference in energy efficiency rises question on the assumption that breeding for higher yield gives more efficient animals.

The indicated differences in grazing preferences on extensive pastures is a confirmation on these native and endangered breeds’ potential importance for the management of endangered semi-natural grasslands.
THANK YOU FOR YOUR ATTENTION!