The effect of increased production efficiency in beef production

I. **Cow population size**

II. Greenhouse gas emissions

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Laila Aass

B.A. Åby and O.M. Harstad

Dept. of Animal and Aquacultural Sciences

Introduction

- A simulation study

  - production strategies to meet domestic demand for milk and beef towards 2030

- Background:

✓Domestic milk quotas

✓Import restrictions on milk and beef

✓High annual increase in milk yield/dairy cow from ΔG/E-improvements

⇒ decrease in dairy beef production

✓To ensure domestic beef production to meet market demands:

⇒ increase in suckler beef production

⇒ undesirable due to increased greenhouse gas (GHG) emissions

- Key role: Annual milk yield/dairy cow

Project:
"Strategies in dairy and beef production for meeting the demand of food based on a climate- and cost efficient use of domestic feeds" (2013-2015)

The simulation - assumptions

- Time span: 2012-2030
- Annual domestic human population growth rate: +1 % (Statistics Norway, 2015)

- **Four scenaries for production goals:**

  A: Milk quota constant - beef + 1% per year (market demand)

  B: Both milk and beef + 1 % per year

  C: As B, with restrictions on dairy cow feed rations:
  - min. 60 % roughage on energy basis
  - min. 85 % domestic ingredients in concentrates (⇒ developed two new concentrate types; C1 and C2)

  D: Change import restrictions:
  - Domestic milk production declines (– 1 % per year)
  - Domestic beef production constant (2012 level)

The simulation - assumptions

- *Four scenaries for production goals:*

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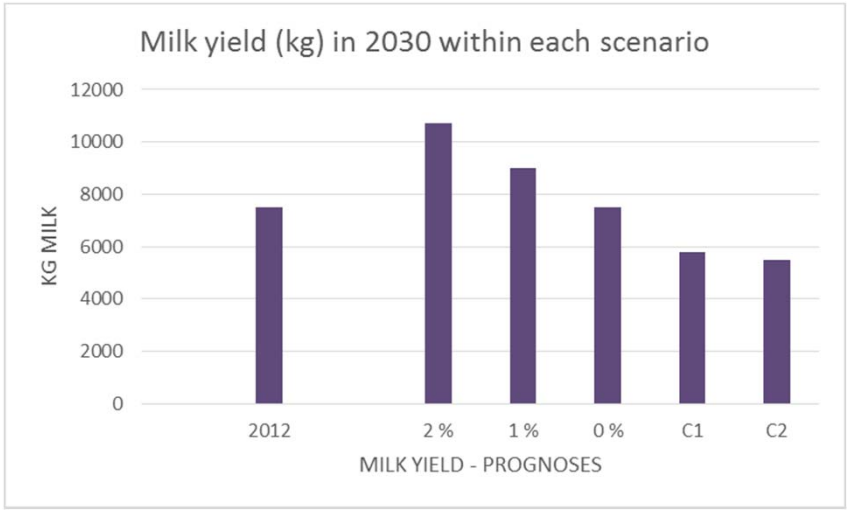
  - Domestic beef production constant

- Within scenario A, B, D:

  Three prognoses for increase in annual milk yield/dairy cow:

  - 2 %
  - 1 %
  - 0 %

- Scenario C: Milk yield set by feed resource restrictions



Assumptions – summarised:

- Four scenaries for production level
- Within each scenario three prognoses for increase in annual milk yield/dairy cow

Production goal 2030	A	B	C	D
Milk (mill. litres)	1 500	1 770	1 770	1 230
Beef (tonnes)	110 000	110 000	110 000	80 000
Feed resource restrictions	no	no	yes	no
Annual increase in milk yield/dairy cow	2, 1, 0 %	2, 1, 0 %	*)	2, 1, 0 %
*) milk yield are set by feed restrictions				

- Production statistics from official and livestock data bases (baseyear 2012)

- 2012 population sizes: - 233 000 dairy cows
  - 70 000 suckler cows

Analyses:

- How will an increase in milk yield per dairy cow
  affect the need for cows to meet demands for milk and beef within the given scenaries

- when beef production efficiency (kg carcass/cow*year) is

  1) held constant (2012 level)
  2) or with realistic increases in population means of traits for both dairy and suckler cows
     respectively, by 2030? (ΔG and/or E-improvements)

Traits and breeds studied

- ✓ Replacement rate (%)
- ✓ Calf losses (stillborn & died before 180 d)
- ✓ Age at 1th calving
- ✓ Calving interval
- ✓ Twinning frequency (suckler cows only)
- ✓ Carcass weight heifers
- ✓ Carcass weight bulls (and steers)

✓Breeds:

- Dairy (Norwegian Red)
- British (Hereford/Angus)
- Continental (Charolais, Limousin, Simmental)

Model to describe calf and beef production from dairy/suckler cow herds

R%= Replacement rate (%)
CL= Calf losses (stillborn & died before 180 d)
AFC= Age at 1th calving
CI= Calving interval
CWH = Carcass weight heifers
CWB = Carcass weight bulls (and steers)
CWC= Carcass weight cow
HL= Herd life of cow
TW = twinning % (suckler cows)

Changed one at a time or in various combinations as deviations from actual population means 2012

DCS = days from calving-slaughter cow

PYC = production years of cow (= slaughter age – age 1th calving)

Total nb. of weaned calves per cow= $TNWC = 1 + \frac{(HL - AFC - DCS)}{CI} * (1 - CL) * (1 + TW)$

Total nb. of heifers for slaughter = $TNFS = (TNWC * 0.5) - 1$

Total nb. of bulls for slaughter = $TNBS = (TNWC * 0.5)$

Carcass production:

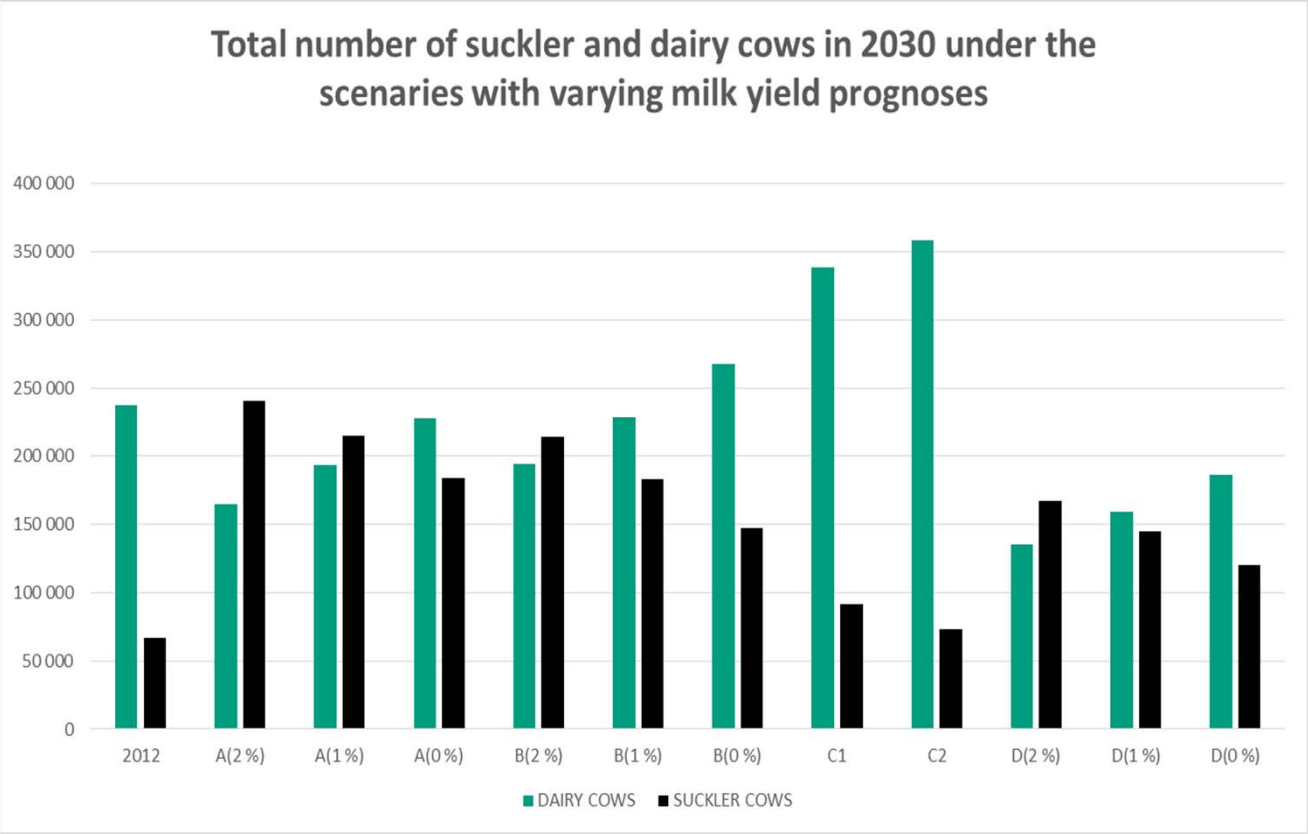
Heifers: TNFS/PYC ∗CWH

Bulls: TNBS/PYC ∗CWB

Cow: R% ∗ CWC

Carcass production per cow and year = (TNFS/PYC ∗CWH) + (TNBS/PYC∗CWB) + (R% ∗ CWC)

Results 1):
Beef production efficiency (kg carcass/cow*year) held constant, 2012 level



- Increased milk/beef production in step with human population growth will require + 100 000 cows (B and C)
- Milk yield level per dairy cow had a strong influence on number of suckler cows
- Dairy cow feed rations with higher contents of domestic feed resources (roughage and grain/low soy %) caused substantial changes in the ratio dairy/suckler cows needed (Scenario C1/C2)

The potential for increased production efficiency in beef production (ΔG and/or E-improvements)

- Effectivity measures:

✓Weaned calves/cow∗year

✓***Kg carcass/cow∗year***

- Measured as:

✓***Absolute production level (kg)***

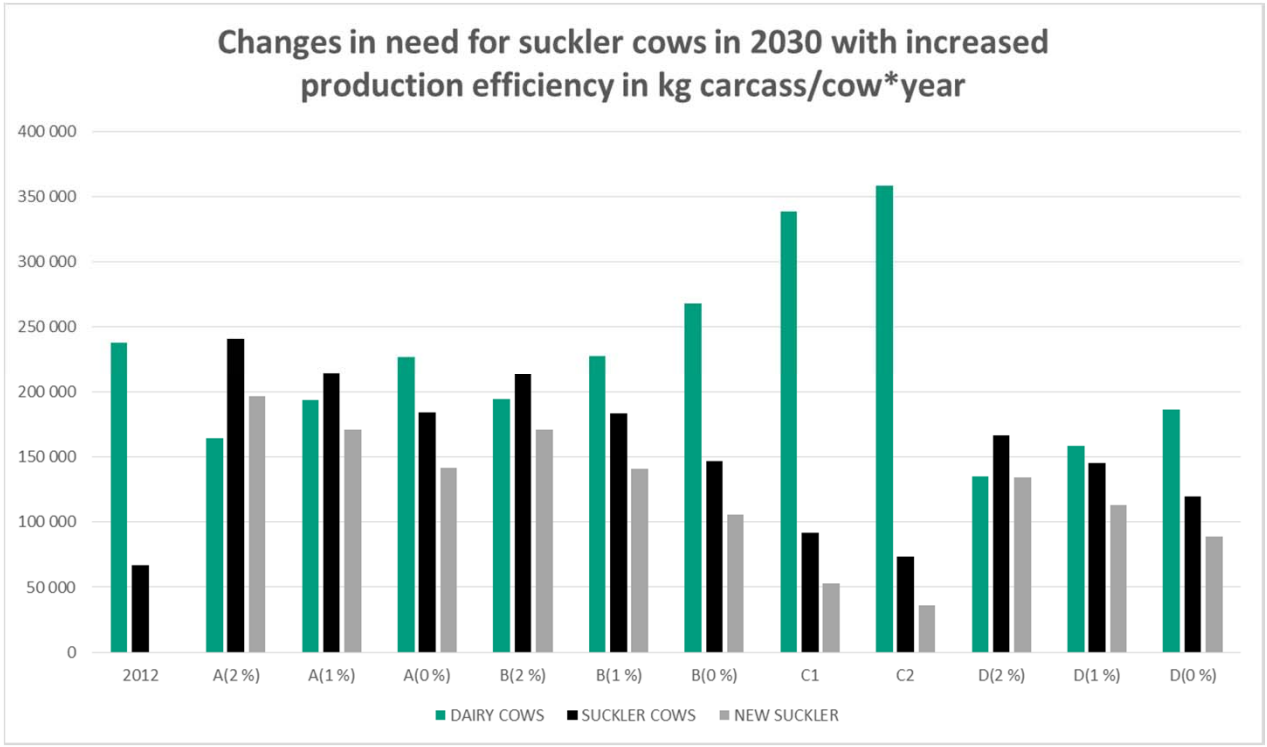
✓Production change in % as deviation from a base level (year 2012)

- Calculated as:

✓ Improvement in single traits

✓ ***Various combinations of traits***

Results 2):
The effect of increase in beef production efficiency (kg carcass/cow*year)



Traits with the largest single effect on efficiency were:

- Replacement rate (%)
- Calving interval
- Carcass weight of bulls/steers

- for both dairy and suckler production

- Increased efficiency with realistic assumptions of changes in population means, several traits combined:
  - 10 % in the dairy
  - 15 % in the suckler cow population, respectively, by 2030

  $\Rightarrow$ corresponded to a reduction of 30' – 45' cows $\approx$ 11.000 tonnes of carcass

Conclusions

✓In a system with milk quotas and import restrictions on milk/beef

- the annual milk yield per dairy cow has a key role in use of production resources and relative size of the dairy vs. the suckler cow population

✓An increase in milk/beef production in step with human population growth will require a substantial increase in total number of cows

✓Significant improvements in production efficiency may be obtained with realistic changes in population means of beef traits from ΔG/E-improvements

✓ Restrictions in composition of dairy cow feed rations – i.e. high share of «local» feed resources; -

- reduced the milk yield per dairy cow with 25 % and lowered the need for suckler cows
- especially with improved beef production efficiency

❑ The calculated effects of improvements in beef production efficiency demonstrate the potential for reductions in environmental impacts from ruminants

Corresponding effects on greenhouse gas (GHG) emissions?

Thank you for the attention!

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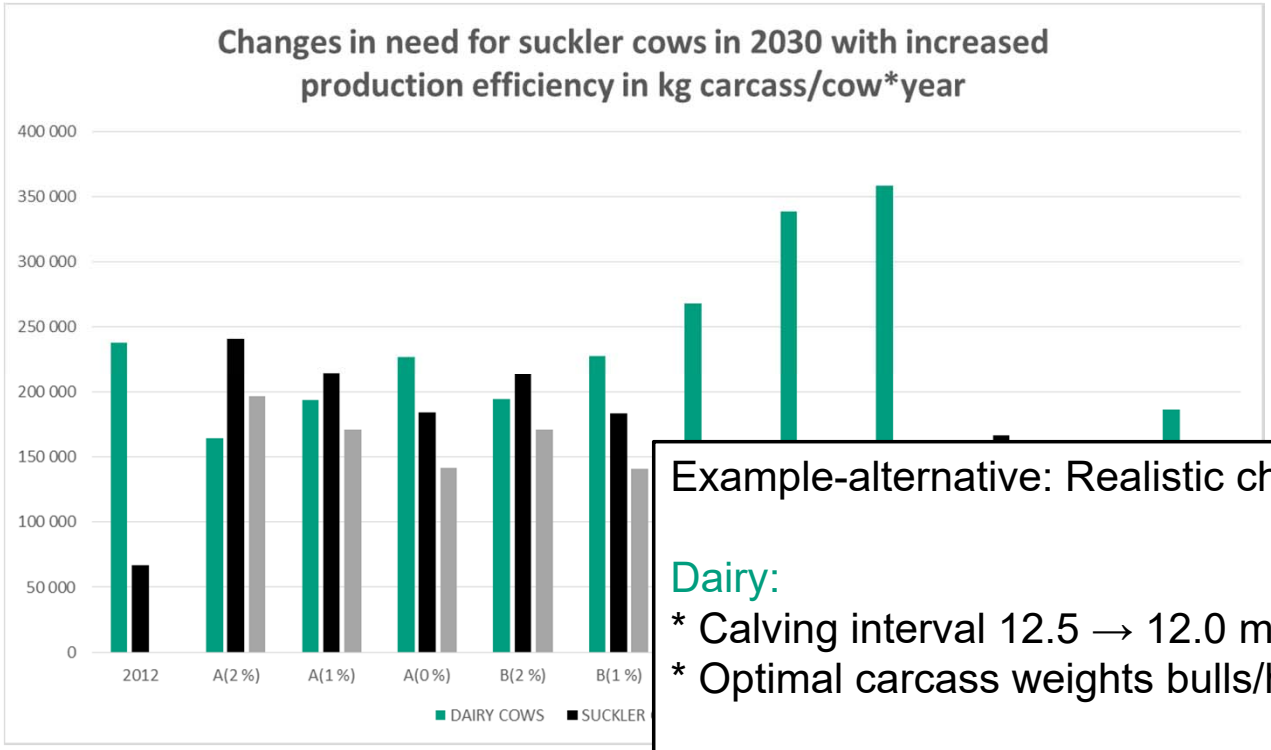

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Example-alternative: Realistic changes in population means

Dairy:
* Calving interval 12.5 → 12.0 mnd.
* Optimal carcass weights bulls/heifers (+ 10 %)

Suckler:
* Calving interval 12.9 → 12.5 mnd.
* Calf losses (8 → 6 %)
* Optimal carcass weights bulls/heifers (+ 6 %)

- With realistic assumptions of imp
  - 10 % in the dairy
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