Production efficiency and greenhouse gas emissions in Dutch dairy farming

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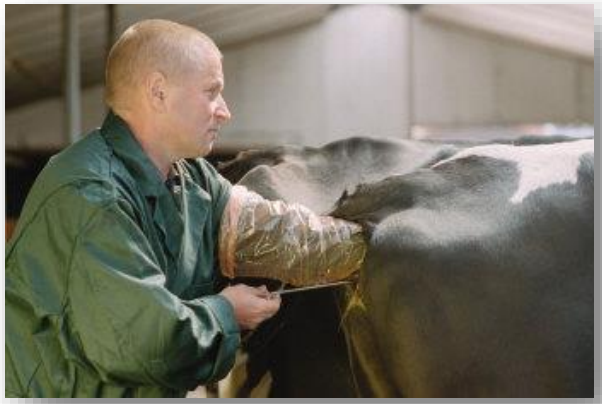
CRV

Cooperative herd improvement organisation

- genetics
- management information
- services



Dutch dairy farming

Size

- 18,500 dairy herds
- 1.6m dairy cows (90 cows / herd)
- 12.6b kg milk / yr (7900 kg / cow / yr)

High-input high-output farming system

- 2100 kg concentrates / cow / yr
- 15,000 kg milk / ha

Economic situation

- Increasing global demand dairy products
- Many farmers with growth ambitions
- High production costs: land, labour, feed
- Volatile milk prices

Environmental restrictions

- Phosphorus
- Manure production
- Ammonia
- Greenhouse gases (GHG)
  - methane
  - nitrous oxide
  - carbon dioxide

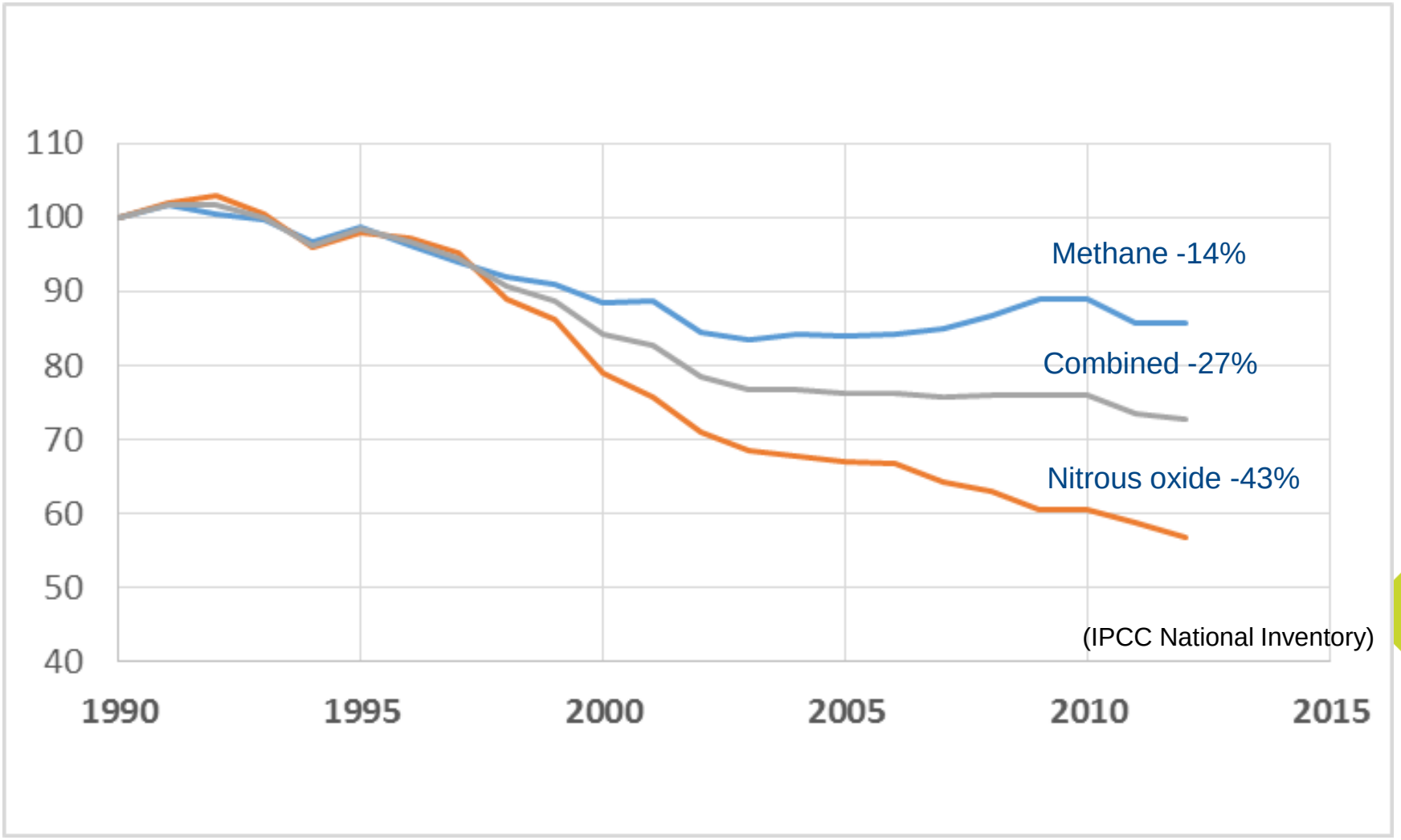
Reduction targets 1990-2020

- European Union
  GHG emissions: -20%

- The Netherlands
  - Agricultural CH_4 and N_2O emissions (until farm gate): -30%

  - GHG emissions dairy chain (until factory gate): -20%

Methane and nitrous oxide emissions Dutch agriculture
(1990 = 100)



Carbon footprint Dutch dairy chain

- Measure of total GHG emissions during production cycle
- Combines CH_4, N_2O and CO_2 based on GWP
- 1990: 2.06 kg CO_2 / kg milk
  2012: 1.42 kg CO_2 / kg milk
  (Kool *et al*., 2014)

31% reduction

Background of the reductions

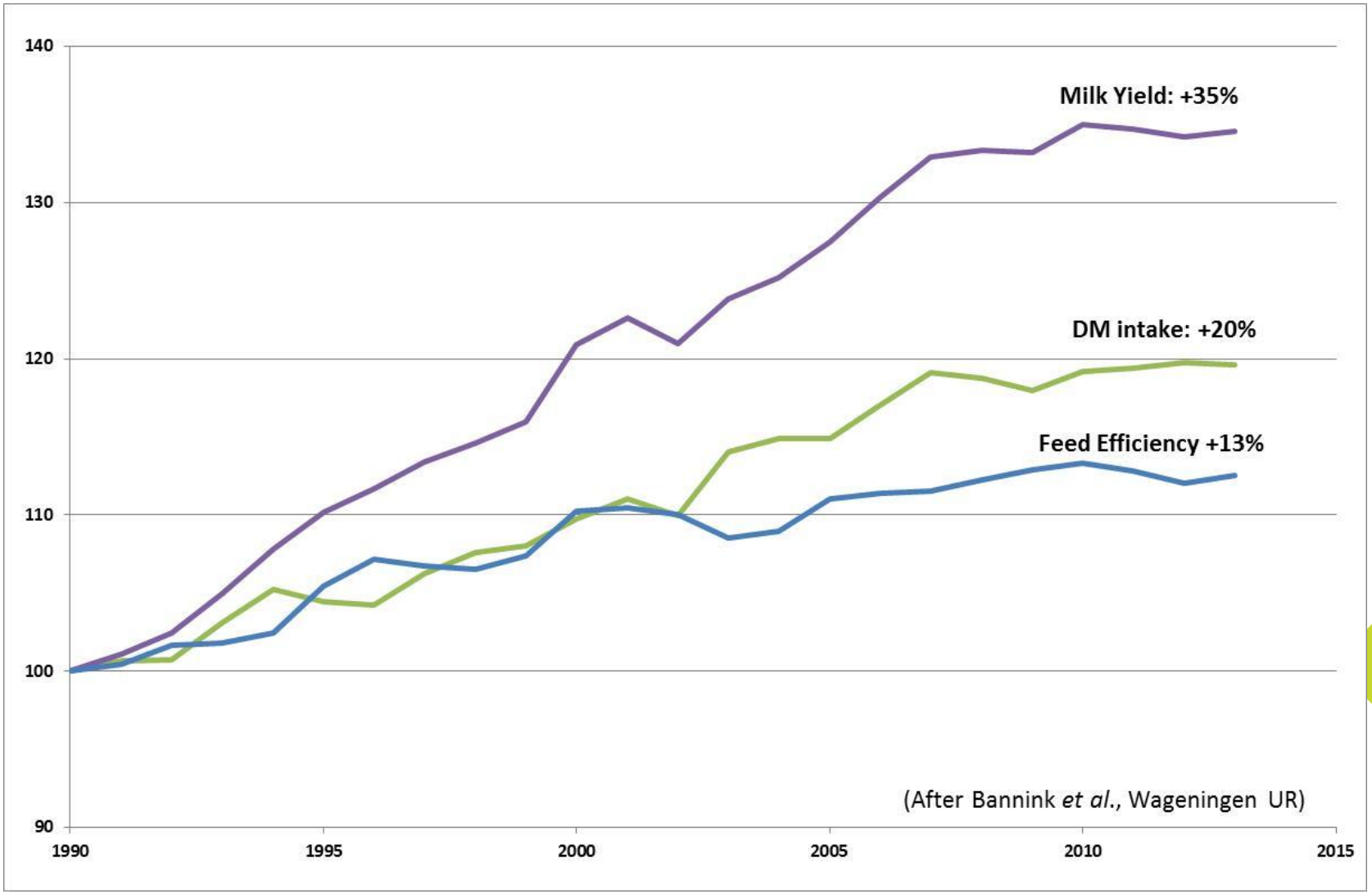
Main drivers

- economic optimisation of farming
- legislation of nutrient use

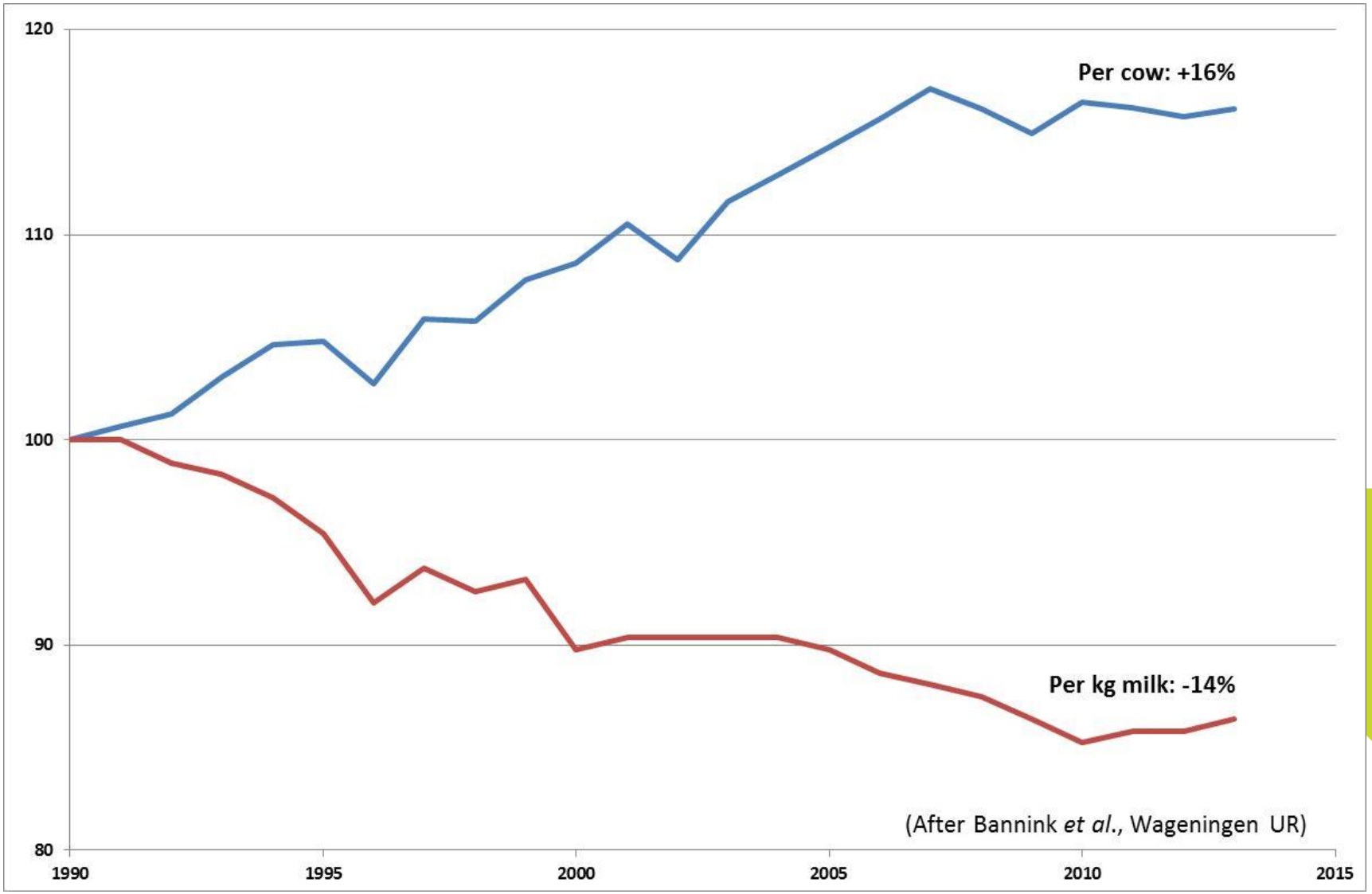
Improved environmental efficiency

- less artificial fertilisers
- less concentrates
- less enteric methane
- improved manure management

Milk yield and feed efficiency Dutch dairy cow
(1990 = 100)



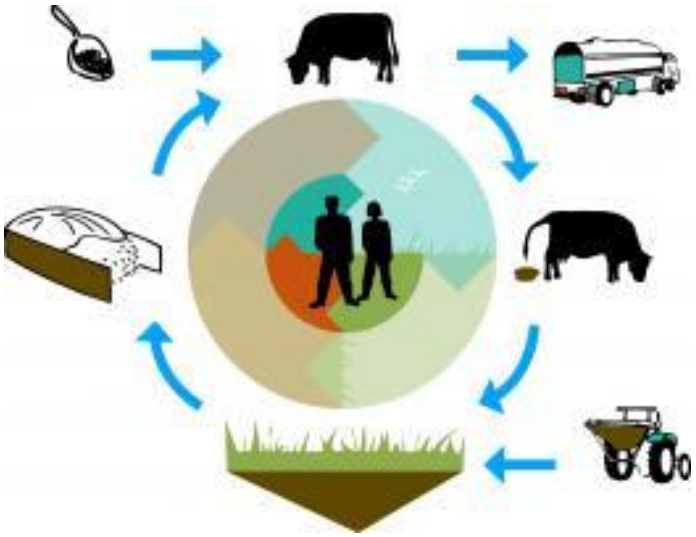
Methane emissions Dutch dairy cows
(1990 = 100)



How to realise sustainable growth?

- Strong drivers for higher efficiency:
  - increasing milk production
  - new EU reduction targets (-40% by 2030)

- Focus on lower carbon footprint at farm level



Options to reduce carbon footprint

- Improved farm and animal management

- Improved genetics
  - production efficiency (indirect selection)
  - enteric methane (direct selection)

Better Life Efficiency

- CRV tool to select bulls with more efficient daughters
- Index for lifetime efficiency (birth – last productive day)
- Average cow modeled by population means of 7 traits (milk production, longevity, live weight, feed intake, ..)
- Efficiency (%) = $\frac{\text{energy in milk}}{\text{net energy in feed}}$

Selection for efficiency

- Index bulls based on differences in underlying breeding values

- 10% best bulls for efficiency produce daughters with:
  - higher economic margins
  - lower CH_4 emissions / kg milk

- Efficiency index is extremely sensitive to breeding values for feed intake

Improving genetic evaluation feed intake

- Combine multiple datasets dry-matter intake records
- Genomic predictions improve reliability information
- CRV one of the first to use genomic proofs for bulls

Direct selection for lower enteric CH_4

- Direct recording of CH_4 expensive and not practical

- Many initiatives worldwide on alternatives
  - breath analyses (sniffers)
  - milk composition (infrared spectral data)
  - genomics (host, rumen)

Selection for less enteric CH_4

- Relation CH_4 emissions and other traits of interest

- Preferred multi-trait selection strategy
  - existing traits *vs* novel traits
  - economic *vs* environmental improvements

Conclusions

- GHG emissions in Dutch dairy production have been reduced by nearly 30% since 1990
- Sustainable growth of dairy production requires further improvements of environmental efficiency
- Defining the optimal future breeding strategy to reduce emissions remains challenging

Thank you for your attention!

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