

PRECISION TECHNOLOGIES IN EUROPEAN DAIRY FARMS IN 2020: NEW FARM MEASUREMENTS

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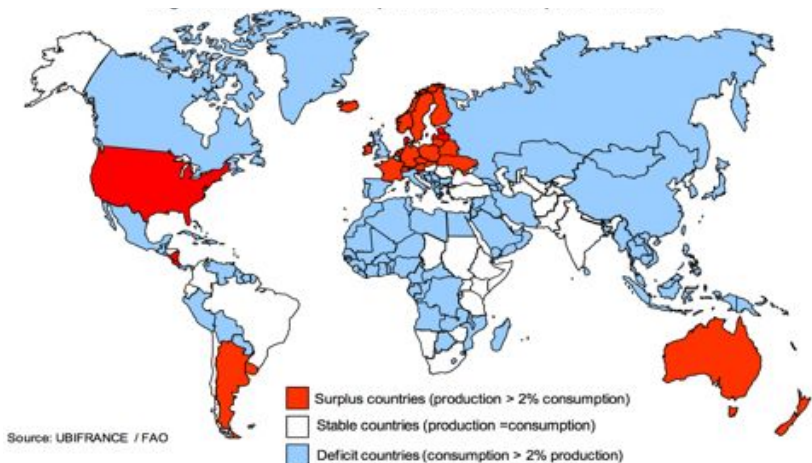
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Introduction



Introduction

- 👤 Milk production by cow has doubled in the last 20 years
- 👤 Milk production per capita is 14% lower now than in 1960
- 👤 Need to improve efficiency of production
- 👤 Some new technologies may help, some others may not

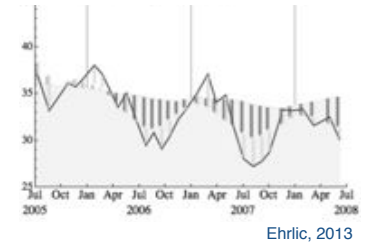
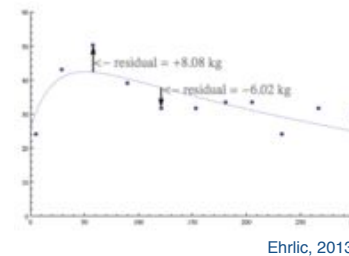
Introduction

- 👤 In recent years, a myriad of sensors have been developed and applied to dairy cattle
- 👤 In some occasions, technologies has driven the question, rather than the technological solution being driven by a practical problem
- 👤 Today, we can measure many things in a dairy herd. Which ones are useful? Which ones yield an economic return?



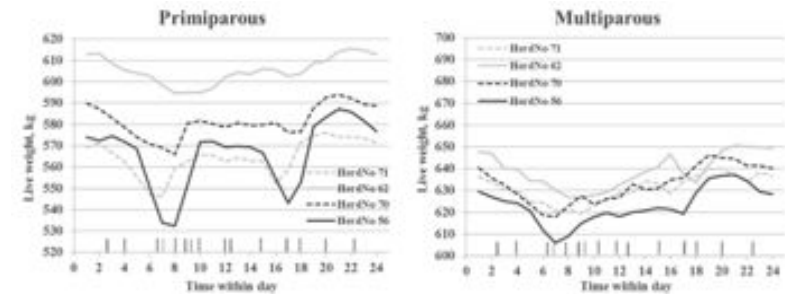
Milk Meters

- Monitoring individual milk production on a daily basis may be helpful to identify sick cows
- Looking at the residuals from predictions may alert of changes in management, health, etc...



Body Weight Measurements

- Monitoring BW can be useful to predict DMI as well as changes in body condition



Bossen et al., 2013

Somatic cell counts

- Cell counters
- Conductivity



Activity Monitors

- Great aid in heat detection
- Additional information about lying time (interesting for heat stress, overcrowding, ...)



Rumen Boluses

- Can measure rumen pH
- Can measure temperature (some think it correlates with fermentation vigor)



Rumination Loggers

- Estimate rumination through sound
- Only works (more or less) with older cows



Automatic Milking Machines

- ⚙ Might be a solution for small herds
- ⚙ Need to think about hidden costs
- ⚙ Nothing beats properly trained and motivated labor...



Automatic Milking Machines

- ⚙ The future looks better than the present



Milk Components

- ⚙ Today we can measure: fat, protein, BHBA, urea, progesterone, and LDH
- ⚙ Ketosis
- ⚙ Heat
- ⚙ Protein utilization

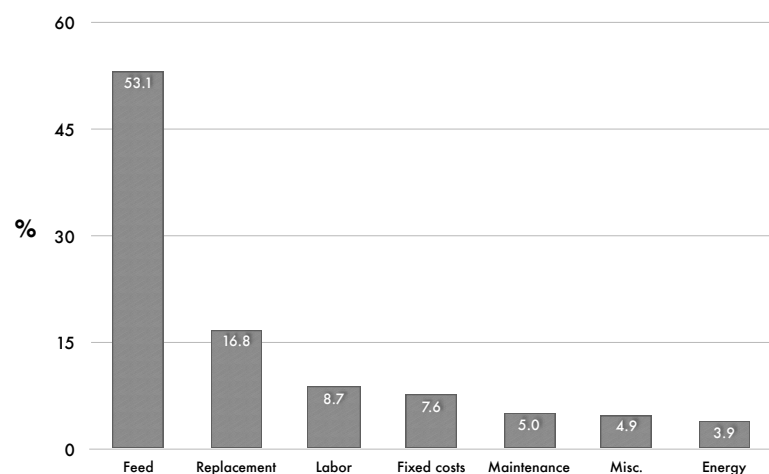


Automatic Nursering Machines

- ⚙ Allow individually feeding calves (precision feeding)



Economics



Economics

- 🐄 Milk production
- 🐄 Days in milk
- 🐄 Butter fat
- 🐄 Calving interval
- 🐄 Conception rate
- 🐄 Pregnancy rate
- 🐄 Days open
- 🐄 Feed efficiency?

Feed efficiency

- 🐄 There are two main ways to improve profit:
 - 🐄 Reducing feed costs and maintaining milk or loose very little milk
 - 🐄 Increase feed cost and improve milk yield in amounts that offset the investment in feed



Feed efficiency

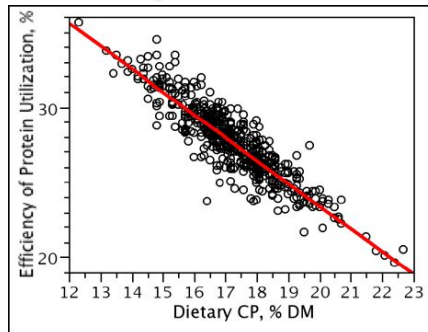
- 🐄 For many years profitability in dairy production has relied in economies of scale
- 🐄 Current feed prices (and likely the future ones) and feed availability may render this strategy inadequate
- 🐄 What really makes a dairy herd profitable (and sustainable) is the efficiency of conversion of natural resources into milk

$$\text{FEED EFFICIENCY} = \text{MILK YIELD (kg)} / \text{DMI (kg)}$$

$$\text{FEED EFFICIENCY} = \text{ECM YIELD (kg)} / \text{DMI (kg)}$$

$$\text{PROTEIN EFFICIENCY} = \text{PROTEIN YIELD (kg)} / \text{PROTEIN INTAKE (kg)}$$

Feed efficiency



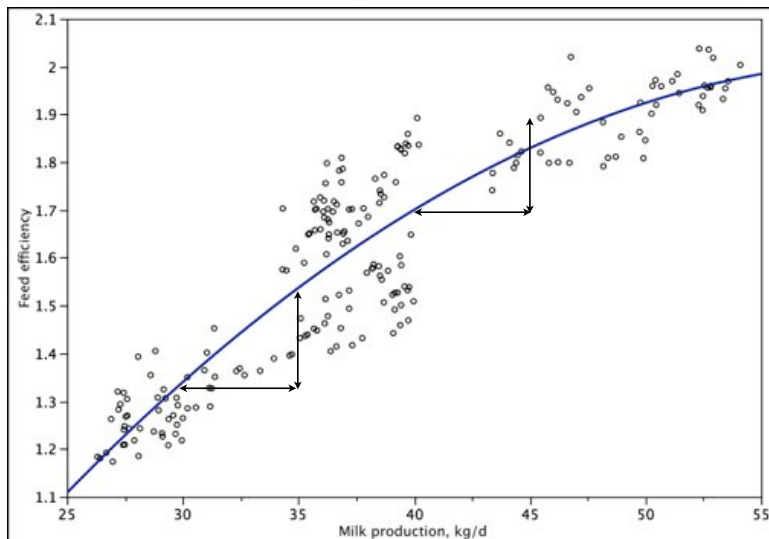
Bach et al., 2006

SBM at 500 €/Ton $\xrightarrow{44\%}$ 1136 €/Ton of CP
 $\xrightarrow{35\%}$ 3,245 €/Ton of milk protein
 $\xrightarrow{22\%}$ 4,544 €/Ton of milk protein

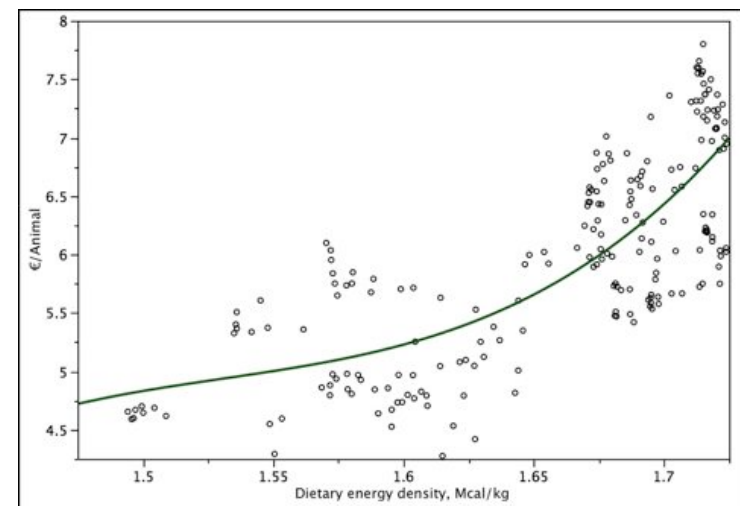
Feed efficiency

- It has been traditionally assumed that the economic model for milk production has no marginal diminishing returns
- We commonly assume that the efficiency at which cows are able to convert 1 kg of feed into milk is independent of the level of milk production
- As more milk the cow produces, the more diluted the maintenance cost are, and thus more profit is achieved

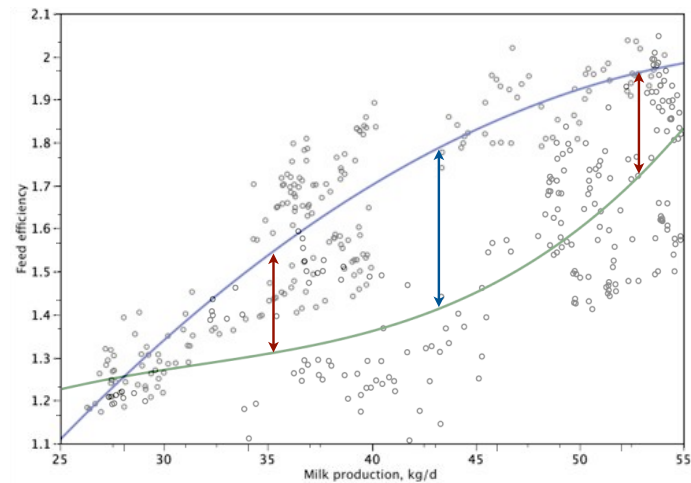
Feed efficiency



Feed efficiency



Feed efficiency



Profit

$$\text{IOFC} = (\text{milk} \times \text{price of milk}) - (\text{feed} \times \text{price of feed})$$

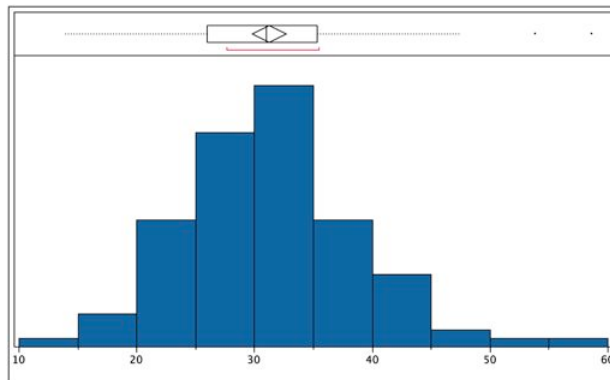
Yield, kg/d	FE	Feed cost, €/d	Income, €/d	IOFC, €/d
45	1.81	5.18	14.4	9.22
40	1.7	4.86	12.8	7.93
35	1.54	4.56	11.2	6.64

With a 20% increase in feed costs...

45	1.81	6.47	14.4	7.92
40	1.7	6.08	12.8	6.72
35	1.54	5.71	11.2	5.49

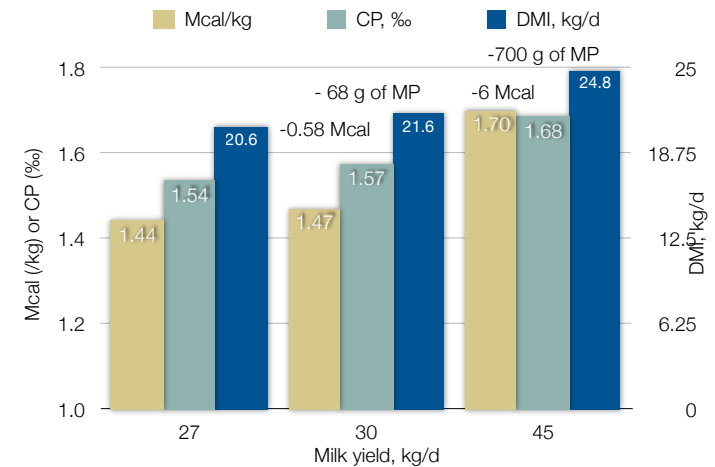
Precision Feeding

🧠 TMR are very practical, ... but note very efficient



Precision Feeding

🧠 A “balanced” mouth-full for cow A will be an “imbalanced” mouth-full for cow B

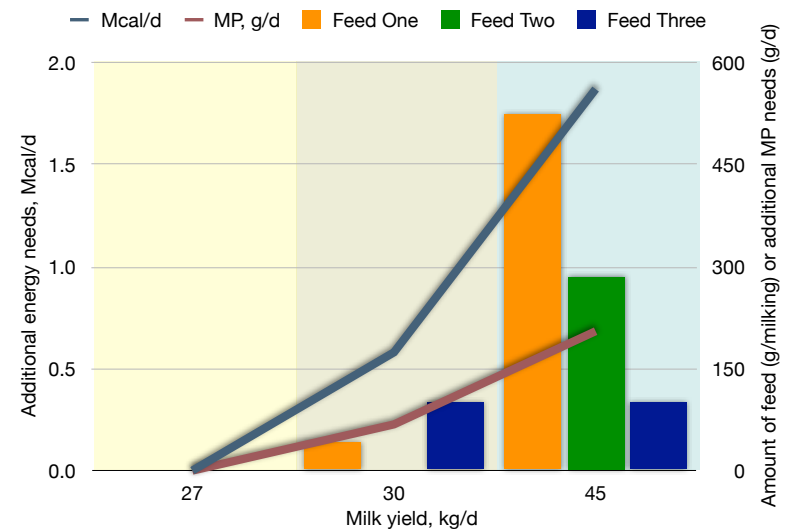


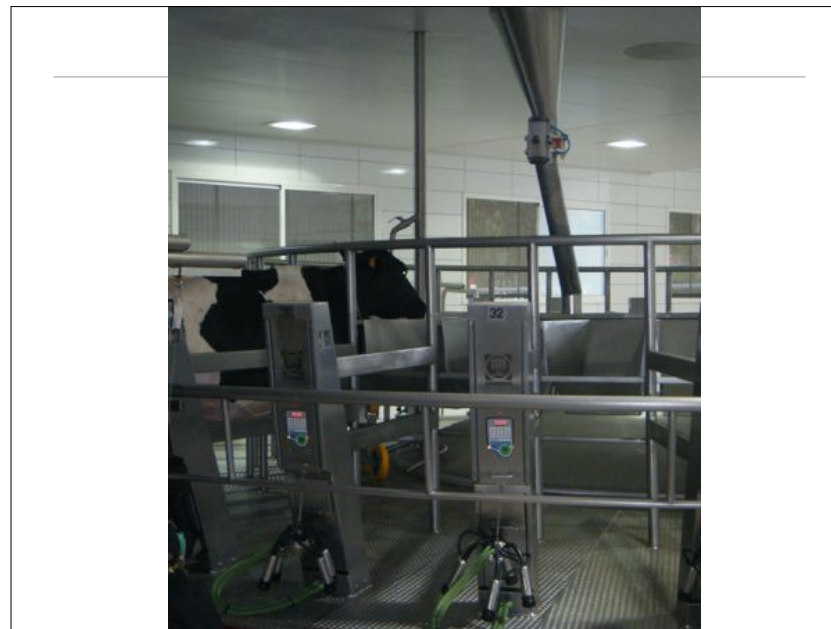
Feed Dispensers

A rudimentary approach for precision feeding

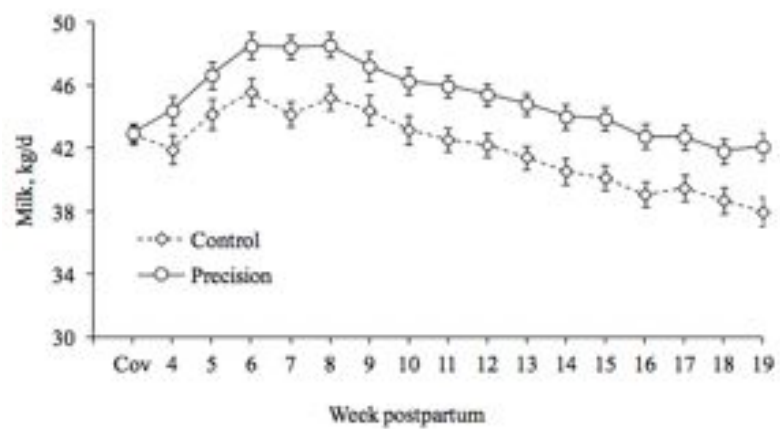


Precision Feeding





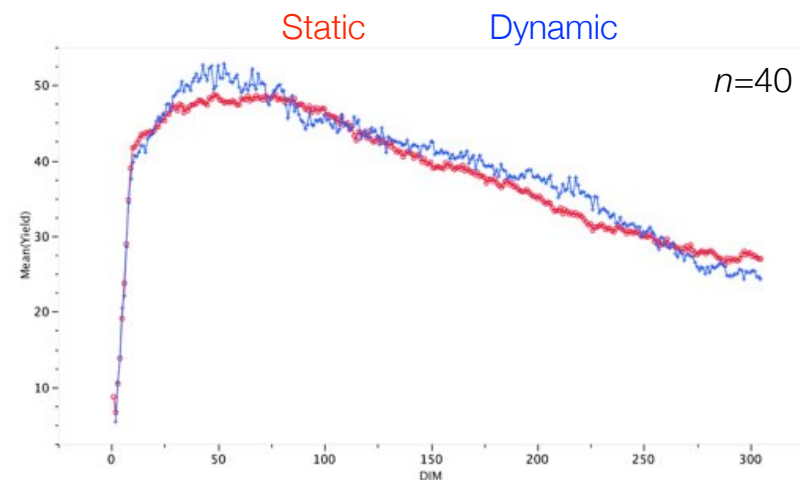
Precision Feeding



Maltz et al., 2013

Precision Feeding

Can the lactation curve be modified?



Precision Feeding

- Potential caveat with DCPF (as well as AMS, etc...) is that any dispensed feed that is not consumed represents a lost of resources
- To our experience, this occurs in very limited instances when feeding up to 1.5 kg of concentrate per milking
- Cows not needing to be fed at the parlor may become anxious when seeing that other mates are getting feed
- Provide 100 g/milking of an inexpensive formula

Future Technologies

- The use of miRNAs to assess expression of important genes at the GIT level, mammary level, etc...
- Genomic testing (pro-active management)
- Embryo transfer

Summary

- Lots of technology available
- Think on the return on the investment. Think about the question that technology answers.
- Investing in improving reproduction may proof profitable
- Improving feed efficiency will likely be profitable
- DCPF offers the advantage of allowing feeding a low-density TMR and supplement each cow according to her needs, which results in increased IOFC and improve utilization of natural resources

Summary

- Do not forget the basis
- In many occasions (automatic milking systems, automatic milk feeders, etc...) focus is placed in the new technology and basic and pivotal aspects such as ensuring that the mixing errors in TMR are minimum, that the moisture content of feeds is measured (and accounted for) frequently, DMI is monitored, etc... tend to be neglected
- Precision technologies only work when the rest works, as they provide a marginal advantage but not a total solution

Thank You

