

How to optimize feed efficiency by automatic data exchange

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Feeding the dairy cow the right and optimal way is an increasing challenge.

- There is an increasing focus on the overflow on especially nitrogen and phosphorus to the environment.
- The climate challenge in general is setting requirement for decrease the Carbon Footprint
- The genetic improvement increases the requirement for the composition of the nutrients in the diet.

To face these challenges the dairy farmer needs to monitor both the input- and the output side very closely and of course use newest knowledge about cattle nutrition. The input side consist of monitoring the amount of each feedstuff and the quality including content of nutrients. The output side is the performance of the cow meaning the milk production and gain/loss in weight.

In Denmark *SEGES Innovation* has been working on these issues for years together with relevant stakeholders like feed equipment manufacturers, dairies, milk recording and laboratories. For a start we used manual generated data, both on the input and the output side. We have together with other Nordic Countries developed a dynamic feed evaluation system, NorFor, which is used for both optimizing the ration and for evaluating the performed feeding. The challenge has been that it is labor costly to do manually and that the manual monitoring will be a snapshot on the specific day, and not the whole picture with data from each day. The overcome the challenge, there has been focus on getting the data automatic recorded by the feeding equipment and get data automatic transferred.

Today the full data chain is operational. Data from the storage, the laboratory, the feeding equipment, the dairy are transferred automatic to the Central Cattle database in Denmark. In the management system data are used for automatic daily efficiency calculation including parameters on nutrients and different relevant key figures. The farmers and the advisor use the output via different kind of reports to evaluate the feeding for the best of the cow, the production, the climate, and the economy.

Keywords: Feed efficiency, data exchange, data transfer, innovation, standardisation, automatization.

Abstract

Introduction

Producing milk on a dairy farm is a complex task. You need to control and manage a lot of different factors e.g. genetics, reproduction, health management and feeding. Regarding the feeding you need to optimize the input on order to optimize the output. The output side will mainly be the milk including the content parameters defining the value of the milk. On the input side the farmers need to optimize the feed to the need of the cow and the bacteria in the rumen. This is all very detailed described in different model for feed evaluation and feed optimization, which the farmers and nutritionist advisors are working with. The benefit has for a long time been economy and over the last 5-10 years we see some others values to increase the focus on the optimized feeding of the dairy cow f. ex. decrease of nitrogen and phosphor to the environment and latest reduce the methane emission from the dairy cow. All in all, it just gives even more incentive to look for more improvement in the feed management.

Optimize the feed management

The feed management consist of the following steps

Optimize the feed ration for the cow or the group of cows to be fed.

- Feed the ration including the right amount.
- Follow up on the feeding be measuring the fed amount of feedstuff and the correctness of the mixture.
- Calculate the feed efficiency and the different nutrient parameters to see how the fit with the plan.
- Adjust next day's ration according to the calculated result.

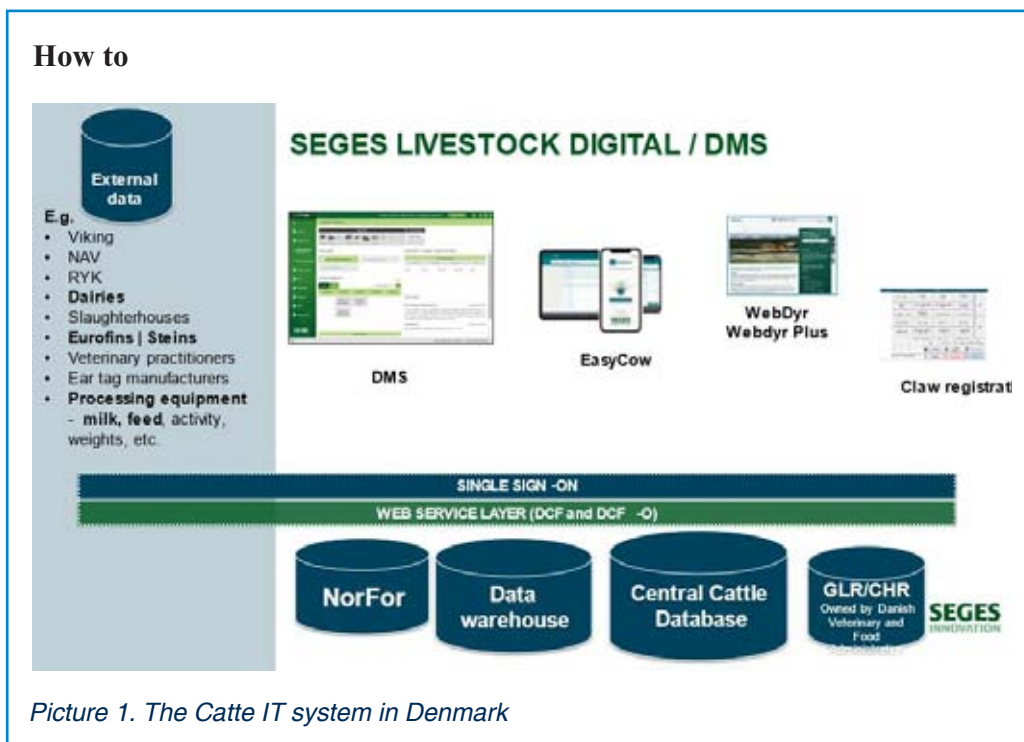
At SEGES Innovation we have been working with the whole feeding management for decades and our experiences are that is one our more points are not done sufficient the feed management will not be optimal with the consequence that the farmer lose money the animal do not function optimal, the loos of nutrient to environment is increase og the climate impact are challenged. The reason for this is not lack of will og knowledge, but lack of automated ways the track the management.

To overcome the described challenge SEGES Innovation in several project has been working on how to digitalize the data flow in or to automate all steps in the feeding management.

The overall picture of the Cattle systems in Denmark are described in picture, where the main parts are:

- The central Cattle database, which hold data – both mandatory movement and medicine data on all cattle in Denmark
- The Data WareHouse (DWH) database, which hold key figures on a lot of production parameters.
- The NorFor IT system, which manage the NorFor biologic system and by this provides the feed evaluation, feedstuff parameters and feed evaluation.
- DMS, Dairy Management system, the management system used by 97% of the Dairy farmers most advisors and veterinarians in Denmark. DMS is used for daily management, feeding, performance check, planning, budgeting etc.

- Connection to external databases like
 - Milk recording
 - Breeding
 - Veterinarians,
 - Laboratories
 - Slaughterhouses
 - On farm equipment like milking, feeding and activity equipment.



In the following we will describe how we have solved the challenges

Data on the cow and the herd are together with data on the feed including automatic transferred feed analysis are send to the NorFor system. The NorFor system returns with and optimized ration. The user might edit the ration to optimize for specific local conditions on the farm and/or in the herd.

Optimize the feed ration for the cow or the group of cows to be fed

Feed the ration including the right amount

The ration is converted into a recipe for the individual group. The recipe is sent to the feeding equipment, managed by different systems. The 4 most common in Denmark do have this connection.

Follow up on the feeding by measuring the fed amount of feedstuff and the correctness of the mixture.

The management system on the feeding equipment returns with the mixed amount including data on what has been loaded in the mixer wagon and how much of the mixture has been fed to specific groups. Data are automatic exchange once per day.

Calculate the feed efficiency and the different nutrient parameters to see how the fit with the plan.

Data from the feeding are now together with automatic data on the milk from the Dairy and relevant data from the Cattle database send to the NorFor system and a daily efficient report on the feeding is generated,

The parameters and key figures from the feed evaluation are stored in the DWH to be used in different reports on time series of data – see examples in figure 2 and 3.

Adjust next day's ration according to the calculated result.

Based on the results from the reports and which parameters are not optimal, the farmer and/or the advisor can adjust the ration

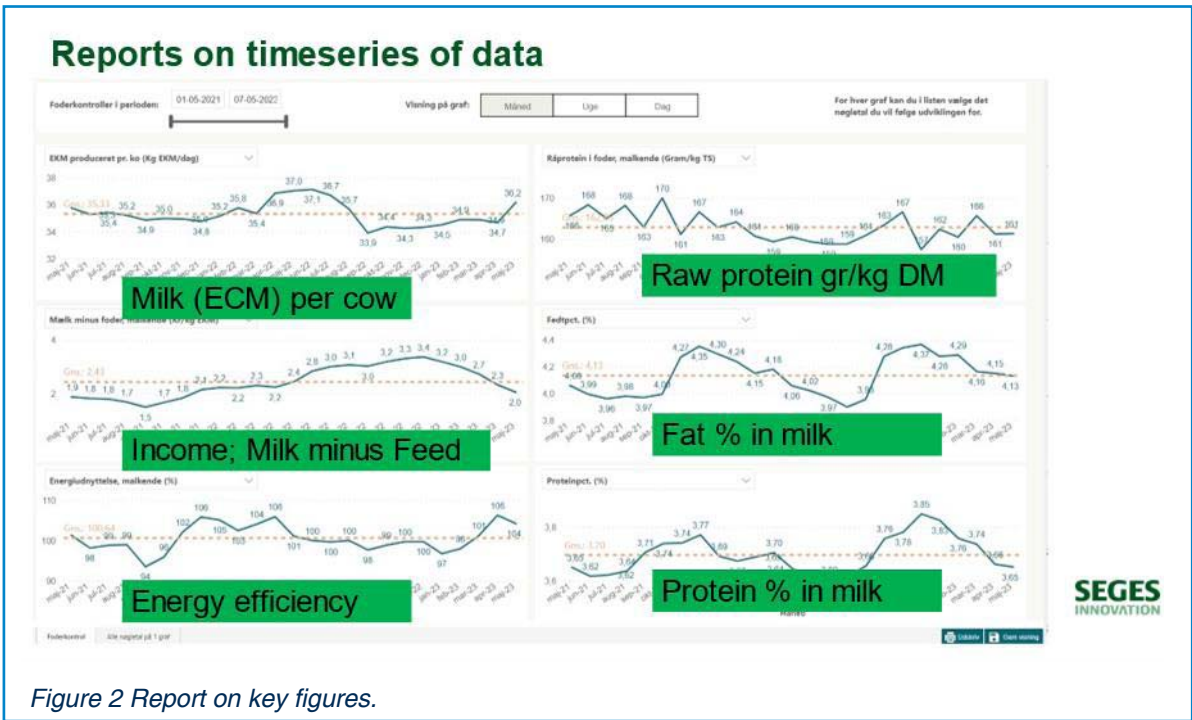


Figure 2 Report on key figures.

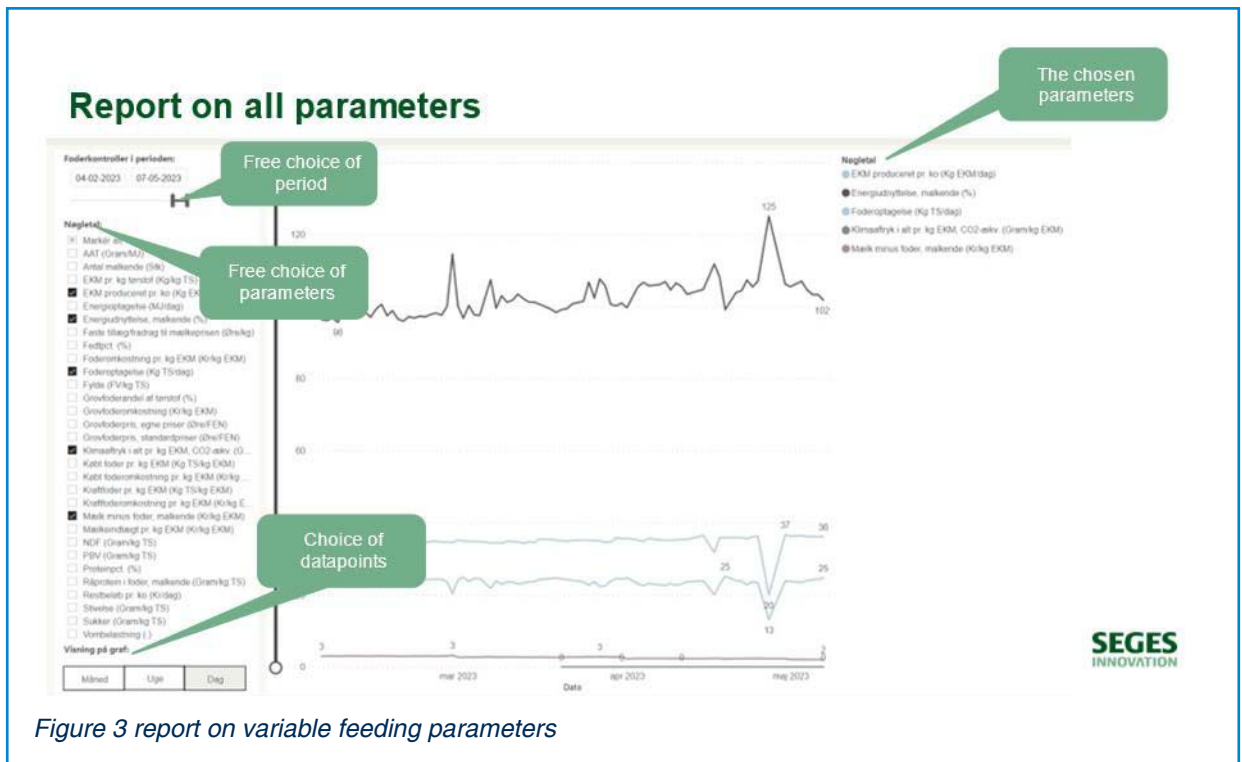


Figure 3 report on variable feeding parameters

- Data connections have been automated.
- Newest knowledge within nutrition have been implemented in the "Data machine"
- Newest technology to present status, benchmark, and development in production.
- Automated data
- Provides the tools for
 - Optimizing the nutrition
 - Optimizing the economy
 - Minimizing the waste of nutrients to the environment
 - Documentation and optimization for Carbon Footprint
- Used by 25% of the herds / 40% of the cows in full scale
- Still a lot of improvement potential
 - More users
 - More details on group/animal level
 - Calibration of equipment
 - Use to days output for regulations in tomorrow's input
 - Improve data generation and atomization in the whole feed chain.

Summary on how to optimize the feed management