# Testing the cows' ration with a new data mining software based on NOA data base

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## Abstract

Today, ration programing for dairy cows is usually done by the liner programing in the herd management program (NOA) or another program. This method takes into consideration just the price of the feeds and the physiological borders given to each food by the nutritionist. The liner program will find the cheapest ratio without looking at other parameters. Today, by looking on the big data base that is available in the dairy farms we can find thousands of rules that describe the connection between different feeds and ratio giving to the cows and cows' production in terms of milk (kg), fat percentage and protein percentage. To each rule we can define level of significance and from that to understand how it can affect specific physiological parameters and farm production. The purpose of this study is to look on the dairy farm historical data and according to former results plan the ratio that gave the best result. This will be led to higher efficiency and higher financial profit for the dairy farm. The first stage includes establishment of an easy way for receive the exact data on nutrition, milk level and DHI data from the NOA system. The second part was to test in 15 big dairy farms the historical data and to see if the data is fit for good analysis. From those 15 farms we found 3 that had good historical data that can be used for further analysis. Data analysis of the data from those 3 dairy farms revealed different effects of different foods on production performance and how a change in a food within the physiological range will affect production performance and profit per cow. Using this method can improve the professional and economic performance of the dairy.

## Introduction

The large amounts of information available today in the Israeli dairy farms in particular and in the world in general poses many challenges in data analysis. The global and local dairy barn has undergone major changes. The number of cowshed violations has increased significantly, and detection systems have been installed with controllers to help manage the cowshed. farm management is undergoing a revolution to "smart or accurate farming" (Sundmaeker *et al.*, 2016). Analyzing a large and diverse amount of information is called Big Data. Big Data represents very large amounts of information that need advanced methods as well as advanced technology to make available and usable information for decision making (De Mauro *et al.*, 2016). Large-scale data analysis, big data, and accurate agriculture are fairly new issues in cattle and therefore lack information on practices. Recently, a conference on this topic was organized by ADSA - American Dairy Science Association Conference on improving profitability while analyzing existing data in the cowshed and changes based on the findings.

In all the major industries that use more and more powerful computers and powerful technologies that allow for new analytics options like Big Data. This term can vary between topics but in general the intention is to use large databases to make complex decisions where traditional data usage may be lacking. The key components of this method are gathering information, analyzing information, storing it and finding future solutions through it. It is also possible to analyze existing data in new and advanced ways. Recently, there has been a significant trend to examine the application of Big Data techniques and methods to the use of agriculture as a key opportunity for realizing additional value in the agricultural sector (Noyes, 2014; Sun *et al.*, 2013; Yang, 2014). Using these methods can significantly improve the efficiency of various factors in the barn which will lead to improved profitability (Esmeijer *et al.*, 2015; Gilpin, 2015). Using these methods can predict various factors related to cow's effectiveness such as milk production and food consumption. Business owners are looking for ways to improve profitability and efficiency on the one hand by lowering production costs and on the other by getting a better price for the product they market. For this, good decisions must be made that will lead to improved cow behavior and better interface decisions. In the past as well as in the present all the consulting services of experts in various fields was and still is based on knowledge coming from different studies, there is a need for data and knowledge based on the local dairy farm performance with all the conditions that affect it and may differ between farms. Using technology based on local farms data (Big Data) can help achieve these goals better (Poppe *et al.*, 2015; Sonka, 2015). For example, in the dairy industry (our industry) use of this method involves combining and analyzing many types of data such as: milk and solids production, onset of estrus, dairy expenses, health and fertility data, genetic data, feed and food consumption as well as weather data, Body condition score, body weight and more. Incorporating information with sophisticated tools for analysis will help improve decision making, operational efficiency and risk management.

The dairy industry is very suitable for this method for several reasons:

1. Characterized by the existence of a reasonable price, there is biological variability as well as weather variability as well as uncertainty.
2. There are advanced technologies that provide continuous information on the cow's milk yield and medical and physiological problems that occur to her.
3. Using this Big Data method is a breakthrough in analyzing data and in the ability to use this data for future decisions.

Currently the food ratio design in the herd management software is carried out as follows: a feeding expert sets constraint of ingredients and foods according to his experience and education. The software will choose the low-cost ratio that will fill the expert's requirements. The software does not attempt to set a maximum profit per dairy farm. The idea in this research project is to use a planning method that will maximize the profit for the farm and not look just for the ratio with the minimal price. This can be done by learning the specific farm situation (from cow and cow data) and finding the optimal ratio for each farm. In addition, this method can also be examined for additional data besides feed and try to explain the relationship between cause and effect in general parameters in the farm. Like the optimal time for inseminate the cows.

Previous work that was done in one dairy farm in Israel, test this method. The cows were divided to two groups based on their milk levels, fat and protein levels, days in milk and lactation number. The food ratio for each group was done by the two different methods:

1. By using the traditional method.
2. By using the e-learning software.

The result shows difference of 1 kg/day for the group that used the e-learning software for ratio planning compare to the traditional method. The benefit has been translated into a profit of about NIS 40,000 per year in a 4-million-liter dairy farm.

The purpose of the current study was to examine the use of the mew method (Big Data) compared to the linear program that is used today in the Israeli dairy farms.

## Materials and methods

Two groups of dairy cows (n=60 in each group) were separated according to milk level, number of lactation days in milk and health status.

Ratio planning for the control group was based on the current method and done by an expert nutritionist. Ratio planning for the treatment group was done by the new method based on 8 years of historical data from the specific dairy farm.

The total mixed ratio (TMR) for control and treatment group is presented in table 1. The main difference is higher amount of Whet silage group and lower amount of Sorghum silage in the treatment compare to the control group.

The Chemical composition of the diets is presented in table 2. There is no difference between the groups. Protein % and net energy are similar and those are typical levels for high producing dairy cows in Israel.

*Table 1. Ingredients of the diets (20 kg/dry mater).*

| Item | Control | Treatment |
|---|---|---|
| Ground corn grain | 5.2 | 6.6 |
| Premix* | 2.4 | 2.1 |
| DDGS | 1.8 | 0.4 |
| Dry gluten feed | 3.0 | 1.6 |
| Canola meal | 2.2 | 3.7 |
| Sunflower meal | 0.8 | 1.0 |
| Wheat silage | 7.3 | 10.8 |
| Sorghum silage | 7.0 | 4.0 |
| Wheat hay | 1.6 | 1.5 |
| Total | 31.3 | 31.7 |

*Same premix for both experimental groups.

*Table 2. Chemical composition of the diets.*

| Item | Control | Treatment |
|---|---|---|
| Protein (%) | 16.6 | 16.5 |
| Net energy (kg of DM) | 1.77 | 1.75 |
| Forge NDF | 18.5 | 18.5 |
| Total NDF | 32.6 | 32.5 |
| NSC | 37.9 | 40.5 |
| Ether extract | 4.9 | 4.2 |

## Result and discussion

TMR planning with the new method showed higher ECM production throw all the study: 36.1 vs. 35.1kg/day (figure 1). Fat percentage were also higher throw all the study: 3.74 vs. 3.65%. However, Protein level did not differ between groups. Dry matter in take was around 23.5kg dry mater/day and did not differ between groups.

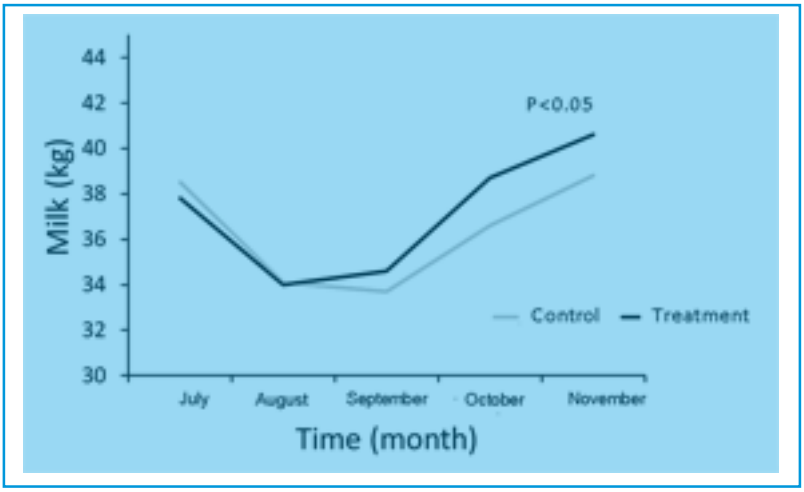


*Figure 1. ECM throughout the experiment.*

Data analysis shows the different effects of different foods on production level, the effect of changes in the amount of specific food in the physiological range on milk production, fat %, protein % food efficiency and profit. Using the new method require good quality database including historical data for at least 5 years. In addition, planning ratio for dairy cows using this new method can find the most profit ratio based on the historical data from a specific dairy farm and achieve higher profit for the all farm.

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