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Consulting, Research for  
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## **PRECISION AGRICULTURE (PA) AND THE POTENTIAL FOR AUTOMATIC CORRECTION IN REAL TIME OF FOOD VALUES IN FEED CENTERS USING NIR SPECTROSCOPY**

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Forage and feed laboratory for the testing of feeds for animal's consumption

Precision Agriculture, which is gaining momentum with the development of the electro-optical and satellite navigation fields, enables more efficient and more accurate use (optimization) of production resources: land, water, fertilizers and feeds and food.

Precision Agriculture is based on observation, measurement and comment on the condition of the agricultural sector, to the level of the plot of land for a specific agricultural crop, during fertilization, harvesting, and feeding livestock at the food center, with ongoing feeding on rainy days, for example, and with shortages of protein, energy or other feed components.

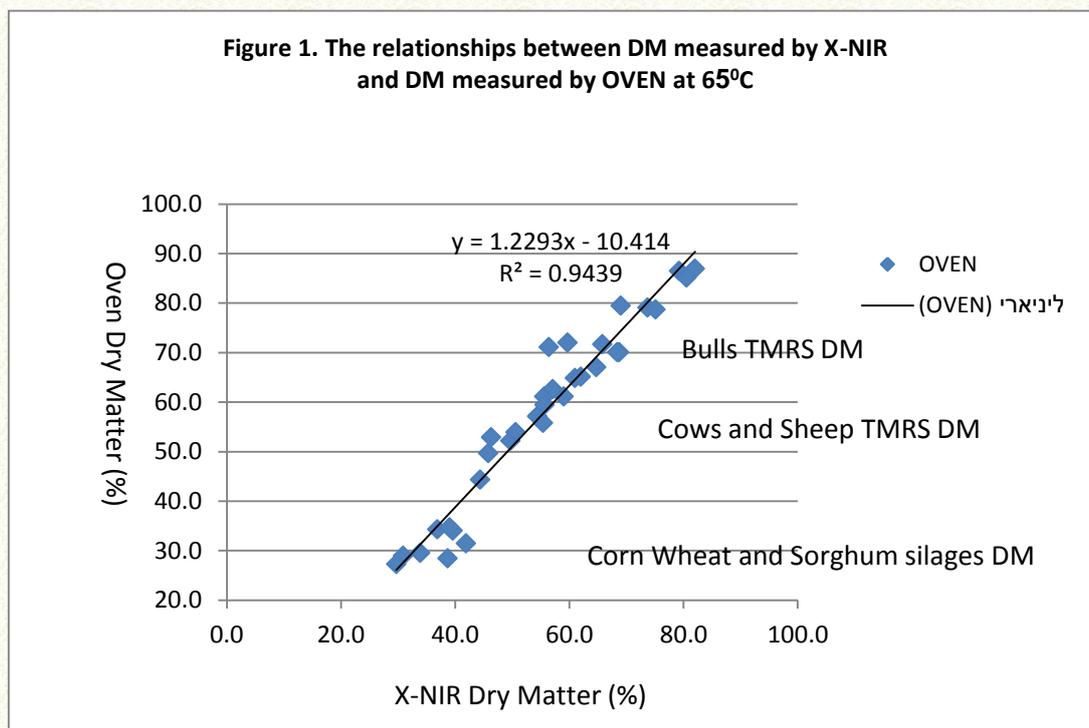
Italian company Dinamica Generale works in the field of manufacture of weighing bars and electronic equipment for fodder mixing wagons, offering today's market a range of NIR systems integrated with harvester manufacturing systems, mixers, tractor shovel systems and portable field devices. E.H. Smoler Consulting research for Agricultural Sciences Ltd. Has a Forage and Feed laboratory, and as a portion of our development and efficiency strategies in the use of manufacturing resources, we have engaged in a cooperative project whose results are beginning to bear fruit in feeding areas on Israeli dairy farms and feeding centers.

Using NIR technology (near infrared wavelengths of 780-2500 nanometers), which has been around for approximately 60 years, precision agriculture enables more accurate stock management, actual payment to customers according to dry materials, and analysis of product composition like milk and its components in real time, with considerable shortening of times between actions and receipt of lab results (which may sometimes take weeks).

NIR (near infra-red) ranges from 780 to 2500 nanometers. Light absorption causes molecules to vibrate, and these molecular vibrations provide spectral data with characteristics that depend on the chemical composition of the sample. In the case of food samples and agricultural products, the spectrums of infrared light are usually

composed of broad peaks that result from overlapping light absorption caused by combinations of vibration modes in organic groups, eg. O-H, H-N- and CH bonds. The spectrum of NIR light provides a "snapshot" of the sampling, with information regarding many components existing in a single NIR spectrum. These characteristics and others render modern spectroscopic NIR equipment particularly suitable for monitoring during advanced statistical/mathematical treatment and process control. Today, the different systems in agricultural and industrial feed systems are calibrated at global standards to a basic composition of feeding center requirements: dry/moist materials, ash/organic materials, proteins, nutritional fibers (CF,NDF,ADF) fats, starch and other food components – and creating the necessary calibrations.

In order to test our entry into the field of real-time testing, we conducted a preliminary test of total mixture rations (TMR) and fermented feeds (silages) for dry matter (DM). The results obtained were pleasantly surprising, showing, on a calibrated company device with no particular adjustments, a unique correlation of 97% between lab values and values measured with X-NIR equipment on a range of TMR's and Silages (see Figure 1).



From results tested in data set of 32 observations of feed samples including TMRs and Silages the following relationships were established:

**(1) Oven DM(%) = -10.414 (s.e. 3.085)+1.2293 (s.e. 0.0538) [X-NIR DM%]**



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One can say that in a measure of percentages of dry/moist materials, the system explains 94% of the variance between samplings at the highest level of significance.

In light of these results, we have decided to progress and to begin comprehensive testing, to develop the science for all animal fodders in Israeli dairy farms and feeding centers in real time and in the field, and we have created the concept of results in the field in real time: **Real Time Field Precision Agriculture**

The matter shall be tested in depth in feeding center cooperation with the lab over the next few years.