

## **Precision Animal Nutrition: The Role of Portable NIR on the Farm**

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The time for precision animal nutrition has arrived. Animal producers can no longer tolerate the economic consequences of avoidable variation in feed cost, nutrient composition of diets, and animal performance. Wary consumer, activist, and media groups are increasingly intolerant of perceived lapses in animal welfare, environmental stewardship, and food safety and composition. The technology – hardware and software - required to make significant advances in precision of animal nutrition exists now but data flow is typically disconnected and the technology itself has not yet gained wide acceptance. This communication will focus on a new entry in the precision animal nutrition space – the AgriNIR™ portable near-infrared reflectance (NIR) spectrophotometer (a dinamica generale® product) - and how it fits into the bigger picture of precision animal nutrition technology.

Animal performance is not about the feedstuffs the animal is fed; it's about the nutrients delivered to the animal. However, given the significant variation in nutrient content of forages, grains and other feedstuffs and, importantly, the dry matter content of those feedstuffs (especially wet forages), the nutrient composition of the diet delivered to animals can be quite variable from feeding to feeding. For example, the moisture content of corn and hay-crop silages can vary significantly in various regions of the forage mass for a number of reasons – moisture content on the day of ensiling, rainfall on the silage mass, especially on the day of feeding, etc. The forage will be weighed into the ration mixture on an as-fed basis, so the moisture content will dilute or concentrate nutrients in relation to the intended nutrient density of the diet. While it has been possible to measure moisture content of forages, grains, other feedstuffs and total diets for some time, the methods haven't always been convenient or time-efficient. This tool allows for moisture measurements in two minutes.

### The Role of the Portable NIR Instrument

The AgriNIR™ instrument is portable so it can be taken to any location on the farm where it is needed to measure analytes/nutrients (silo, grain bin, feed mixer or harvest location). In this way, real-time nutrient analyses can be used to adjust the ration “recipe” and reduce variation in nutrient delivery to the animal. This has health and performance implications for the animals. The instrument is also useful for controlling inbound variation in purchased forages and grains and in harvest management. For example, the instrument is a tremendous advantage for “green-chop” feeds and controlling potassium in dry cow diets. Future applications include use in manure management – to ensure compliance with nutrient management plans – and for measuring components in milk.

AgriNIR™ specifications:

- Size: 50 cm x 30 cm x 46 cm (20” x 12” x 18”)
- Weight: 19 kg (42 lb)
- Case: ABS (Acrylonitrile Butadiene Styrene, a rugged enclosure for measuring components)

- User interface: Keys: soft; Display: LCD ¼ VGA
- Working temperature: 0°C / + 40°C (32°F to 104°F)
- Power supply: 110 – 220 v AC / 9-32 v DC (lighter plug or vehicle battery)
- Accuracy: varies with robustness of calibrations, but general specifications for the instrument as delivered today are: moisture: within 2%; starch: within 3%; crude protein: within 3%; ash: within 3%; ADF: within 3%; NDF: within 3%

Now, consider the possibilities for the remainder of a precision animal nutrition system that can wrap around real-time NIR nutrient analyses. To build an effective system and process it would be helpful to have:

- A Laboratory Information Management System (LIMS) to receive and manage laboratory analyses data for feedstuffs used on the farm. (Note: Laboratory analyses from wet chemistry are used to calibrate the NIR instrument so that results from NIR analyses reflect wet chemistry results.)
- Supplier database software to monitor nutrient content of feedstuffs purchased off-farm and to select vendors who provide consistent quality. (It would be best to know, with a high degree of statistical accuracy, the nutrient content of purchased feedstuffs before they arrive on the farm.)
- Feed inventory software to manage supplies of feedstuffs available on the farm.
- Feed delivery software to convert the animal diet into a batch of feed that fits the capacity of the mixer and the number of animals to be fed.
- Formulation software to build the total diet to meet the needs of the animals.
- Mixers with sufficiently sensitive load cells and readable cumulative weight graphics to ensure that accurate weights of nutrient-assessed feedstuffs are weighed into the batch.

All of these components of a precision animal nutrition solution exist today. One of the ongoing difficulties is data flow and management from component to component of the “network.” For example, how difficult is it to get updated calibrations delivered to the NIR instrument? How difficult is it to incorporate nutrient analyses from wet chemistry or NIR analyses into the diet formulation software? How difficult is it to enter and translate the animal diet into the mixer batch and how difficult is it to adjust the mixer batch based on the number of animals in a pen, new moisture data on a wet forage and other such information affecting the amount and nutrient composition of the diet to be delivered to the animals?

### Reducing Variation and Improving Accountability

Variation can and must be controlled to respond appropriately to wildly fluctuating feed ingredient and livestock markets, variations in nutrient content of feedstuffs, and escalating consumer demands for accountability in the animal production industry. Feed ingredients must be safe, traceable and of known nutrient composition. Green house gases and nutrient excretion in manure must be minimized. Food safety must be documentable and consistent. Animals must be fed and otherwise treated properly. Precision animal nutrition is now possible and desirable and awaiting additional connections to advance it further. The needed connections will arise from networks of technology providers working together to benefit their customers – the animal producers – by allowing data to flow to where it is needed to make precision agriculture easier, more timely, and more effective.