Reading – History of NIRS in Agriculture

NIRS is used most frequently in agriculture to determine moisture, protein, oil/fat, fiber and starch contents. It has also been used to obtain results for amino and fatty acids. Each section below gives a brief overview of some of the applications of NIRS outside of fecal sampling in agriculture.

Feed Industry

- Analysis of raw materials
- Feed-mix formulation
- Analysis of final mixes
- Testing mixing efficiency

NIRS analysis in a feed mill can help feed manufacturers derive the most efficient feed formula by selecting the right protein and mineral supplements, fiber sources, and grain forms. Each of these ingredients vary in their spectral signatures. Decisions can be made on what ingredients to include based on chemical makeup and price to maximize profits and efficiency of the feed mix produced.

Flour Milling

- Flour marketed based on protein, ash content, and water absorption.
- Millers need to know the moisture, ash, and protein in the final product.
- Monitor continuous performance of the mill.
- Test wheat purchased from farms.

Grists can be blended in milling process to assure the end product meets specifications if the protein content of the wheat predicted by NIRS is not sufficient.

Forage Analysis

- Dry matter
- Protein
- Natural detergent fiber (NDF)
- Acid detergent fiber (ADF)
- In vitro and in vivo digestibility
- Lignin
- Ash

The difficulty in forage analysis lies in sampling and sampling techniques. To sample a large field, one would need to sample bales from different spots. This is time consuming and costly. In addition, analysis of fresh or mature forages before size reduction is not practical. It is important to remember that the true value of the forage to an animal depends on the state the forage is in when it is ingested. **Fecal sampling via NIRS is a viable option to forage analysis for obtaining the true value of forage at ingestion.**
Grain Handling

- Compositional analysis – moisture, protein, starch, and oil
- Classification
- Grading

Plant Breeding

- Screening of whole kernels and seeds in early generations
- Increases the number of samples that can be screened
- Enables testing of large trials grown on different locations within a region
- Provides information on genotype/location/season interactions

Soil Analysis

- Organic and total carbon in soil
- Total organic nitrogen
- pH
- Cation exchange capacity

Precision Agriculture

The objective of precision agriculture is to map the fertility of a field to improve the efficiency of fertilizer, but applying more heavily where the fertility is low. An NIRS instrument and GPS system is attached to a combine harvester to monitor protein content and position in the field of wheat being harvested. This information is used to determine where and how much fertilizer should be applied.