Reflecting On Protein:

Assessing Forage Nutrition Through Spectral Signatures

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Abstract:

Remote sensing is a key technology driving the precision farming revolution. Farmers can assess soil moisture, erosion, chlorophyll, crop yield, pests and disease of their crops using spectroscopy. This is done by measuring how the crop reflects and absorbs energy from the sun in the visible and infrared spectrum. The spectral signatures are not only unique for different cover types, they can also be used to determine the structure and chemical composition of a specific crop. Currently, the normalized difference vegetation index (NDVI), an indicator of chlorophyll, is the most commonly used index to monitor the quality of a crop. Chlorophyll is important because it reveals stress (water and nutrient) in plants and can help a farmer apply irrigation and/or fertilizer to relieve this stress; however, NDVI cannot help a farmer monitor the nutritive quality of the crop. In the case of forage crops, crude protein (cp) is a key indicator of nutrition. This project seeks to develop a remote sensing method to estimate cp from reflected solar energy using a statistical model that relates cp to the temporal pattern of reflectance of alfalfa (*Medicago Sativa* L.) through its phenological cycle as measured by a broad band radiometer. This study is expected to:

1.) Result in a new a model for optimizing yield, where quality (protein) and quantity (biomass) converge
2.) Evaluate whether the model can be used to assess forage nutrition with real-time sensing.

Alfalfa is the fourth most common field crop in Canada and it is a high protein livestock feed. If proven effective, these methods can help support farmers in harvesting and marketing their feed crops and can potentially be adapted for assessing forage nutrition in other forage crop species.

Keywords: precision farming, remote sensing, forage crops, protein, optimal yield