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SPECTRAL RESPONSES TO DETECT CERCOSPORA LEAF SPOT

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Introduction:

In recent years, concentrations and infestation rates of Cercospora Leaf Spot (CLS) have frequently reached alarming levels in the Red River Valley. The disease is caused by a fungus, known as *Cercospora beticola* Sacc., that overwinters on infected plants and weeds and is dispersed by wind. The disease has become extremely harmful in North Dakota and Minnesota, especially during years with high amounts of rainfall, humidity and temps late in the growing season.

Visual evaluations of disease severity, by humans, are subjective with accuracies depending upon the ability of the assessor. Recent advancements in remote sensing technology indicate a potential for the early warning and detection of the disease prior to visual confirmation. Armed with this information and capability, producers would be better equipped to take prompt control actions to reduce the spread and impact of the infected regions.

Objectives:

1. Monitor disease progression using a portable spectroradiometer.
2. Detect CLS with the sensor before the visual symptoms show up.

Procedure:

In this experiment, Beta 6447 sugarbeet seed was planted on May 13, 2003 in the Red River Valley at Crookston, MN. The seeds were planted six rows at a time in twenty-two inch rows stretching thirty-five feet long. The plots were arranged in a RBCD containing five treatments and four replications of each. The treatments consisted of varying fungicide applications including 1. application at the onset of the disease 2. application at ten percent infestation 3. thirty percent infestation 4. fifty percent infestation and 5. no application (untreated check). Sixty-four individual plants (four plants per treatment) were randomly selected and flagged within the two center rows. Three canopy reflectance readings per plant were measured with an Analytical Spectral Devices (ASD) Fieldspec Pro spectroradiometer on approximately a weekly basis.

Fungicide treatments were applied at a pressure of 100 psi and a volume of twenty gallons per acre to the center four rows. Treatment one received the application on July 28th, August 11th and August 25th and treatment two received one application on August 25th. On October 16, 2003, the plants were visually evaluated and rated for CLS according to the subjective 0-9 KJeinwanzlebener Saatziucht (KWS) scale and the middle two rows were harvested for yield. The sugar percentage and loss to molasses (LTM) factors were determined at the American Crystal Sugar Company Quality Laboratory in East Grand Forks, MN. All other cultural and pesticide practices were performed as recommended.

Results & Conclusions:

The sugarbeet variety used in this trial was selected only for its susceptibility to Cercospora Leaf Spot according to the KWS scale. No other inferences should be drawn relative to yield or quality factors.

At the time of harvest, under natural Cercospora infection (non-inoculated) there were significant differences in the degree of Cercospora infection between treatments (Table 1). The visual estimates, however, provided no significant correlation with beet tonnage, sugar percentage or LTM.

There were no statistical differences between yield, sugar and LTM treatment means (Table 2). This is perhaps due to the lack of moisture and infestation early on in the season therefore there was no apparent crop stresses to cause the yield to fluctuate.

Spectral responses of the plants on August 6th and October 16th are graphically presented in table 3 and table 4, respectively. A statistical evaluation of all of the treatments, over time, will be conducted to more appropriately explain the significance of the variation. The dataset is still under investigation and a spectral signature assignment of the disease is pending. Analysis of this data is continuing.

Summary:

Monitoring of the disease progression using the portable spectroradiometer was completed over a four-month period starting on July 16, 2003 and ending October 16, 2003. Variations within the reflectance data are becoming increasingly apparent despite the

late arrival of the disease pressure.

Due to this low disease pressure early in the growing season, it is uncertain whether the spectroradiometer proves useful in early disease detection.

References:

1. Khan, M., Smith, L., Bredehoeft, M., Roehl, S. 2002. Cercospora Leaf Spot Control in Eastern North Dakota and Minnesota in 2002. 2002 Sugarbeet Res. Ext Rept. 33:223-230.
2. Rush, C.M., Steddom, K. 2002. Genetic variability of BNYVVand BSBMV and quantification of Cercospora Leaf Spot with remote sensing. 2002 Sugarbeet Res. Ext Rept 33:206-209.
3. Smith, L.J. 2002. Managing Cercospora Leaf Spot for Profitability. 2002 Sugarbeet Res. Ext. Rept. 33:231-233.

Acknowledgements:

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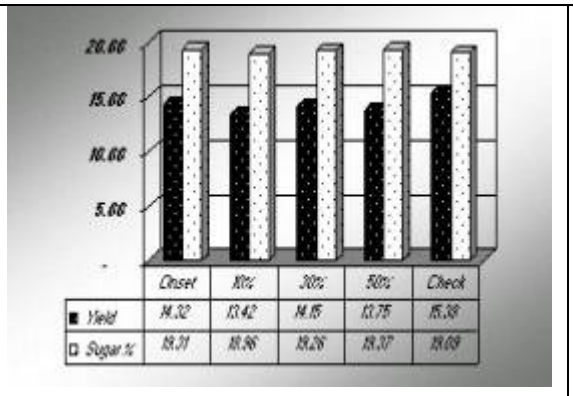

Table 2. Yield and sugar percentage results.

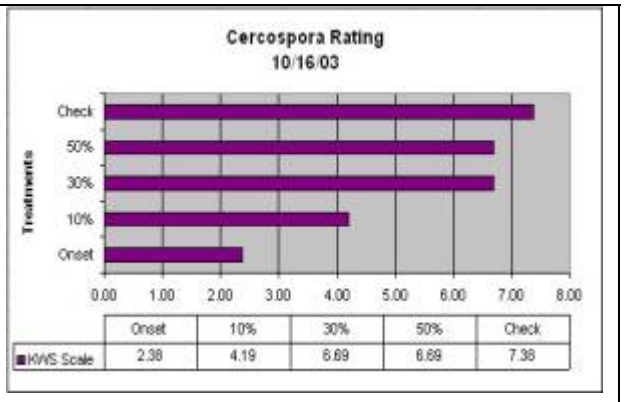

Table 1. Cercospora rating at harvest.

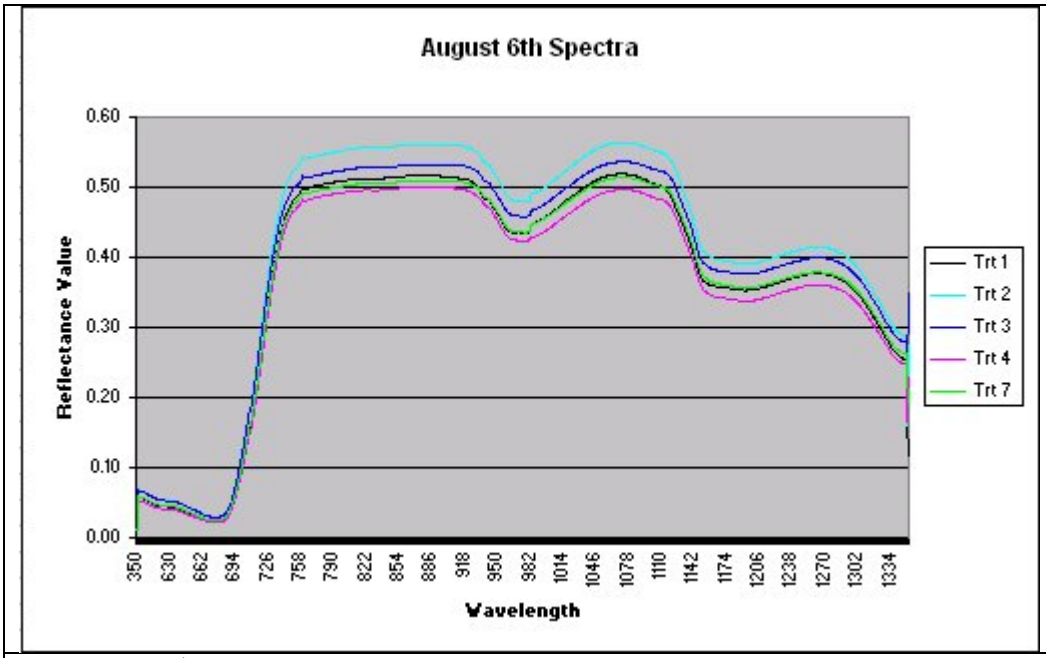

Table 3. August 6th spectral readings per treatment.

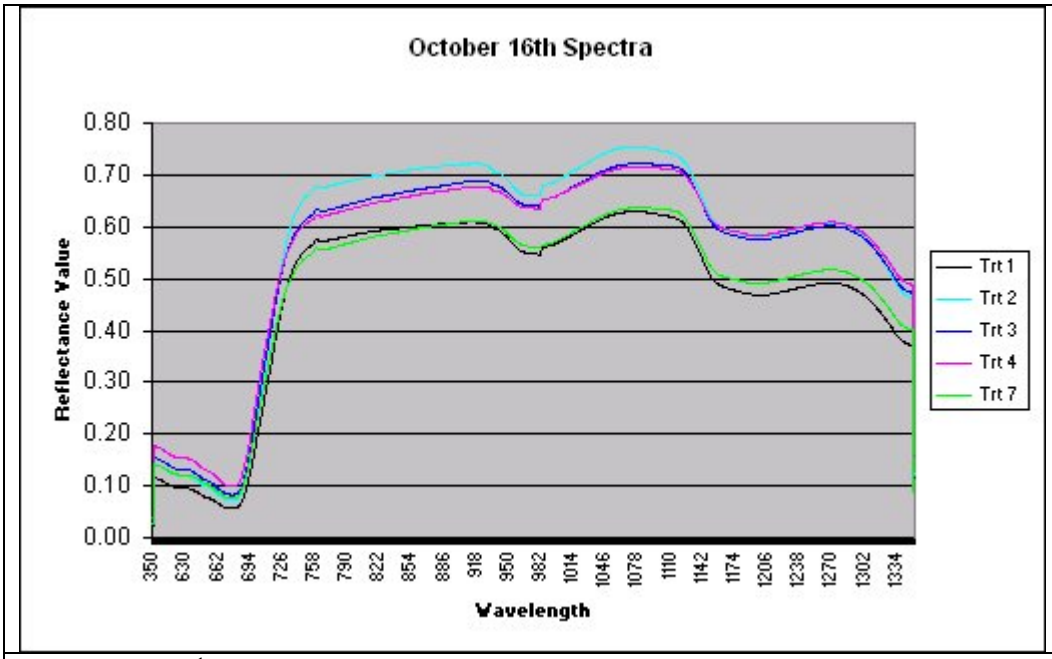

Table 4. October 16th spectral readings per treatment.