

## Using Remote Sensing to Estimate Nitrogen Credit from Sugar Beet Tops

### Background:

One of the most economically important crops in the Red River Valley of North Dakota and Minnesota is sugar beet. Sugar beet harvesting takes only the sugar laden root (or beet) to harvest and process into sugar (Figure 1). The leaf and stems are left to return back to the soil. The above ground plant parts contain important nutrients that can be utilized by crops in the next rotation. Remote sensing can be used to estimate how much nutrition, specifically nitrogen, sugar beet tops add into the soil. These estimates are called nitrogen credits.



Figure 1. Sugar beets in the Red River Valley of North Dakota and Minnesota.

### Use of Data:

Estimates of nitrogen credits are calculated by using remote sensing to assess the greenness of the sugar beet tops. All green plants have chlorophyll, a pigment, which makes them green in color. Chlorophyll is made with nitrogen, and therefore a plant that appears greener and healthier has more nitrogen inside its leaves. More green leaves result in more nitrogen in the soil, a higher nitrogen credit and less nitrogen applied from fertilizer. Remote sensing imagery is obtained as close to harvest as possible. A credit, usually described as high, medium or low nutrient zone, is calculated using an equation according to greenness zones and then suggested to the producer.

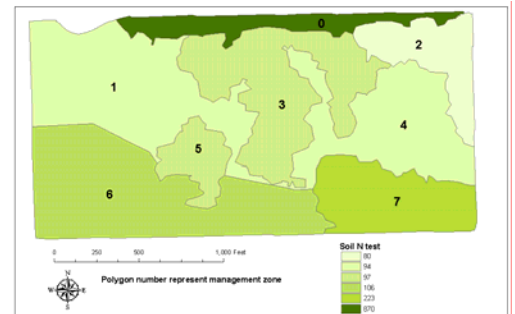


Figure 2. Map of nutrient zones using nitrogen credit zones derived from the greenness of sugar beet tops.

### Economic and Environmental Benefits:

Farmers, like Gary Wagner, use this technique to estimate the amount of nitrogen from the greenness of sugar beet tops and save money on soil testing. Traditional farming calls for grid based testing while farmers that use nitrogen credits test fewer sites in each management zone (See Figure 2). This reduces the initial cost of soil testing. Furthermore, application of smaller amounts of nutrients saves the producer money. Gary estimates he saved \$12 per acre on fertilizer costs by applying fertilizer at variable rates based on nitrogen credits estimated from the color of sugar beet tops (See Figure 3). Farmers are not the only ones to benefit from this technique. Over application of nitrogen leaches into ground water when plants use only a portion of fertilizer added. This form of precision farming reduces the amounts of nitrogen fertilizers produced and applied and helps reduce the harmful effects of excess nutrients to land and water of the Upper Midwest

### Variable Rate Sugar Beet Tops

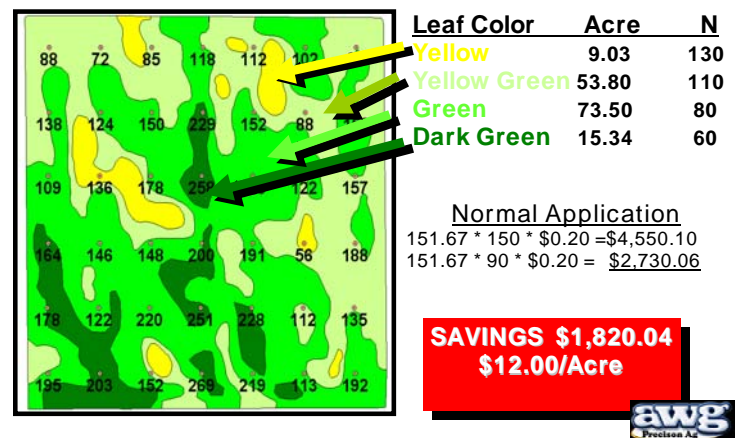


Figure 3. An image illustrating nitrogen application and cost savings when estimating Nitrogen contributions of sugar beet tops based on satellite images showing. (Courtesy of Gary Wagner, AWG farms Crookston, Minnesota.)

