The Oklahoma Cooperative Extension Service
Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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Using the GreenSeeker™ Handheld Sensor and Sensor-Based Nitrogen Rate Calculator

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Oklahoma Cooperative Extension Fact Sheets are also available on our website at:
http://osufacts.okstate.edu

The Sensor-based Nitrogen Rate Calculator (SBNRC) is a free on-line sensor-based nitrogen (N) recommendation calculator. This web-based application was developed at Oklahoma State University and has been documented to increase profit of winter wheat production through either the reduction of N fertilizer inputs without loss of yield or an increase in yields with increased N fertilizer. The technique utilizes the GreenSeeker™ sensor, which records NDVI (normalized difference vegetative index), to measure a high N strip (N-Rich Strip) placed in the field, pre-plant and an adjacent area representing the farmer practice. These values are then put in an algorithm that provides an estimate of potential yield, as well as estimated response to applied N to recommend a field-specific N rate.

I. GreenSeeker™ Handheld Sensor

The GreenSeeker™ handheld sensor is an easy-to-use optical sensor that instantly measures plant health and vigor in terms of NDVI readings. The sensor emits brief bursts of red and infrared light, then measures the amount of each type of light reflected back from the plant. NDVI is related to vegetation because healthy green plants absorb most of the red light and reflect the infrared light. The strength of the detected light is a direct indicator of the health of the crop.

How to use the GreenSeeker™ handheld sensor. Point the sensor towards the ground then press and hold the trigger button located near the handle of the sensor (Figure 1). The sensor continues to sample the scanned area as long as the trigger remains engaged. When the trigger is released, the sensor displays the measured value in terms of an NDVI reading (ranging from 0.00 to 0.99) on its LCD display screen for 10 seconds. Make sure to have a pen and a paper to record the data, since information cannot be stored in the sensor.

Figure 1. The GreenSeeker™ handheld sensor.

How to collect NDVI readings? Prior to applying fertilizer, collect NDVI readings from both N-rich strip and farmer practice plots at least 10 feet to 20 feet apart. Walk approximately 100 paces at the center of each plot. To ensure accuracy of the readings, hold the sensor 24 inches to 48 inches (60 cm to120 cm) above the crop canopy while the trigger is pulled. Avoid sampling in areas that are unrepresentative of the remaining acres, including areas of poor crop stand.

II. Sensor-Based Nitrogen Rate Calculator

What information do I need?

1. NDVI readings from the N-Rich Strip and Farmer's Practice field
2. Planting date

Where do I start?

Step 1. Go to the Sensor-based nitrogen rate calculator webpage.

Either google "NUE" or go to the website: nue.okstate.edu. Once at the website, go to the NUE tools and click on the "Sensor Based Nitrogen Rate Calculator" button (Figure 2a). This will bring a drop-down menu of options (Figure 2b. As of 2015, it has 32 options). Choose the crop of interest. For example, "Winter Wheat (US Grain Belt)." This will bring up the online calculator. Once on the online calculator webpage, there will be an input and output section. Scroll down to the bottom of the page, if located in the state of Oklahoma, click "Within Oklahoma" button. This will allow access to the Mesonet site, which gives the readings of temperature and growing degree days (GDD). This information is very important in the calculation of the N rate. That is also where the planting date becomes important.

Step 2. Enter required data in the input section (Figure 3).

- **Planting date.** Date of wheat planting.
- **Day prior to sensing.** The day prior to sensing is necessary because this calculator relies on weather data from the Oklahoma Mesonet. Since Mesonet has not compiled the weather data for the current day (the day being sensed), enter the date prior to sensing.

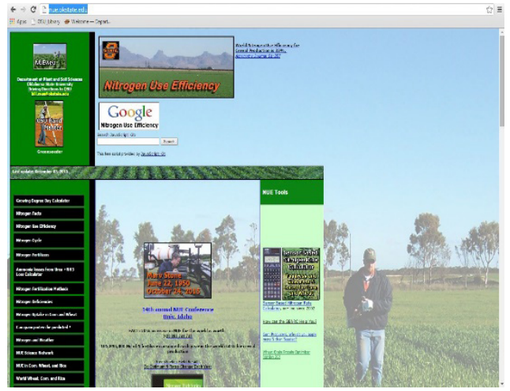

Figure 2a.

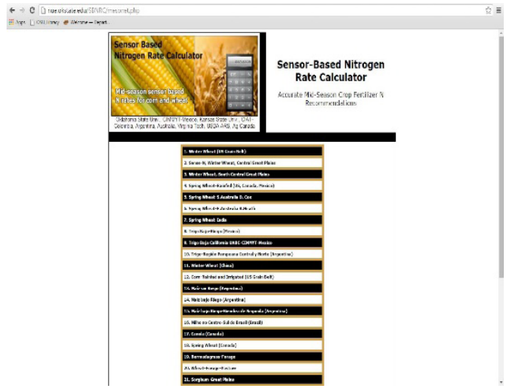

Figure 2b.

Figure 2.

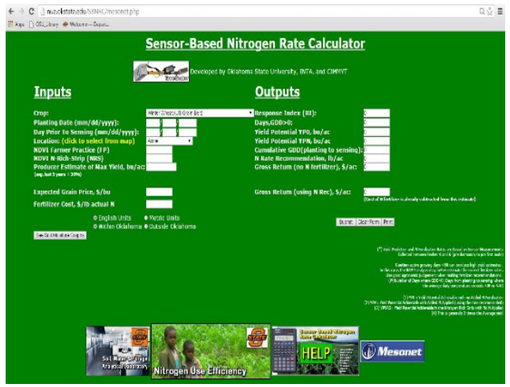

Figure 3. Fill out required data.

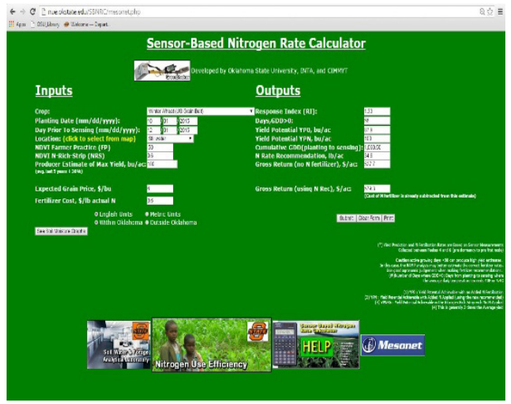

Figure 4. Outputs.

- **Location.** Enter the location or choose the closest Mesonet site to the field of interest.
- **NDVI farmer practice.** This would be from an area in the field adjacent to where the N-rich strip was placed and that is representative of the rest of the field.
- **NDVI N-Rich Strip.** This is the NDVI reading from the N-rich strip plot.
- **Producer estimate of max yield.** Should be at least two to three times greater than the maximum yield for a field. The need for this input is to avoid fertilizing for unrealistic yields.
- **Expected grain price and fertilizer cost.** These numbers needs to be filled out, but do not make a difference in the N rate that is recommended. It is something that can be used when deciding whether or not applying fertilizer is economical.

For growers outside the state of Oklahoma, you must calculate GDD, DFP, or CumGDD. The best method is to access a local weather or NOAA station.

GDD is computed using the formula: [(Tmax-Tmin)/2] – Tbase

Where: Tmax, Tmin and Tbase are the maximum temperature, minimum temperature and base temperature, respectively.

DFP – Days from planting to sensing

CumGDD – Cumulative growing degree days from planting to sensing were GDD is greater than zero.

Step 3. Click submit. This will give you the outputs (Figure 4).

What do these output values mean?

- **Response index.** Response in yield to additional nitrogen fertilizer. The response index is essentially the NDVI of the N-rich strip divided by the NDVI of the farmer practice. If this is 1.33, it means an increase of 33 percent can be achieved if fertilizer is applied, but does not provide the N rate that should be applied.
- **Days, GDD>0**. Number of days the winter wheat has grown since it was planted.
- **Yield potential, YP0.** Possible attainable yield without fertilizer.
- **Yield potential, YPN.** Possible attainable yield when N fertilizer is applied.
- **Cumulative GDD.** Value used for summer crops and winter canola. For winter wheat it is not important.
- **N rate recommendation.** Amount of N fertilizer needed to attain the YPN.
- **Gross return (no N fertilizer).** The total expected rate of return with no N fertilizer.
- **Gross return (using N Rec).** The total expected rate of return when the N rate recommendation is used.

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