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Green Seeker

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Dr. Akhila Nand Dubey

Assistant Professor-cum-Junior Scientist, Department of Soil Science & Agricultural Chemistry,
Rabindra Nath Tagore Agriculture College, Deoghar, Birsa Agricultural University, Ranchi

Precision agriculture, based on knowledge and information, is a new combined technology for the scientific management of modern agriculture. It is a complete system that maximizes available agricultural resources, reduces pollution, protects the environment and promotes sustainable agriculture (Reddy and Reddy, 2015). Precise nitrogen management is one of the best methods. There are several methods of real-time nitrogen fertilization, i.e. leaf color chart, soil test plant development meter or chlorophyll meter, green seeker.

Green Seeker is an integrated optical sensor based variable rate application and mapping system that measures the nitrogen requirements of crops. This technology was developed at Oklahoma State University in the United States and was approved by N Tech Industries (www.ntechindustries.com) in 2001. The sensor based on the technology of light-emitting diodes (LEDs) to detect red light (660nm) and produce near infrared light (780nm). Plant chlorophyll absorbs red light as a source of energy during photosynthesis. Healthy plants absorb more red lights and show a closer infrared NIR. Biomass produced per day, as measured by Normalized Difference Vegetation Index (NDVI) measurements using optical sensors, is a reliable predictor of yield potential. NDVI is calculated from the red and near infrared band. This we can observe to physical inspection of plants related to plant biomass, crop production, plant nitrogen, plant chlorophyll, water stress, plant disease, and insect control. This practices of fertilizer applications to be used more efficiently, which benefits both the farmer and the environment.

Green Seeker is a non-destructive method to precisely estimate the amount of nitrogen required based on specific plant and site conditions. The combination of the prescribed N dose at the beginning of planting, rooting and the modified N dose induced by the Green Seeker optical sensor at different stages of different crops could be used to achieve high yield as well as N use efficiency. It also enhance biomass per day, as measured by NDVI measurements using optical sensors, is a reliable predictor of yield capacity. Green Seeker contributes to the expected performance over traditional nitrogen application methods.

Figure- Green Seeker

Features of Green Seeker

- The sensors emit short bursts of red and infrared light to measure the amount of each type of light reflected and emitted by the plant.
- The sensor will continue to sample the scanned area as long as the trigger is activated.
- The sensor displays the measured value on the LCD screen with NDVI readings (range 0.00 to 0.99).
- The intensity of the light detected directly indicates the health of the crop. The higher the reading, the healthier the plant
- Save money by applying the necessary fertilizers for the health of your ideal crop
- Reduce the use of chemicals to reduce the impact on the environment
- Affordable data collection allows any operation to benefit from objective decision making
- No additional equipment required - connect via Bluetooth using free apps and mobile devices you already own

Use of Green Seeker for Prescriptive N Dose at Standing Crop

In India, farmers applied half of the total dose of 120 or 150 kg N ha-1 at planting and the other half at the root initiation stage consistent with the first irrigation event 3-4 weeks after planting Processing reference configured and configured to evaluate the management of the base of green seekers N.

Sensor measurements were taken from treatment with different levels of nutrient N within each replicate. Spectral reflection, expressed as Normalized Difference Vegetation Index (NDVI), was measured using a Green Seeker handheld optical sensor unit (N Tech Industries Incorporation, Ukiah, CA, USA). The spot unit sits 0.6-0.01m when held approximately 0.6-1.0m from the illuminated surface. The sensor dimensions remain nearly constant over the sensor height range. The sensor unit has self-illuminating red (656 nm, full width at half maximum (FWHM)) and NIR (774, FWHM) bands (http://www.ntechindustries.com/datasheets.php,) Certified on September 1, 2008). The device uses proprietary technology to measure the percentage of light emitted in the detection area returned to the sensor (peak reflectivity) and to calculate NDVI as follows

$$NDVI = \frac{F_{NIR} - F_{Red}}{F_{NIR} + F_{Red}}$$

Where F_{NIR} and F_{Red} are respectively the fractions of emitted NIR and red radiation reflected back from the sensed area. The sensor outputs NDVI at a rate of 10 readings per second. The sensor was passed over the crop at a height of approximately 0.9 m above the crop canopy and oriented so that the 0.6 m sensed width was perpendicular to the row and centered over the row. With advancing stage of growth, sensor height above the ground increased proportionally. Travel velocities were at a slow walking speed of approximately 0.5 m s^{-1} resulting in NDVI readings averaged over distances of <0.05 m.

The NDVI measurements form the N rich strip ($NDVI_{NRICH}$) and the test plots ($NDVI_{TEST}$) were used to calculate response index (RI) to fertilizer N (Johnson and Raun, 2003) as:

$$RI = \frac{NDVI_{NRICH}}{NDVI_{TEST}}$$

As advocated by Raun *et al.* (2001 & 2002) the yield of the test plot achievable by applying additional fertilizer N (YPn) was estimated as the product of YP_0 and RI. The N fertilizer algorithm to compute fertilizer N to be applied using Green Seeker optical sensor (Raun *et al*., 2002) is based on determining the difference in estimated N uptake between YPn and YP_0. It was done by estimating the mean N content of the grain at harvest and multiplying this number by YPn (kg ha^{-1}) and YP_0 (kg ha^{-1}), respectively. The difference in N uptake between YP_0 and YPn was then divided by efficiency factor (taken as 0.5 to be reasonably achievable under South Asian conditions) to work out the fertilizer N dose using the equation:

$$\textbf{Fertilizer N dose (kg ha-1)} = \frac{1.85 \times (YP_n - YP_0)}{100 \times 0.5}$$

Innovative fertilizer management methods aimed at efficient N management are committed to maintaining the soil resource base, increasing the profitability of various crops, achieving high yields, and efficient N use. To do this, they must be integrated both normative and corrective strategies. Biomass produced per day, measured by NDVI measurements using optical sensors, such as wheat crops, is a reliable predictor of potential yield. Using the yield potential and response index obtained from NDVI measurements in N-rich test plots and strips, modified rates of N fertilizer applied to wheat crops for 5 to 6 weeks are soil N supplies and specific expected returns per year. In general, the combination of moderately formulated N fertilizer and green trace-based N fertilizer always produces significant savings compared to general recommendations, but has not reduced productivity.

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