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REAL TIME NITROGEN MANAGEMENT IN CEREALS

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Crop nutrient management, among various production practices, plays a pivotal role in enhancing productivity and quality of produce. Nitrogen being a dominant nutrient particularly in cereals. It have a important role in crop production, but when used in excess, it pollutes the environment. Current fertilizer N recommendations in India typically consist of higher rates and timings for large scale cereal production. These “blanket” recommendations have served their purpose in producing good yields, but they are reduces the capacity to increase nutrient use efficiency and many times, to ensure high yields, farmers apply fertilizer N rates even higher than the blanket recommendation. Over application of N in cereal crops leads to further lowering of N fertilizer recovery efficiency. Use of N in excess of crop requirement and inefficient splitting of N applications are the main reasons for low N use efficiency in crops. Since improving the synchrony between crop N demand and the N supply from soil and/or the applied N fertilizer is likely to be the most promising strategy to increase N use efficiency, the split application of fertilizer N is going to remain an essential component of fertilizer N management strategies in rice. Real-time corrective N management is based on periodic assessment of plant N status, and the application of fertilizer N is delayed until N deficiency symptoms start to appear. Thus, a key ingredient for real-time N management is a method of rapid assessment of leaf N content that is closely related to photosynthetic rate and biomass production and is a sensitive indicator of changes in crop N demand within the growing season.

Various state of the art techniques in nitrogen nutrient recommendation aim to reduce fertilizer dose or tailor the supply of nutrient for the target yield besides enhancing use efficiency of applied fertilizers to address cost effectiveness and environmental concerns. Decision support tools, therefore, focus on real time plant nutrient supply as per crop needs. Leaf color chart (LCC) is a simple, cheap, and user friendly tool to manage N more precisely. Again, Chlorophyll meter (SPAD) thresholds and optical sensors like Green Seeker enable nutrient recommendation based on chlorophyll content, an indirect measure of plant nitrogen content. The LCC threshold of 4 or 5 could be adopted to save 20-50 kg N/ha particularly in crops with greater N demand or in crops grown under environment prone to N loss. Various researches carried out so far using these techniques reveal that in addition to enhancement of productivity, agronomic, physiological and recovery efficiencies are also improved in field crops. Therefore, there is a need to sensitize scientists, extension personnel, farmers and other stakeholders on LCC, chlorophyll meters, optical sensors and various web based ready reckoners for effective nutrient management in cereals. So in this background, the present this is a attempts to highlight certain pertinent issues on the necessity to use proven decision support tools to enhance fertilizer use efficiency with emphasis on economics and environment.

Leaf colour chart (LCC)

leaf color is a good indicator of leaf N content, the LCC, developed through collaboration of the International Rice Research Institute (IRRI) with agricultural research systems of several countries in Asia, serves as a visual and subjective indicator of plant N deficiency. With its 4- or 6-color panels of different shades of green, the LCC is used as a reference tool and is becoming popular as an inexpensive and easy-to-use tool for estimating leaf N content and managing fertilizer N in rice. LCC-based, real-time N management can be practiced in rice by monitoring leaf color at 7- to 10-day intervals during the growing season. Fertilizer N is applied whenever the leaves are less greenish than a threshold LCC value, which corresponds to a critical leaf N content (Alam *et al*., 2005). The LCC is also suitable for maize & wheat providing farmers with a good diagnostic tool for detecting N deficiency. The leaf color chart (LCC) is an innovative cost effective tool for real-time or crop-need-based N management in Rice, Maize and Wheat. LCC is a visual and subjective indicator of plant nitrogen deficiency and is an inexpensive, easy to use. It measures the leaf color intensity which is related to present leaf N status. LCC is an ideal tool to optimize N use in Rice/Maize/Wheat at high yield levels, irrespective of the source of N applied, viz.,organic manure, biologically fixed N, or chemical fertilizers. Thus, it is an eco-friendly tool in the hands of farmers.

LCC (Leaf color chart)

Soil and plant analysis development (SPAD) meter

The SPAD meter is a hand held, simple, quick and non-destructive *in-situ* tool for measuring relative content of chlorophyll in leaf that is directly proportional to leaf N content. Hence, the SPAD chlorophyll meter is used to diagnose the N status in crops and determine the right time of N application. The SPAD meter measures how much of the light of a certain wavelength is absorbed (chlorophyll molecules) by the leaf sample. The instrument measures transmission of red light at 650 nm, at which chlorophyll absorbs light, and transmission of infrared light at 940 nm, at which no absorption occurs, before the measurement, instrument is calibrated-transmission is measured with no leaf inside. Minolta SPAD-502 chlorophyll meter is used to assess the nitrogen status of crops. It measures the greenness of leaves. Greenness is determined by the chlorophyll and nitrogen content. However, it is too expensive to be owned by farmers in developing countries which restricts its wide spread use, (Ghosh *et al*.,2013).

Optical sensors for N recommendation:

Light absorption and reflection are the characteristics of leaf which is typical in every crop and/or variety under a particular set of growing conditions. Therefore, scientists use this SPAD Meter characteristic as an indicator of plant nitrogen stress. Since chlorophyll absorbs

red light, low reflectance and more absorption in this band indicates a healthy plant. Conversely, *t*he cellular structure of healthy plants reflects light in the near infrared band. When plants are under stress, red band reflectance increases and near infrared band reflectance decreases and *vice-versa* happens if plants are not stressed. The Normalized Difference Vegetation Index (NDVI) is a unit measured by an optical sensor which is based on the reflectance at red and near infrared (NIR) regions. Optical sensor readings can be used for obtaining NDVI using a hand held Green Seeker TM, (Balasubramanian *et al*., 2000)

NDVI measurements can range from -1 to 1, with higher values indicating better plant health. It has the ability to predict yield potential of crops, *viz.*, rice, maize.

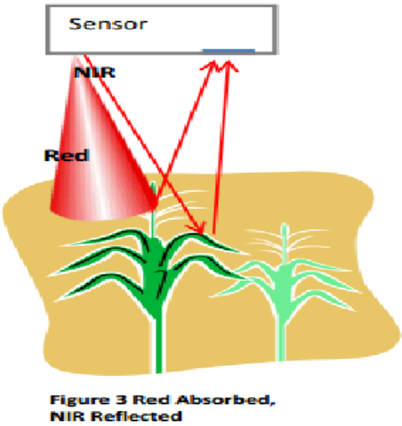

Fig. Functioning of optical nitrogen sensor

Optical N sensor

References:

Alam, M.M., Ladha ,J.K., Rahaman, K. S., Foyjunnessa, H.R., Khan, A.H., Buresh, R.J. (2005). Leaf Color Chart for Managing Nitrogen Fertilizer in Lowland Rice in Bangladesh," *Agronomy Journal*. **97**(3): 949-959.

Balasubramanian, V., Morales, A. C., Cruz, R. T., Thiyagarajan, T. M., Nagarajan, R., Babu, M., Abdulrachman, S. and Hai, L. H., (2000). Application of the chlorophyll meter (SPAD) technology for real-time N management in rice. A review, *IRRI Notes*, **251**: 4 -8.

Ghosh, M., Dillip, K. S., Madan, K. J. and Virendra, K. T., (2013). Precision nitrogen management using chlorophyll meter for improving growth, productivity and N use efficiency of rice in subtropical climate. *Journal of Agriculture Science*., **5**(2): 253-266.