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Evaluation use leaf color chart in rice for nitrogen management

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Rice

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A B S T R A C T

Nitrogen is the major nutrient limiting the high yield potential of rice cultivars, Farmers generally apply fertilizer nitrogen in several split applications, that results in high pest and disease incidence and serious lodging. Precise application of nitrogen fertilizer based on plant need and location in the field greatly improves fertiliser use efficiency in rice. One of the recently introduced nitrogen management approach was estimating the leaf nitrogen concentration by the measurement of leaf greenness. The leaf color chart (lcc) is an easy-to-use and inexpensive diagnostic tool for monitoring the relative greenness of a rice leaf as an indicator of the plant N status . Inexpensive leaf color chart(lcc) have proved quick and reliable tools to decide the time when fertilizer n needs to be applied to the crop. the use of the lcc ,farmers can apply N at the right time,thereby increasing the productivity and profitability of direct rice and reduction of used nitrogen fertilizer.

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Introduction

Rice (Oryza sativa L.) is being one of principal food crops and utilized by one third of world population. It provides some 700 calories per person, mostly residing in developing countries(Barai tari et al,2009). The International Rice Research Institute (IRRI 2000) studied the food problem in relation to world population, and they predict that 800 million tons of rice will be required in 2025 (Kubo &Purevdorj,2004). Nutrient management is a major component of a soil and crop management system(Nedunchezhiyan & Laxminarayan, 2011). Increase in fertilizer nutrient input, especially N fertilizer, has contributed significantly to the improvement of crop yields in the world(Peng et al,2010). Knowing the required nutrients for all stages of growth and understanding the soil's ability to supply those needed nutrients is critical to profitable crop production (Nedunchezhiyan & Laxminarayan, 2011). Nitrogen is the major nutrient limiting the high yield potential of rice cultivars (Shrestha & Maskey,2005). Farmers generally apply fertilizer N in several split applications, but the number of splits, amount of N applied per split, and the time of applications vary substantially. The apparent flexibility of rice farmers in adjusting the time and amount of fertilizer application offers potential to synchronize Nitrogen application with the real-time demand of the rice crop(Witt et al, 2005). Farmers generally apply too much N (and little P and K and other nutrients) that results in high pest and disease incidence and serious lodging. The consequence of high N application is high pesticide use to control pests, more expenditure on pesticides, and reduced yield and poor grain quality due to lodging(Alam et al,2007). site specific nitrogen management has the potential to increase fertilizer use efficiency as well as grain yield in the farmers fields (Nath et al,2013). Improved Nitrogen management and balanced fertilization are key components of the site-specific nutrient management approach development(Witt et al, 2005). Current fertilizer nitrogen(N) recommendations for irrigated rice (Oryza Sativa L.)Typically consist of fixed rates and timings for large rice growing tracts having similar climate and landforms. These Blanket recommendations have served the purpose well but cannot help increase N Use efficiency beyond a limit. Due To large field-to-field variability of soil N supply, efficient use of N fertilizer is not possible when broad-based blanket recommendations for fertilizer N Are used (Singh et al, 2012). Precise application of N fertilizer based on plant need and location in the field greatly improves fertiliser use efficiency in rice. The optimum use of N can be achieved by matching N supply with crop demand. Farmers generally use leaf colour as a visual and subjective indicator of the rice crop's nitrogen status and need for N fertilizer application. Leaf colour intensity is directly related to leaf chlorophyll content which, in turn, is related to leaf N status. The concept is based on results that show a close link between leaf chlorophyll content and leaf N content(Alam et al,2007). One of the recently introduced N management approach was estimating the leaf N concentration by the measurement of leaf greenness. Among the different tools available to measure the leaf greenness, the non-destructive measurement of leaf green colour intensity using Leaf Green Color Charts (LCC) are gaining importance(Ravi et al,2007). A potential solution has been tried to regulate the timing of Nitrogen application in rice using a Leaf Color Chart to determine

the plant Nitrogen(Alam et al,2007). Advances in N management for rice include adjustment of the early N application to match the relatively low demand of young rice plants and varying rates and distribution of fertilizer N within the growing season to match crop demand for supplemental N. In this respect, the leaf N status of rice, which is closely related to photosynthetic rate and biomass production, serves as a sensitive indicator of the crop demand for N during the growing season(Singh et al, 2012).

What is Leaf Color Chart (Lcc)?

A leaf color chart developed in in japan,it used to measure green color intensity of rice leaves,serves as cheaper tool to assess the nitrogen requirements by non destructive method(Nachimuthu et al, 2007), is being standardized with chlorophyll meter, the lcc can be compared with the chlorophyll meter to determine their relative accuracy of assessing the leaf n status(IRRI,2003). leaf color chart(LCC) is made of high quality plastic material(8"×3")(singh et al,2006), It consist of six colour shades ranging from light yellowish green(no1) to dark green(no6) colour strips fabricated with veins resembling those of rice leaves (Nachimuthu et al, 2007). (Sathiya et al,2009), (ramanathan et al,2003).The LCCs used in Asia are typically a durable plastic strip about 7 cm wide and 13 to 20 cm long, containing four to six panels hat range in color from yellowish green to dark green(Hushmandfar & Kimaro,2011). These include use of a Leaf Color Chart (LCC), which relies on visual comparison between leaf colour and a colour chart to assess the N status of certain plants(Ali et al,2013). It is a simple-to-use and inexpensive and can even help farmers who are not highly trained in making nitrogen recommendations (singh et al,2010) Inexpensive leaf color chart(lcc) have proved quick and reliable tools to decide the time when fertilizer n needs to be applied to the crop(singh,2008). In the real-time approach prescribed of fertilizer N is applied whenever the color of rice leaves falls below the critical lcc value.the critical value might fall between two existing panels of the lcc ,but guidelines can be adjusted so that color panels of the lcc, will not have to be changed(Witt et al 2005).

How to use Leaf Colour Chart (LCC)?

Randomly select at least 10 disease-free rice plants or hills in a field with uniform plant population.

Select the topmost fully expanded leaf from each hill or plant. Place the middle part of the leaf on a chart and compare the leaf color with the color panels of the LCC. Do not detach or destroy the leaf.

Measure the leaf color under the shade of your body, (direct sunlight affects leaf color readings). If possible, the same person should take LCC readings at the same time of the day every time.

Determine the average LCC reading for the selected leaves.

Take reading in the morning (8-10AM) or in the after noon(2-4 PM) preferably by the sameperson from randomly selected fully expanded new leaves.

Under the shade, measure the color of each leaf by holding the LCC and placing the middle part of the leaf on the to pof the color stripe for comparison.

If the color of the leaf falls between the two shades, then take mean of the two values.

Take reading a tan interval of7-10 days string from 2 weeks aftert ransplanting up to star to fflowering.

Generally critical value for semi dwarf high yielding varieties 4.0.If the average value fall below 4.0,top dres N fertilizer(20-30 kg / ha) to correct N deficiency.

Alternately,if more than five leaves show reading below the set critical value,top dress N fertilizer to correct N deficiency(Regmi,2006),(IRRI,1996),(Ramanathan et al,2003).

Leaf Color Chart (LCC) for Fertilizer Nitrogen Management in Rice

Nitrogen application should coincide with crop growth and its requirement. The leaf color chart (LCC) is an easy-to-use and inexpensive diagnostic tool for monitoring the relative greenness of a rice leaf as an indicator of the plant N status,The LCC can be used to guide the application of fertilizer N to maintaian optimal leaf N content for achieving high rice yield with effective N management(Sathiya et al,2009). leaf color is generally used as a visual and subjective indicator of the rice crops need for nitrogen(N) fertilizer .leaf color intensity is directly related to leaf chlorophyll content and leaf N status. here is a tool that can help farmers improve their decision-making process in N management(Yoseftabar et al, 2012). Application of N based on LCC value found to be efficient in economizing N requirement with increased nitrogen use efficiency as compared to conventional practices under Tamil Nadu condition(Ravi et al,2007). (Budhar & Tamilselvan,2003) at the study leaf color chart-based N management in wet–seeded rice revealed that the use of the lcc can prevent under or over fertilization of direct seeded rice crops,also saying by using the lcc, farmers can apply N at the right time,thereby increasing the productivity and profitability of direct wet-seed rice. The lcc determines the right time of N application to the rice crop by measuring leaf color intensity which is related to leaf N status. in addition ,it also helps optimize N use at reasonably high yield levels, ragged less of N source identifying the correct threshold values of the lcc is essential as they differ according to location,season variety and rice ecosystem. our investigation was conducted to study crop need-based N management using the lcc in irrigated rice (Budhar,2005).The use of LCC for scheduling N application may not be uniformly applicable to all varieties that differ in

inherent leaf color and regions that differ in climate, thereby necessitating individual or group standardization in different cultivated areas (Hushmandfar & kimaro,2011). (Yoseftabar et al,2012) showed that the Split application N fertilizer and using leaf color chart resulted showed lcc values increase by application N fertilizer at different growth stage. Thus,used lcc in rice field and split application N fertilizer based lcc values can reduction of used nitrogen fertilizer. the Real-time N management based on applying fertilizer N whenever leaf color was less than critical greenness resulted in application of 60 to 120 kg N/ha with rice yields being equivalent to those obtained with the blanket recommendation(Singh et al,2010). (Sen et al,2011) in study the leaf colour chart vis-a-vis nitrogen management in different rice genotypes showed that Critical or threshold LCC values are known as those that optimize simultaneously the grain yield and NUE. It has been reported that higher agronomic efficiency of N with consistent high grain yield could be regarded as an indicator for efficient N management in rice. Nitrogen management based on LCC shade 4 which received 20 kg N ha-1 each time with a total dose of 60 kg N ha1 recorded comparable yield with 120 kg N ha-1 in four equal split, with saving of 50% N fertilizer (Hushmandfar & Kimaro,2011). The results show that for many farmers, sub-optimal nitrogen management is a key constraint to increasing yield The fertilizer nitrogen applied to the rice crop, based nitrogen management, the LCC values recorded as per the standard procedure at weekly intervals starting from 14 DAT to flowering. Whenever the LCC values were found to be below the fixed critical level, recommended quantity of fertilizer N was applied(Ravi et al,2007)

Conclusions

Nitrogen application should coincide with crop growth and its requirement. The leaf color chart (LCC) is an easy-to-use and inexpensive diagnostic tool for monitoring the relative greenness of a rice leaf as an indicator of the plant N status,Leaf colour chart is a low cost tool to assist farmers and effective in improving nitrogen fertilizer management. Using LCC helped farmers estimate plant nitrogen demand, to produce high rice yields.The general idea is that a critical leaf colour has to be maintained for optimal growth, and the LCC provides guidance when to apply nitrogen fertilizer to avoid nitrogen deficiency. The critical leaf colour depends on the varietal group and crop establishment method. The optimum use of N can be achieved by matching N supply with crop demand. Farmers generally use leaf colour as a visual and subjective indicator of the rice crops nitrogen status and need for N fertilizer application The LCC is used at critical growth stages to decide whether the recommended standard nitrogen rate needs to be adjusted up or down based on the leaf color. Consequently, improving nitrogen management can help produce greater yields.

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