



CUSTOMIZED LEAF COLOUR CHART (CLCC): A PARADIGM SHIFT IN REAL TIME NITROGEN (N) MANAGE- MENT IN LOWLAND RICE



भाकृअनुप-राष्ट्रीय चावल अनुसंधान संस्थान, कटक, ओडिशा
ICAR-National Rice Research Institute, Cuttack, Odisha

Introduction

Customized leaf colour chart (CLCC) for nitrogen management in rice developed at NRRI Cuttack based on the fact that greenness of leaf is associated with leaf N content which is closely related to photosynthetic rate and biomass production. The five panels of CLCC represent gradual transition of color from yellowish green to dark green matching the color range of rice leaves that cover a continuum from leaf N deficiency to excessive leaf N content. The CLCC is an effective, low-cost, easy to use diagnostic tool which can be used by the farmers to monitor the relative greenness of rice leaf as an indicator of the leaf N status and decide when and how much N should be applied to the crop. This real time N management tool ensures yield and N use efficiency.



Fig. 1. Five panel customized leaf colour Chart

Enhancement of yield

Customized leaf colour chart (CLCC) based N application enhanced yield by 10.3-13.3 % and 9.9-10.9 % over conventionally applied urea (RDF urea) in direct seeded (DSR) and transplanted rice (PTR), respectively. Yield enhancement with neem coated urea (NCU) when applied conventionally was 7.1-13.4 % and 6.8-10.0 % respectively. Whereas NCU when applied on the basis of CLCC, the yield enhancement over conventionally applied urea was 21.2-22.9 % and 14.6-15.9 % respectively for DSR and PTR.

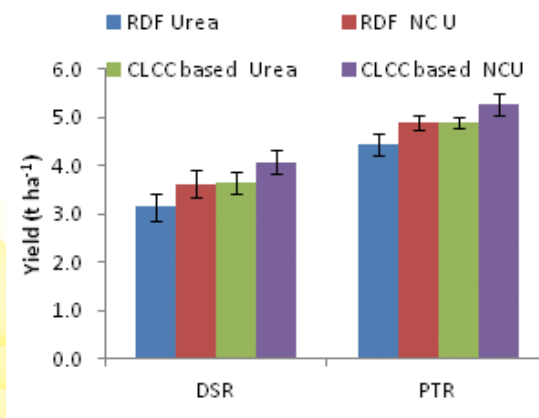


Fig. 2. Effect of CLCC based N application on yield in direct seeded and transplanted rice (Vertical bars represent \pm standard error of the mean)

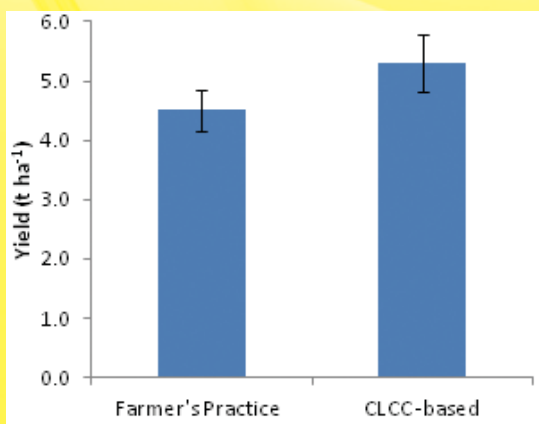


Fig. 3. Yield comparison between farmers' practice and CLCC recommendation (Vertical bars represent \pm standard error of the mean)

Results farmer's field trial in villages of Jagatsingh pur district showed as compared to prevailing farmer's practice in the region (Application of 60-80 kg of N mostly in the form of gromor and DAP, 70-80 % of which is applied by maximum tillering stage. 10-20% N is applied during panicle initiation (PI) stage), CLCC based N application produced 11.2-18.7 % more yield as compared to farmer's practice. Farmer's feedback data obtained from deputy directors of agriculture (DDA) from different district indicated yield advantage of 5-20% due to use of CLCC

Improved Nitrogen Use efficiency

As compared to RDF urea, CLCC based urea enhanced N recover efficiency (RE_N) by 10.7-12.4 % and 9.1-12.2 % in DSR and PTR, respectively. The increase of RE_N with NCU applied conventionally was 6.6-8.9 % and 6.2-6.7 % respectively. Whereas NCU when applied on the basis of CLCC, the increase in RE_N over conventionally applied urea was 16.3-18.0 % and 11.6-14.6 % respectively for DSR and PTR.

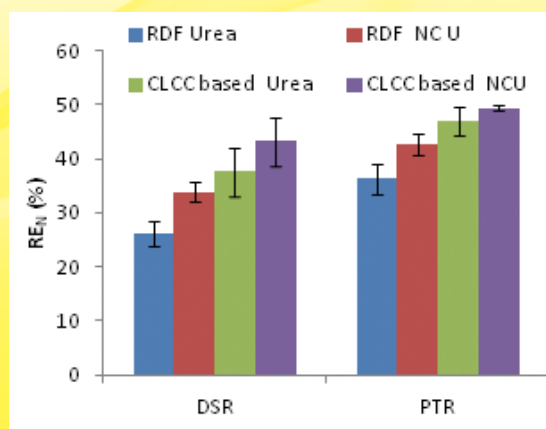


Fig. 4. Effect of CLCC based N application on N recovery efficiency (RE_N) in direct seeded and transplanted rice (Vertical bars represent \pm standard error of the mean)

Reduced N loss

N₂O emission

Application of N on the basis of CLCC reading could reduce N₂O (a potent greenhouse gas with global warming potential more than 300 times that of CO₂) emission by 13 -21 % as compared to conventional N application in puddled transplanted rice.

NO₃ leaching

As compared to conventionally applied urea, CLCC based urea reduced NO₃-N leaching by 29.8 % in direct seeded aerobic rice. Neem coated urea could reduce NO₃-N leaching by 18.6 % as compared to urea when applied conventionally. Whereas NCU when applied on the basis of CLCC recommendation the extent of reduction was as high as 39.8%.

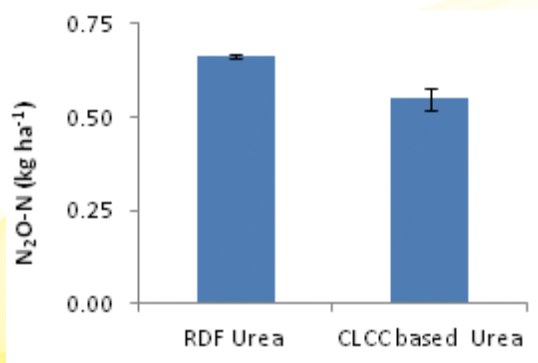


Fig. 5. Effect of CLCC based N application on N recovery efficiency (RE_N) in direct seeded and transplanted rice (Vertical bars represent \pm standard error of the mean)

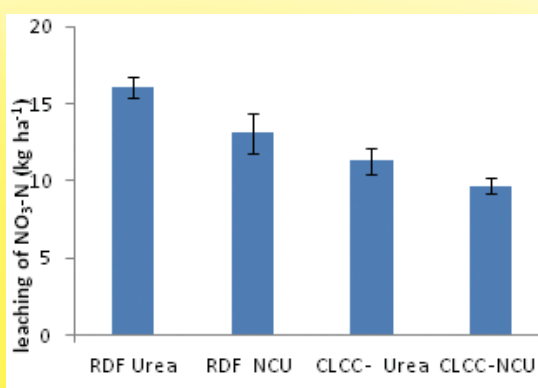


Fig. 6. NO₃-N leaching from DSR under different N management (Vertical bars represent \pm standard error of the mean)

Saving of fertilizer

Since CLCC based N recommendation could increase N recovery efficiency from applied urea by 9.1-12.2 % as compared to conventional practice in transplanted rice it has the potential to save 18.5-27.3 % urea to produce same level of yield. Field trials also demonstrated application of 75% of recommended N on the basis of CLCC reading produced similar yield as that of 100% RDF, thereby saving 25% of fertilizer.

Monetary Benefit

Results of on station and farmers' field experiment showed that at same level of N application yield advantages of 0.5-0.7 t ha⁻¹ and 0.5-1.0 t ha⁻¹ could be achieved that following CLCC recommendation over RDF application and farmer's practice, respectively. That can lead to monetary benefits of Rs 6680-10080/- and Rs 7776-

14544/- respectively per hectare. In addition to this with a potential of cutting down approximately 25 % total fertilizer consumption in low land rice, it can save upto Rs. 1514/- crores from the total urea subsidy bill of Govt of India.

Upscaling option

The CLCC is commercialized and an MOU was signed with M/S Nitrogen Parameters, Chennai for manufacturing and distributing the CLCC. The State Government of Uttar Pradesh has included this technology in their RKVY programme.



Fig. 7. Signing of Memorandum of Understanding (MOU) with Nitrogen Parameters



Fig. 8. Training and distribution of CLCC to farmers

In the same line, it can be included in the various central and state government programmes like NFSM, RKVY, BGREI etc. in other states. The CLCC may be included as a recommendation in the government programme on 'Soil Health Card' for the application of nitrogenous fertilizers in rice.

Adoption

The unit price of CLCC is Rs. 110/- which includes five panel chart and a folder with the recommendation of nitrogen application for different rice ecologies. Various government agencies from Odisha, Bihar, Chhattisgarh, Madhya Pradesh, Jharkhand, West Bengal and Uttar Pradesh have procured the CLCC and till date about 48000 pieces of CLCC is sold. Trainings have been conducted for various stakeholders including farmers. Based on the farmers' field trials and feedback obtained through interaction with state government functionaries, nitrogen application based on CLCC recommendation has resulted in increase of rice yield, saving of nitrogenous fertilizer, increase in the use efficiency of nitrogen application, reduction in the emission of greenhouse gases and high benefit cost ratio.

Citation

A. K. Nayak, Sangita Mohanty, R. Raja, Mohammad Shahid, B. Lal, Rahul Tripathi, P. Bhattacharyya, B. B. Panda, Priyanka Gautam, V. Kasthuri Thilagam, Anjani Kumar, J. Meher and K. S. Rao (2017). Customized leaf colour chart (CLCC): A paradigm shift in real time nitrogen (N) management in lowland rice. Success Story, ICAR-National Rice Research Institute, Cuttack, p.4.



Published by:

Dr. Himanshu Pathak, Director
ICAR-National Rice Research Institute
Cuttack-753006, Odisha
Phone No. - 0671-2367757;
Email - director.nrri@icar.gov.in