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Effect of Nutrient and Land Management Strategies in rice on yield and Soil Fertility Under Island Condition

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Abstract

Rice is the most important food grain grown all over the tropical world. Nitrogen is one of the most yield-limiting nutrients for rice production, and proper nitrogen fertilizer management is critical for high yields. Real-time N management for rice was standardized for canopy development, increase biomass accumulation and yield formation based on leaf colour chart which also helped to monitor leaf N status and determine the timing of N application. The results showed that T_7 (5 t ha^{-1} of vermicompost and LCC based split application of slow release nitrogen) had significant effect on the growth and yield performance of paddy crop followed by T_3 (FYM and LCC based split application of slow release nitrogen) the application of 5 t ha^{-1} of when the threshold value of LCC is 3 in all the three stages.

Key words: *nutrient management, leaf colour chart, rainfed rice*

Introduction

Rice is the staple food of around half of world's population. The total rice area in the world is 153.80 million hectare of which 42.5 m ha in India with a production of 90 million tonnes (Mc Lean et al. 2002). However when compared to the world average the rice productivity in India is low. Further, there is also a growing concern about the stagnation in rice yield as the demand for food grain is growing due to population explosion there is urgent need to increase the production.

Nitrogen is one of the most yield-limiting nutrients for rice production, and proper nitrogen fertilizer management is critical for high yields. Rice production consumes approximately 20% of the total N fertilizer used for agriculture. This N fertilizer is often not effectively used by irrigated rice because of improper timing and rates of application resulting in losses. Traditional methods of fixed N fertilizer scheduling might be inappropriate for the maximization of fertilizer N-use efficiency in current rice production systems because these practices do not consider the dynamic nature of N supply and demand in irrigated rice ecosystems. Real-time N management was developed based on the physiology of rice leaf photosynthesis, tillering and leaf area growth to optimize canopy development and increase biomass accumulation and yield formation. Leaf colour chart (LCC) is very cost effective tool used to monitor leaf N status and determine the timing of N application in real-time N management.

Bijay Singh *et al.,* (2002) reported that plant need based N management through chlorophyll meter reduces N requirement of rice from 12.5 to 25%, with no loss in yield. Devkota *et al.,* (2008) found that the methods of N management and their interaction with varieties did not influence the yield of rice significantly. However, hybrid varieties consumed more nitrogen than inbred varieties, whereas 10-16% of nitrogen was saved by LCC based N management as compared to recommended practice. Jayanthi *et al*., (2007) revealed that application of recommended dose of nitrogen @ 20 kg N ha^{-1} at LCC-3 value at bi weekly observations after 21 days after rice emergence was found to be a better method of nitrogen management in rain fed rice.

Rice is grown in Andaman and Nicobar Islands since the beginning of organised settlement in the late 1950's. Rice is grown in these islands in an area of 11,000 ha with a productivity of 2.7 tonnes per ha^{-1}. North Andaman is the rice bowl of these islands with an area of 7300 ha with annual production of 21,250 MT. Rice being the staple food of the settler family, rice is grown in almost all the fields. However, the productivity of the paddy in North and Middle Andaman is low owing to flash floods, water logging/ submergence; low soil fertility and imbalanced fertilizer use and most of the farmers are small and marginal who cann't affords to use high inputs. Therefore it is essential to devise location specific production technology to increase the yield of rice without much wastage of nitrogen and other inputs. Jat *et al.,* (2011) advocated site-specific nutrient management to achieve the goals of improved productivity and higher N use efficiency (NUE). Leaf color charts and chlorophyll meters assist in the prediction of crop N needs for rice leading to greater N-fertilizer efficiency at various yield levels. In view of these the present study was conducted to ascertain the effect of best nitrogen management practices by using Leaf Colour Chart and a combination of organic and inorganic sources of nitrogen.

Materials and Methods

Study area

In the humid tropical islands of Andaman the climate is dominated by tropical conditions with little difference (< 5^0C) between mean summer and mean winter soil temperature. The soils are sandy loam to clay loam in texture. The soil moisture deficit is observed for a short period during January to March/April and the moisture availability for crop growth is more than 270 days which is adequate for moisture of the field crops and plantation tree crops. The area experiences Udic soil moisture and *iso-hyperthermic* soil temperature regimes. Plantations followed by rice, tubers, vegetables and pulses are the main crops grown here.

Details of technical programme

The study was carried out at farmers' field in Diglipur, North Andaman. The soil was slightly acidic (pH 6.1), non-saline (EC 0.4 dSm^{-1}), medium in organic carbon (0.5%), low in N, medium in P and K. The treatment schedule for the rice is as follows:

Crop	:	Rice
Variety	:	Jaya
Time of sowing	:	1^{st} fortnight of May
Fertilizer dose	:	90: 60: 40 NPK
Spacing	:	20 cm x 10 cm
Plot size	:	5.0 m x 4.0 m

Treatment details

T_1	Control
T_2	5 tonnes ha^{-1} FYM and 80 Kg N ha^{-1} (Basal 40 Kg N ha^{-1} and 40 Kg N ha^{-1}after 40 DAT)
T_3	5 tonnes ha^{-1} FYM and LCC based split using slow release N (Mud coated urea) when threshold value of LCC is 3
T_4	5 tonnes ha^{-1} FYM and LCC based split using slow release N (Mud coated urea) when threshold value of LCC is 5
T_5	5 tonnes ha^{-1} Vermicompost and LCC based split using Vermi compost i.e. thresh-old value of LCC is 3
T_6	5 tonnes ha^{-1} Vermi compost and LCC based split using Vermi compost i.e. thresh-old value of LCC is 5
T_7	5 tonnes ha^{-1} Vermi compost and LCC based split using slow release N (Mud coated urea) when threshold value of LCC is 3
T_8	5 tonnes ha^{-1} Vermi compost and LCC based split using slow release N (Mud coated urea) when the threshold value of LCC is 5