Environment & Ecology 35 (2) : 739—741, April —June 2017
Website : environmentandecology.com ISSN 0970-0420

Adoptability of N Management in Rice (*Oryza sativa* L.) to Mitigate the Ill Effects of Climate Change

RD Behera, C. Sarangi, SC. Mohapatra

Received 7 June 2016, Accepted 11 July 2016, Published online 27 July 2016

Abstract Rice is the staple food of India feeding over 70% of its population. Heat wave or extreme temperature events are projected to become more intense, more frequent and last longer. Some varieties do not switch over to reproductive phase due to extreme thermal stress. Nitrogen management plays a great role for this change. LCC is a very useful tool in determining this need of rice. Three N management practices T_1-80-40-40 N, P_2O_5 and K_2O kg ha^{-1}, T_2-Soil test based NPK and T_3-N as per LCC and P_2O_5, K_2O as soil test based in RBD were compared as to their effect on rice along with their biomass C fixation capacity and ability to reduce atmospheric CO_2 reduction and profitability in a field experiment at seven locations. The treatment N as per LCC and P_2O_5, K_2O as soil test based produced the maximum adoptability features.

Keywords Adoptability, N management, Rice, climate chage, LCC.

RD Behera[1], C. Sarangi[2*], SC. Mohapatra[3]
[1]Program Assistant (Soil Science) KVK Malkangiri 764045, Odisha, India
[2]Assistant Professor (Soil Science) RRTTS Ranital, Bhadrak 754103, Odisha, India
[3]Joint Director, DEE OUAT Bhubaneswar 751003, Odisha, India
e-mail : crsarangi2014@yahoo.com
*Correspondence

Introduction

Rice is the staple food of India feeding over 70% of its population. In Odisha, rice covers 46% of gross cropped area (GCA), out of which 38.80 lakh ha (66.6%) and 3.0 lakh ha (11.1%) area under *kharif* and *rabi* season, respectively [1]. As per report of Inter Governmental panel for Climate Change (IPCC) 2007, the expected change in temperature over next 30-50 years are predicted to be in the range of 2-3°C. Heat wave or extreme temperature events are projected to become more intense, more frequent and last longer than what is being currently observed in recent years [2]. Extreme temperature events mays have short term duration of few days with temperature increase of over 5°C above the normal temperature. Extreme events occur in summer period would have the most dramatic impact on plant productivity particularly on reproductive stages, Some varieties do not switch over to this phase.

Nitrogen (N) is a major macronutrient essential for crop production. It is the most deficient ele-

ment in the soil. Generally nutrients are applied as blanket dose/soil test based recommendation. When supplied through fertilizers, it is subject to loss in the form of nitrates that moves with water and also denitrified in rice paddies if it is not taken up by the rice crop. It is important to apply the nitrogenous fertilizers coinciding the plant need. Plants respond to both soil and climate and their nutrient uptake is governed by their genetic character as in interaction with soil and climate. Hence they are the best indicators of their nutrient requirement. Leaf color charts have been developed based on the chlorophyll content of leaves and the need of nutrient N as the later is an integral part of various chlorophylls in which it is attached to a cental Mg ++ion as pyrrole rings.

Decreasing total factor productivity and deteriorating soil health makes it necessary to manage plant nutrients wisely so as to mitigate the ill effects of climate change. A good crop growth is the best insurance against climate change. nitrogen management in rice is of prime importance for raising sustainable productivity profitably mitigating ill effects of climate change. intervention using leaf color chart (LCC) along with soil test based recommendation would help achieve this objective. There is dearth of information in odisha regarding the adoptability of N management to mitigate the ill effects of climate change with these three methods. Hence field trial was undertaken in seven geo-referenced locations with the objectives of (i) effect on productivity, profitability, amount of nitrogen saved and (ii) effect on amount of the carbon dioxide reduced from the atmosphere as carbon fixed in biomass.

Materials and Methods

A field trial was undertaken at seven geo-referenced locations-081°55.300′, 18°17.558′, 081°55.284′, 18°17.368′, 081°51.539′,18°16.546′, 081°51.276′, 18°16.618′, 081°50.666′, 18°16.930′,081°51.603′, 18°16.573′,081°51.869′ and 18°16.593′-with nutrient poor *Rhodic haplustalfs* of Malkangiri district in odisha having three treatments-T_1- 80-40-40 N, P_2O_5 and K_2O kg ha^{-1}, T_2 - Soil test based NPK and T_3 -N as per LCC and P_2O_5, K_2O as Soil test based in RBD. The crop was grown with standard agronomic practices taking Ajay variety (123 days) during *kharif* 2014 and 2015, data were analyzed statistically, but the pooled data are presented for simplicity. The yield and other biometric parameters were recorded, the aerial biomass C was found out on oven dry weight basis and the reduction in atmospheric CO_2 concentration was calculated using the following formula :

Atmospheric CO_2 concentration (mole ha^{-1})
=Biomass C (q ha^{-1}) × 0.306

Adoptability features like yield, N saved, percent increase in atmospheric CO_2 reduced, net income and B : C ratio were calculated. The data are presented in Table 1. The application of N as per LCC and P, K as soil test based increased 31.8% yield of rice against the application of soil test based NPK (21.9%). The amount of N saved was 20.8 and 18.5

Table 1. Adoptability features of various treatments on rice.

Treatments	Yield (q ha^{-1})	% Change in yield	N' saved (kg ha^{-1})	% Increase in atmospheric CO_2 reduced (mole ha^{-1})	Net income (Rs ha^{-1})	B : C ratio
T_1 80-40-40 N, P_2O_5 and K_2O kg ha^{-1}	32.4	–	–	_	16,400	1.56
T_2 Soil test based NPK	39.5	21.9	18.5	18.34	23,900	1.76
T_3 N as per LCC and P, K as soil test based	42.7	31.8	20.8	19.91	27,480	1.85
SEm (+/-)	0.59					
CD (0.05)	1.29					
CV (%)	8.63					

(kg ha^{-1}) respectively. Increase in atmospheric CO_2 reduced (mole ha^{-1}) was the highest (19.91%) in the application of N as per LCC and P, K as soil test based followed by soil test based NPK (18.34%). The per cent change in yield, N saved, percent increase in atmospheric CO_2 reduced, net income and B : C ratio were calculated. The net income and B : C ratio followed the same order. It corroborates the findings of [3].

Conclusion

Application of N as per LCC and P, K as soil test based was the best with respect to all the adoptability features and soil test based NPK was better. But mere application of 80-40-40 N, P_2O_5 and K_2O kg ha^{-1} was the least in all the characters studied.

References

1. Anonymous (2015) Odisha agriculture statistics 2013-14. Directorate of Agriculture and Food Production, Odisha.
2. Meehl GA, Stocker TF, Collins WD, Friedlingstein P, Gayes AT, Gregory JM, Kitoh A, Knutti R, Murphy JM, Noda A, Raper SCB, Watterson IG, Weaver AJ, Zhao Z-C (2007) Global climate projections. In : Climate Change 2007 : The physical science basis. Contribution of Working Group 1 to the 4th Assessment Report of the Intergovernmental Panel on Climate Change [Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL (eds)]. Cambridge Univ Press, Cambridge, United Kingdom and New York, NY, USA.
3. Mohapatra SC, Nanda SS, Sarangi C (2014) Rice (*Oryza sativa* L.) Varieties as intervention to mitigate the ill effects of climate change. Environ Ecol 33 : 392—395.