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Analysis of soil of agricultural field used for rice production with respect to boron and few selected cations of Lakhimpur District of Assam, India

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ABSTRACT

Rice is the major food grain in most of the countries of the world. The demand of rice is in increasing trend due to consumption of various food items prepared from rice starting from baby food to fast food with increasing population. But due to natural and anthropogenic reasons, the farmers are not getting the calculated production. Now to meet the increasing demand of the rice, it is essential to balance the theoretical and observed rice production by finding out the factors responsible for not getting the desired production. Hence an attempt is made to assess the soil quality of agricultural field by considering few selected cations.

***Key words**: Rice, Baby food, Production, Cation, Assess, Quality etc.*

Introduction

UN announced 2004 as "Worldwide Year of Rice" reflecting the importance of rice for mankind. The Asian people use to take sixty to seventy percentages of their required calories from rice and various rice items. Thus all over the world, rice provides nourishment in a broader way to the people. The one fourth of agricultural land is used for rice cultivation in India. Rice is the principal food grain of India. Around ten thousands assortments of rice are found on the planet out of which India alone developed four thousands. In Assam and other north eastern states, rice is considered as the staple food. Rice contributes to the Indian economy in a significant manner. Assam plays a major role in rice production. But it is noticed from secondary data of rice production in Assam and other states of India is not uniform throughout the years. Environmental changes are well noted in the current years followed by all round of pollution.

Study Area

Lakhimpur district of Assam is the study area for the present research topic. The economy of North Lakhimpur district is agronomy based. Around seventy nine percent people of the district are literate as per census of 2011.As per census of 2011, the total population of North Lakhimpur district is 1042137 out of which there are 512463 female and 529674 male. All the nine blocks of North Lakhimpur district are selected for collection of agricultural soil samples for analysis. The samples are given codes as shown below in Table 1. A Google map of the entire district is placed under Fig 1.

Methods and Materials

Polythene bags were used to collect soil samples of half kilogram from the selected sampling agricul-

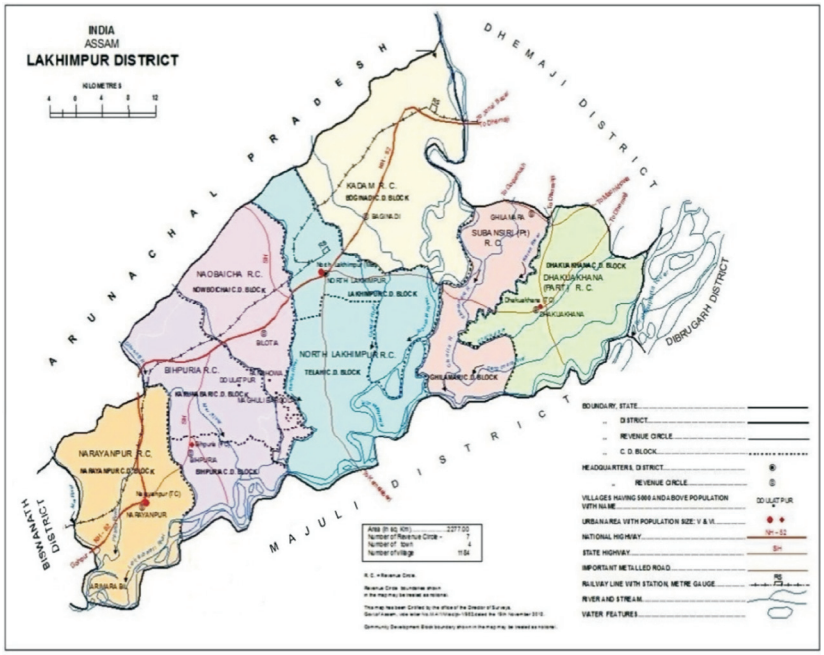

Fig. 1. Map of North Lakhimpur District

Table 1. The sampling code of the study area

Sl No.	Sampling Code
1	CASNL
2	CASNB
3	CASG
4	CASB
5	CASN
6	CASB
7	CASD
8	CAST
9	CASK

tural field. Then the collected samples were taken to the to the laboratory for analysis for the following parameters.

i. Moisture Content (MC)
ii. Water Holding Capacity (WHC)
iii. Boron
iv. Sodium (Na^+)
v. Potassium (K^+)
vi. Calcium (Ca^{2+})
vii. Magnesium (Mg^{2+})

Moisture Content (MC)

Moisture content was calculated by using the following formula.

$$MC = [T_2 - T_1] / [T_3 - T_1] \times 100\ \%$$

Where
T_1 = weight of the brass box
T_2 = weight of 10 g pre dried soil sample
T_3 = weight of dried soil samples
Water Holding Capacity (WHC) :
Water Holding Capacity is measured by using the following formula

$$WHC\ (\%) = [C - (B + M) \times 100] / (B - A)$$

A= weight of metal box
B= A+10 g dry sample
C= A+ weight of 10g wet sample
M= weight of whatman No. 1 filter paper

Boron (B)

Atomic absorption spectrometer is used to measure the concentration of Boron in the soil samples.

Calcium (Ca^+) and Magnesium (Mg^+) ion

Titrimetric method of EDTA is used to estimate the amount of calcium and magnesium ion in the collected soil samples. Chemicals used for the titration are 0.01 N EDTA solutions, 40% alcohol, Buffer solution (NH_4Cl-NH_4OH), 1N NH_4OAC, Aqua regia, 10% NaOH solution, Murexide indicator.

Sodium (Na^+) and Potassium (K^+) ion

Flame photometry is used to estimate the amount of sodium and potassium in the collected samples at a

wavelength of 589 nm.

Results

The average values of the moisture content(MC), water holding capacity (WHC), Boron(B), sodium (Na^+), potassium (K^+), calcium (Ca^{2+}) and magnesium (Mg^{2+}) calculated is presented in Table 2. The variation of the concentration of the various selected parameters with respect to sampling locations is shown in Fig 2. The concentration for the various parameters is found changing for different sampling locations. The moisture content and water holding capacity of soil are the important character of agricultural soil from the view point of soil nutrition. The values of moisture content and water holding capacity of almost all the soil samples are found above sixty percent except for sampling location CASNL. Sodium is essential to maintain osmotic pressure in the cell of living creature and hence considered as an important nutrient for plant but at the same time higher concentration of sodium is reported as poisonous to the living creatures. The concentration of sodium is well noted here. Boron and potassium are the two important essential soil nutrients. The comparison of the concentration of Boron, sodium and potassium ion is shown in Fig 3. From Fig 3, it is observed that the potassium ion concentration is less than the concentration of boron. But the concentration of sodium ion is high for all the samples in comparison to boron and potassium ion.

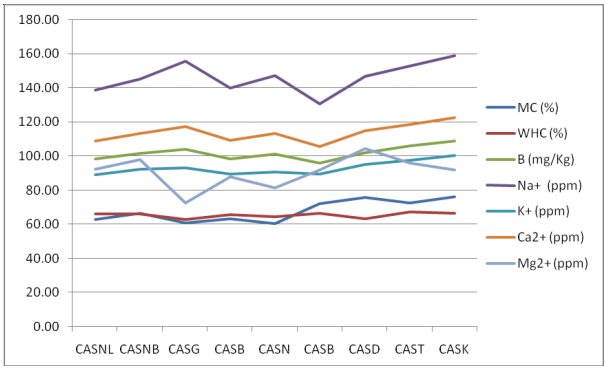

Fig. 2. Location wise concentration of various parameters

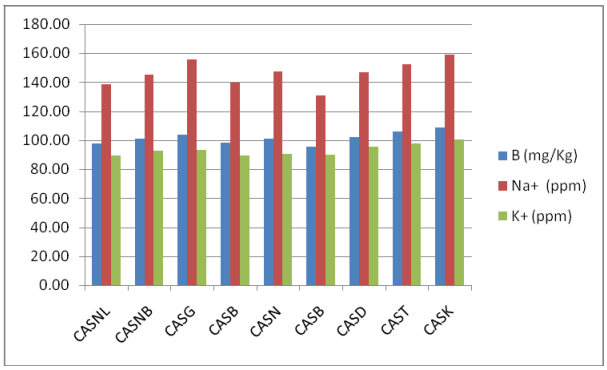

Fig. 3. Comparison of concentration of born, sodium and potasium

Spark in 1987 reported that the expected values for potassium (K^+) in mineral soils is from 0.4g/kg and 30 g/kg . But Jackson (1964) and Xie and Hasegawa(1985) reported the concentration of potassium ion in the rural soil is 10g/kg to 20g/kg. The observed valued of potassium ion is found comparatively less as per literature available.

Calcium and magnesium are the essential minerals. Calcium is also considered as an essential soil nutrient as it helps in maintaining the structure of soil. The well established sources of calcium are salts of calcium, farming lane gypsum etc.

Presence of a good amount of monovalent cation like sodium, potassium and divalent cation like calcium and magnesium indicates about the medium to high pH values of the soil samples.

Table 2. The average value of various parameters

Sampling Location!/ Parameter!	MC(%)	WHC(%)	B(mg/kg)	Na^+ (ppm)	K^+ (ppm)	Ca^{2+} (ppm)	Mg^{2+} (ppm)
CASNL	62.80	66.10	98.00	138.70	89.20	108.63	92.33
CASNB	66.40	66.03	101.32	145.33	92.59	113.08	97.67
CASG	60.80	63.00	103.84	155.43	93.08	117.45	72.33
CASB	63.20	65.57	98.30	139.80	89.52	109.21	87.67
CASN	60.30	64.73	100.94	147.30	90.78	113.00	81.33
CASB	72.13	66.63	95.69	130.63	89.80	105.37	91.67
CASD	75.63	63.53	101.90	146.83	95.33	114.69	104.33
CAST	72.67	67.30	105.84	152.67	97.54	118.68	95.67
CASK	76.23	66.43	108.59	158.83	100.50	122.64	91.67

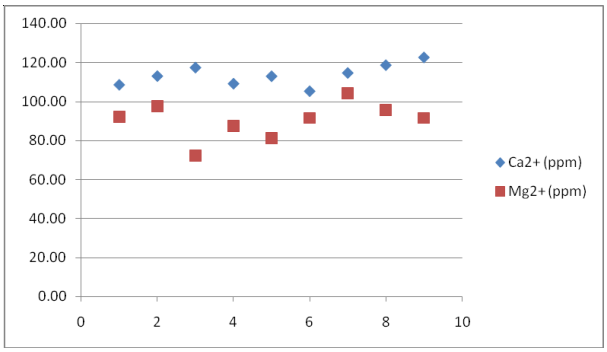

Fig. 4. Comparison of concentration of calcium and magnesium

The concentrations of calcium and magnesium are plotted in Fig 4. The Fig 4 indicates the lower concentration of magnesium in almost all the samples of the present study.

Conclusion

It is observed that all the sampling locations witnessed a variable in the concentration of the various studied parameters. The result also showed that the values of some parameters are not satisfying the required amount to be present in the soil samples. The observation indicates that the variations in the concentration of various essential soil nutrients may be responsible for not getting the expected rice production. A broad study may be helpful to government for adopting appropriate strategy to overcome the problem.

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