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CHOICE OF EXTRACTION METHODS IN ASSESSING AVAILABLE NUTRIENTS OF SOME BANGLADESH SOILS.
III. Calcium and Magnesium

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Abstract

Acidified NaCl (pH I) proved to be the best for available calcium determination. The correlation values for plant uptake and availability of the element as measured by this method were found to be 0.774(0.05) and 0.778(0.05) at the flowering stage under controlled and fertilized conditions respectively. At the harvesting stage these values were 0.758(0.05) and 0.754(0.05) for the two conditions. As regards magnesium, the N NaCl was found to be highly correlated for all the soils at both the stages of growth for the two conditions at both the stages of growth in irterpreting its availability, the values of 'r' being 0.818(0.05) and 0.893(0.01) at the flowering and 0.879(0.01) and 0.801(0.05) at the harvesting stage for the two conditions respectively.

Introduction

Attempts have already been made during the recent past in evaluating a suitable method of extraction for the available calcium and magnesium of some soils of the country (Anam *et al.* 1977, Enayetullah 1976). The present work is a further extension of the previous works with some different extractants and more samples of the representative soils of Bangladesh.

Materials and Methods

The materials and methods, green house experiment and the extractants used are the same as in part I. (Anam *et al.* 1978). The available calcium and magnesium were determined volumetrically by EDTA titration.

Results and Discussion

The amounts of available calcium and magnesium extracted by different methods and the amounts of the corresponding elements in the paddy plants at the flowering stage and harvesting stage as well as in the rice grains are presented in Tables 1 (a & b) and 2(a & b) respectively. The uptake of calcium and magnesium by paddy plants is found to be more or less uniform in all the soils (Table 2) irrespective of the availability as determined by different extraction methods.

Table 1. Available calcium and magnesium contents of soils before cropping as determined by different extractants (mg/100g soil). (a) Ca, (b) Mg.

Soils	N NaCl	NaCl(pH 1)	Extractants Morgan's reagent	O.3NHCl	Spurway test 0.028N CH_3COOH
(a)					
Thakurgaon	20.10	60.24	41.80	40.20	24.00
Gaibandha	60.00	108.00	90.00	98.00	38.40
Serajgonj	80.20	180.50	120.10	156.00	46.00
Daudkandi	76.30	98.90	60.20	132.80	30.00
Kotowali	80.00	104.10	82.10	80.20	26.22
Hathazari	30.00	64.00	70.00	38.00	20.20
(b)					
Thakurgaon	12.16	24.32	19.50	45.12	14.50
Gaibandha	29.81	36.48	22.50	35.12	36.28
Serajgonj	32.61	75.39	26.75	133.76	40.64
Daudkandi	36.48	48.64	38.91	48.64	21.88
Kotowali	58.36	60.80	46.20	65.66	21.05
Hathazari	26.50	36.48	24.32	32.28	21.88

Table 2. Amounts of calcium and magnesium in paddy plants and rice grains (in per cent). (a) calcium, (b) magnesium

Soils	Flowering stage		Harvesting stage		Rice grains	
	Control	Fertil.	Control	Fertil.	Control	Fertil.
(a)						
Thakurgaon	0.320	0.353	0.280	0.301	0.260	0.300
Gaibandha	0.360	0.400	0.240	0.313	0.240	0.300
Serajgonj	0.320	0.413	0.242	0.323	0.240	0.266
Daudkandi	0.340	0.374	0.260	0.313	0.242	0.310
Kotowali	0.320	0.373	0.260	0.280	0.240	0.287
Hathazari	0.320	0.387	0.260	0.287	0.278	0.313
(b)						
Thakurgaon	0.217	0.284	0.195	0.251	0.265	0.295
Gaibandha	0.218	0.251	0.194	0.228	0.243	0.267
Serajgonj	0.220	0.243	0.195	0.219	0.220	0.270
Daudkandi	0.220	0.298	0.200	0.259	0.243	0.305
Kotowali	0.221	0.284	0.210	0.243	0.220	0.256
Hathazari	0.218	0.300	0.194	0.275	0.244	0.275

The correlation coefficient between the uptake of calcium by paddy plants and its availability as determined by acidified NaCl (pH I) method in all the soils was found to be significant. At the flowering stage, the values of 'r' were 0.774 (0.05) and 0.778(0.05) and at the harvesting stage 0.758 (0.05) and 0.754 (0.05) under controlled and fertilized conditions respectively (Table 3a). The uptake of the element by rice grains and its availability as determined by NaCl (pH I) method were found to be significantly correlated, the values of 'r' being 0.782 (0.05) and 0.882 (0.01) under the two conditions respectively (Table 3a). The availability of calcium as assessed by Morgan's reagent was positively correlated with its uptake at the flowering stage under fertilized condition only (Table 3a). The other results were inconsistent.

Table 3. Coefficients of correlation between Ca and Mg contents of paddy plants at flowering and harvesting stages and rice grains and the corresponding available Ca and Mg in soils as determined by various extraction methods. (a) Ca, (b) Mg.

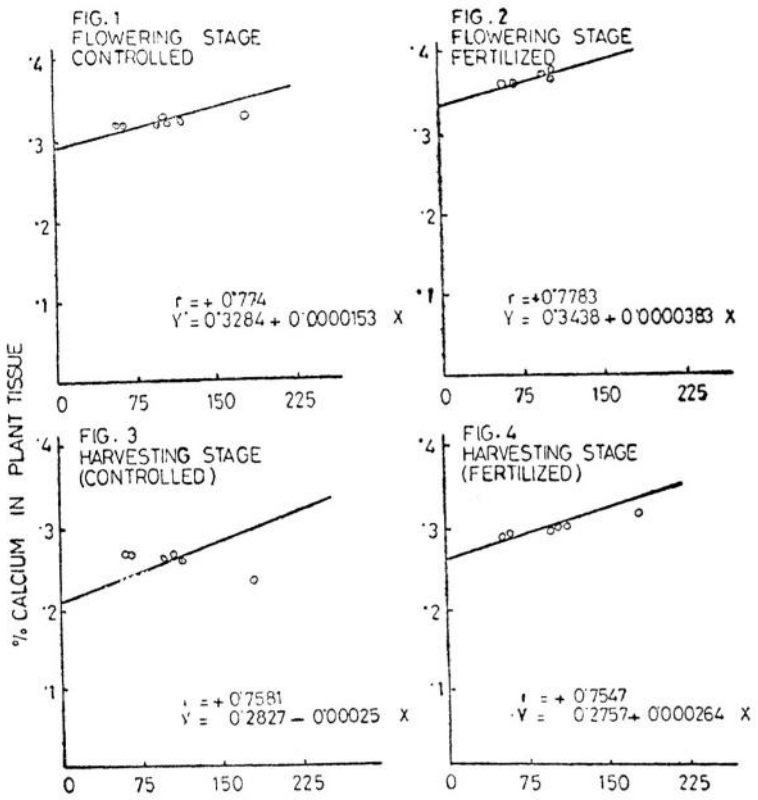
Methods	Flowering stage		Harvesting stage		Rice grains	
	Control	Fertil.	Control	Fertil.	Control	Fertil.
(a)						
N NaCl	0.2067	0.4821	-ve	0.3075	-ve	-ve
NaCl (pH I)	0.7741*	0.7783*	0.7581*	0.7547*	0.7828*	0.8828**
Morgan's reagent	0.1202	0.9219**	-ve	0.4651	-ve	-ve
0.3N HCl	0.2798	0.6177	-ve	0.7668*	0.0120	-ve
Spurway test	0.3560	-ve	-ve	0.8353*	-ve	0.3280
(b)						
N NaCl	0.8185*	0.8933**	0.8792**	0.8016*	0.8124*	0.7677*
NaCl (pH I)	0.6360	-ve	0.4025	-ve	-ve	-ve
Morgan's reagent	0.6204	0.3395	0.9073**	0.9545***	-ve	-ve
0.3N HCl	0.4749	-ve	0.9606***	-ve	-ve	-ve
Spurway test	0.1225	-ve	0.2643	-ve	-ve	-ve

* ** *** Significant at 5, 1 and .01 per cent level respectively.

The available magnesium extracted by N NaCl was significantly correlated with its uptake by paddy plants at both the stages of its growth as well as with the rice grains under controlled and fertilized conditions. The values of 'r' at the flowering stage were 0.818 (0.05) and 0.893(0.01), at the harvesting stage 0.879 (0.01) and 0.801(0.05), and for rice grains 0.812(0.05) and 0.767(0.05) under the two conditions (Table 3b). Morgan's reagent extractable magnesium correlated with the plant uptake at the harvesting stage only under both the conditions

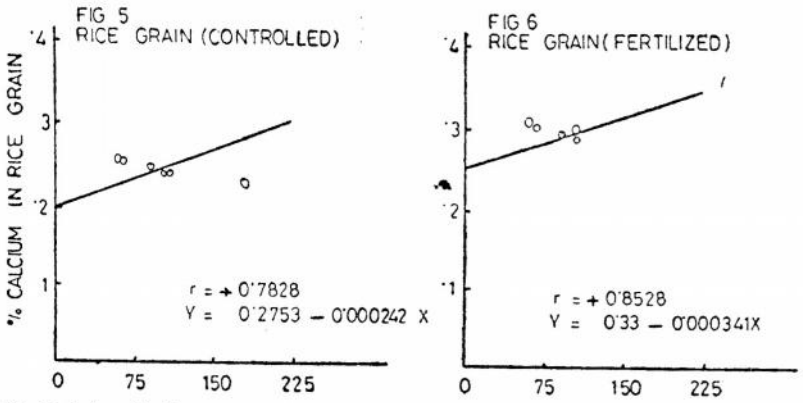
(Table 3b). This corroborates the findings on the previous occasion with some other soils of the country (Anam *et al.* 1977, Enayetullah 1976).

Linear regression equations were calculated to see the distribution of the observed plant uptake of calcium and magnesium in relation to available calcium determined by acidified NaCl (pH I) and available magnesium assessed by N NaCl. The regression lines drawn for calcium (Figs. 1-6) and magnesium (Figs. 6-12) showed that the observed values fall very close to the expected values. From the result of the correlation coefficient and regression equation it was concluded that acidified NaCl (pH I) and N NaCl were by far the most suitable extractants for determining available calcium and magnesium respectively for the soils under study.

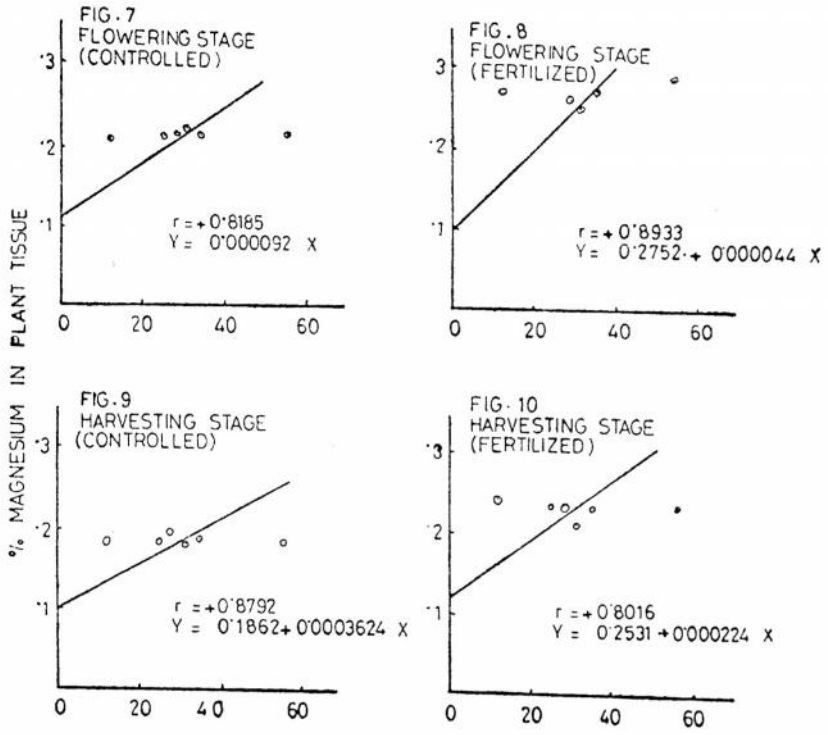


Figs. 1-4. Relationship between available calcium in soil and calcium content in plant tissue.

Generally, most of the calcium and magnesium in soil are present as minerals. Though no calcium and magnesium fertilizers have been added to the soils,

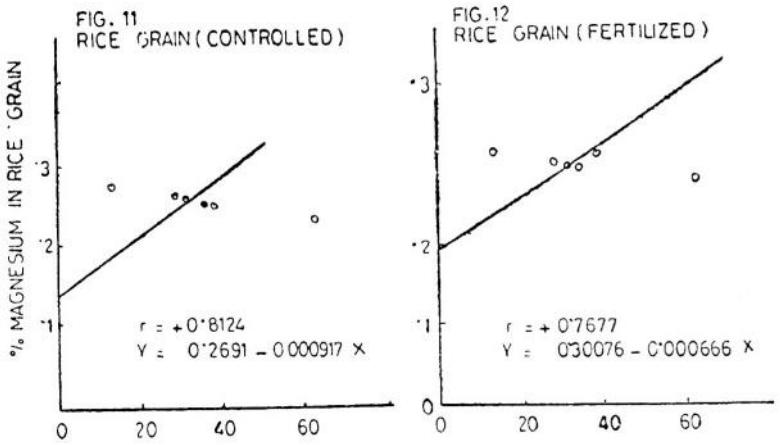


Figs. 5-6. Relationship between available calcium in soil and calcium content in rice grain available calcium measured by acidified sodium chloride method in mg/100 mg of soil.



Figs. 7-10. Relationship between available magnasium in soil and magnesium in plant tissue.

yet the per cent content of these two elements were found to be higher in the plant tissue to some extent where only NPK fertilizers were used. Plant uptake



Figs. 11-12. Relationship between available magnesium in soil and magnesium content in rice grain ; available magnesium measured by normal sodium chloride method in mg/100 gm of soil.

of other nutrients besides calcium and magnesium are increased due to fertilization, while plants absorb more Ca and Mg to maintain ionic equilibrium in the plant cells.

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