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Critical Level of Magnesium in Soils.

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Experiments conducted according to the method of Cate and Nelson (1965) revealed that 2.3 me/100 g of soil of 1 *N* ammonium acetate (pH 7.0) extractable magnesium may be considered as the critical level in Nilgiris soils. Among the soils tested under this experiments, response to applied magnesium could be expected from localities other than Dhavani, Kavaratty and Kuruthukuli.

Widespread occurrence of mangnesium deficiencies have been reported from many parts of the world. Although magnesium deficiency did not appear to be a serious problem now, it is expected that with continuous intensive cropping with high yielding hybrids, higher plant populations and heavier fertilisation (especially potash), magnesium deficiency is likely to become a serious problem in the near future. But yet detailed studies on the various aspects of this nutrient has not been made in India especially in the acid soils where magnesium deficiency poses a major problem.

The Nilgiris where considerable area of acid soils exists, is a hilly tract in Tamil Nadu. India extending over an area of 2532 Km^2 and its average elevation is 19181.2 m above mean sea level. The district receives an annual average rainfall of 1891 mm and soil erosion is a main problem. In the present study therefore, the critical level of magnesium in the representative soils of Nilgiris district has been worked out.

MATERIAL AND METHODS

Twenty four bulk soil samples varying from sandy loam to clay were collected from different locations of the Nilgiris. Three kg of each soil was filled in four pots of the size 22 cm dia x 20 cm the Each soil received two levels of magnesium viz., 0 and 50 kg Mg/ha in the form of magnesium sulphate. The treatments were replicated twice in a randomised block design. A basal dose of 40 kg N, 20 kg P_2O_5 and 8 kg K_2O/ha were applied.

Ragi (*Eleusine coracana Gaerth.*) variety CO 7 was the test crop. Twenty three days old seedlings were transplanted at the rate of three per pot. The soil was maintained at the field moisture level. Grain and straw were harvested separately after fall maturity and their yields were recorded on oven dry basis. Pre-planting soil samples were analysed for the physico-chemical properties. Exchangeable magnesium in the soil was estimated using 1 *N* ammonium acetate of pH 7.0 (Jackson 1967).

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The relationship between the exchangeable magnesium in the soil and the Bray's percentage grain yield and the critical limit of magnesium were established (B'chavarova, 1974).

RESULTS AND DISCUSSION

Soils used for the study varied widely from sandy loam to clay and the total Mg ranged from 4.3 to 10.6me/100g soil. The soils were acidic, the pH values ranging from 3.8 to 6.6 and contained on an average 5.9 per cent of organic carbon (Table 1).

It is seen from the Table 2 that 18 out of 24 soils responded to magnesium application in terms of ragi grain and straw yield. Bray's percentage grain yield for different soils ranged from 59.0 to 199.6 with a mean of 103.3. Exchangeable Mg content in the soils ranged between 0.4 and 3.5 me/100 g with a mean of 1.3 me/100 g soil.

Scatter diagrams illustrating the relationships between the exchangeable Mg and Bray's per cent yield of grain and straw (Fig. 1 and 2) were drawn as per the procedure of Cate and Nelson (1965). It was seen that 2.3 me/100g soil of 1 *N* ammonium acetate (pH 7.0) extractable Mg may be taken as the critical level in the soils, below which response to magnesium can be expected. The predictability of response was 75 per cent. Further the correlation coefficient between values for grain was significant (r=0.61**). Similarly the relationship between Bray's per cent yield of straw and exchangeable Mg was illustrated in Fig. 2. It is seen here also, that 2.3 me/100 g of 1 *N* ammonium acetate (pH 7.0) extractable Mg was the critical level.

In the group of soils used for this purpose, response to applied magnesium could be expected from localities other than Dhavani, Kavaratty and Kuruthukuli.

In the present investigation critical limit was found to vary appreciably from the limits reported by other workers for different soils (Hoffman, 1959; stenuit, 1959 ; Mazayeva, 1967) A shift in the critical limit might be due to the clay to clay loam texture of most of the soils examined (Metson 1977).

REFERENCES

B'CHAVAROVA, I. 1974. the the magnesium status of bulgarian soils *Soils and Fert* 37 : 1094.

CATE, R. B. and L. A. NELSON. 1965. Technical Bulletin No. 2. ISTP series. North Carolina Agricultural Experiment Station.

HOFFMAN, W. S. *et. al.* 1959. Magnesium in vestigations on German soils *Soils and Fert.*, 23 : 521-24.

JACKSON, M. L. 1967. Soil Chemical Analysis Prentice - Hall of India (Pvt.) Ltd., New Delhi.

LOMBIN, L. G. and A. A. A. FAYEMI. 1975 Cuitical level of magnesium is western Nigeria soils as estimated under greenhouse conditions *Agron., J. 67* : 272-275.

MAZAYEVA· M. M. 1967. Critical magnesium content of soils Agrokhimiya No. 10 : 93-105.

METSON, A. J. 1977. Magnesium N. Z. Soil Bureau Publication No. 783.

STENUIT, D. F. 1959. Relationship between magnesium content and yield of Belgram soils *Soils and Fert.*, *23* : 786.

Table 1. Physico-Chemical Properties of soils of Nilgiris District used for the investigation

Location	Texture	pH	E. C. mmhos/ cm	Organic C %	Total Mg me/ 100 g	Ex. Mg me/100 g
Anikkorai	Clay	5.6	0.13	7.8	6.3	0.4
Aravenu	Clay loam	4.8	0.20	3.6	4.8	1.2
Bembathy	Clay	5.3	0.11	4.0	10.6	0.8
Bingichangai	Clay loam	5.1	0.10	6.1	7.6	1.2
Dhavani	Clay loam	5.9	0.11	7.5	6.8	1.4
Doddabetta	Clay	3.6	0.13	25.2	7.6	1.1
Ebbanad	Clay	5.2	0.13	5.1	7.6	1.2
Emerald	Clay	6.2	0.12	4.2	7.9	1.6
Hullathi	Clay loam	5.6	0.10	11.0	6.8	1.5
Ithalar	Clay	5.7	0.10	5.9	7.9	1.2
Kavaratty	Clay	5.3	0.11	7.8	6.8	3.5
Kuruthukuli	Loam	5.6	0.10	4.8	7.6	3.2
Kotagiri	Clay loam	5.5	0.05	10.3	5.8	1.7
Melur	Clay	5.2	0.16	9.3	6.0	0.4
Mulligur	Clay	6.6	0.13	6.8	6.2	2.3
Nanjanad	Clay loam	5.5	0.10	5.9	7.6	0.4
Nunthala	Clay	5.2	0.13	4.3	6.9	0.4
Peddala	Clay loam	5.0	0.10	3.6	4.8	0.8
Porthy	Sandy loam	4.8	0.10	3.9	7.9	0.4
Puduhatty	Clay loam	5.5	0.11	5.6	7.9	1.6
Sulligud	Clay loam	5.2	0.13	7.2	4.8	0.9
Kundha	Sandy clay loam	5.8	0.16	4.6	6.2	1.6
Titukkal	Clay	3.8	0.16	6.3	4.3	0.9
Yedakad	Sandy clay	6.1	0.16	3.9	7.6	0.8
Mean		—	0.12	5.9	6.9	1.3

Table 2. Bray's percent yield response of ragi (*Eleussne coracane* Gaertn.) to magnesium fertilizer treatments in different boils

		Mean grain yield (g/pot)				Mean straw yield (g/pot)		
Mg_{6}	Mg_{44}	Percent increase or decrease over control (g/pot)	Bray's per cent yield	Mg_{8}	Mg_{60}	Percent increase or decrease over control	Bray's per cent yield	Total mg uptake by the crop (mg/pot)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
4.45	4.80	7.77	92.8	8.86	9.03	1.92	98.1	69.7
4.98	5.99	12.35	89.0	9.34	10.18	8.95	91.8	86.7
5.87	8.08	37.83	-72.6	7.39	7.79	5.4	94.9	70.7
4.62	5·33	15.25	86.8	10.00	15.62	56.20	64.0	87.7
10.78	5.48	-49.14	196.6	9.46	7.11	-24.84	133.1	91.7
5.77	6.41	11.04	90.1	6.64	6.71	1.05	95.0	72.7
7.14	8.00	11.99	89.3	8.20	8.62	5.12	95.1	72.7
8.48	9.84	16.01	86.2	7.84	8.80	12.24	89.1	81.3
6.18	6.67	7.43	92.6	5.96	6.81	14.26	87.5	77.3
10.03	7.20	28.23	139.3	9.76	8.11	16.91	120.4	104.1
9.19	8.02	12.77	114.6	9.50	7.05	25.79	134.8	117.2
11.44	7.21	36.98	158.7	0.84	7.35	25.30	133.9	126.1
5.23	5.46	4.52	95.7	7.00	7.62	8.86	91.9	98.8
3.94	4.14	4.90	95.3	8.46	9.54	12.77	88.7	66.0
6.94	7.18	3.39	96.7	7.94	8.83	11.21	89.9	106.3
4.13	4.53	9.48	91.3	9.11	11.74	28.87	77.6	67.6
7.67	4.98	-35.09	164.1	10.07	10.20	1.27	98.7	77.4
7.35	7.97	8.49	92.2	10.57	6.65	58.95	159.0	101.5
6.98	11.83	69.51	59.0	10.22	12.71	24.36	80.4	71.9
6.30	8.03	27.40	78.5	19.33	17.88	11.64	113.2	112.7
13.06	8.90	31.87	146.8	6.88	7.28	5.81	94.5	84.7
7.74	9.86	27.36	78.5	10.95	13.18	20.37	83.1	103.1
4.49	5.62	25.12	79.9	6.85	8.14	18.83	84.2	69.6
10.14	10.17	0.26	99.7	6.24	6.87	10.10	90.8	83.9