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Note on Magnesium Balance Sheet in Acid Soils

All the magnesium applied to the soils is not utilized and part of it is fixed depending upon the quantity of magnesium applied and the type of soil. Prince *et al.* (1947) observed that degree of fixation of magnesium increased by application of magnesium. Fixation of applied magnesium was also reported by McLean and Carbonele (1972). Prince (1951) observed that more than half of the applied Mg could not be accounted for in the harvested crops or in the exchange complex of the soils. Presumably the unaccounted portions were either fixed in the non-exchangeable form or lost in the drainage water.

With the above facts in view, a balance sheet was worked out for two soils of the pot culture experiments (Titukkal and Doddabetta of Nilgiris) in which different combinations of lime, potassium and magnesium were tried. The treatments were replicated six times. Ragi (*Eleusine coracana Gaertn.*) Var Co 7 was the test crop. The treatmental details and the data are presented in Tables I and II.

It was observed that the amount of exchangeable Mg either fixed or leached ranged between 101 and 326 mg/pot in Titukkal soil, and between 169 and 368 mg/pot in Doddabetta soil. Calculated as the percentage, of the total exchangeable Mg at the start of the experiments, the amount of Mg fixed ranged between 28.1 and 57.9 per cent in Titukkal soil and between 43.7 and 62.9 per cent in Doddabetta soil.

It was further observed that the higher the rate of magnesium application, the higher was the amount of Mg fixed. Statistical analysis of the data revealed that liming significantly increased the amount of Mg fixation (Table III). For every increase in the level of Mg application, the amount of Mg fixed was significantly higher than its previous level.

Interaction of Mg X Lime was significant. At both the levels of lime application, fixation increased significantly with increased application of Mg. On the other hand, at Mg_0 level liming did not influence Mg fixation. The influence of liming under Mg_1 was more (29.5 mg/pot) than at Mg_2 level (20.5 mg/pot). As the level was increased further to Mg_3, the influence of lime was suppressed to the extent of 12.3 mg/pot only which was on par with Mg_0 level.

Thus, it was observed that all the applied magnesium was not utilized and part of it was fixed as was evidenced by the Mg balance sheet. Presumably the unaccounted portions were either fixed in the non-exchangeable form or lost in the drainage. In the present investigation loss due to

drainage was checked. Hence most probably fixation was the principal mechanism and the magnitude of fixation varied from soil to soil.

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REFERENCES

McLEAN, E. O and M. O. CARBONELL. 1972. Calcium, magnesium and potassium saturation ratios in two soils and their effects upon yields and nutrient contents of German millet and alfalfa. *Soil. Sci. Soc. Amer. Proc.* **36**: 927 - 30.

PRINCE, A. B. 1951. Magnesium economy in the coastal plain soils of New Jersey. *Soil Sci.* **71** : 91 – 98.

PRINCE, A. B., M. ZIMMERMAN and E. E. BEAR 1947. The magnesium supplying power of twenty New Jersey soils. *Soil Sci.* **63** : 69—78.

TABLE 1 Effect of Treatments on the Magnesium Balance in Titukkal Soil (mg/pot)

Treatments	Initial Ex. Mg in the soil + added	Mg removed by crops	Ex. Mg at the end of the treatment	Fixed or leached	Percentage of Ex. Mg fixed or lost
$L_0 K_0 Mg_0$	360	125	134	+ 101	28.1
$L_0 K_0 Mg_1$	427	163	136	+ 128	30.0
$L_0 K_0 Mg_2$	494	132	137	+ 225	45.3
$L_0 K_0 Mg_3$	561	140	138	+ 283	50.6
$L_0 K_1 Mg_0$	360	113	137	+ 110	30.6
$L_0 K_1 Mg_1$	427	129	137	+ 161	37.7
$L_0 K_1 Mg_2$	494	134	138	+ 222	44.9
$L_0 K_1 Mg_3$	561	150	134	+ 227	49.4
$L_1 K_0 Mg_0$	360	120	134	+ 106	29.4
$L_1 K_0 Mg_1$	427	131	133	+ 162	38.2
$L_1 K_0 Mg_2$	494	126	133	+ 235	47.8
$L_1 K_0 Mg_3$	561	129	132	+ 300	46.5
$L_1 K_1 Mg_0$	360	101	133	+ 126	35.3
$L_1 K_1 Mg_1$	427	138	137	+ 152	35.6
$L_1 K_1 Mg_2$	494	100	136	+ 258	52.2
$L_1 K_1 Mg_3$	561	99	136	+ 326	57.9

— values mean release from non-exchangeable Mg

+ values mean fixation of exchangeable Mg

L_0 — No lime

L_1 — Lime applied as per the lime requirements 16.8 tonnes/ha for Titukkal soil and 19.9 tonnes/ha for Doddabetta soils.

K_0 — No potassium

K_1 — Potassium applied as muriate of potash at the rate of 100 kg K_2O/ha

Mg_0 — No magnesium

Mg_1 — 50 kg Mg/ha as $MgSO_4.7H_2O$

Mg_2 — 100 kg Mg/ha as $MgSO_4.7H_2O$

Mg_3 — 150 kg Mg/ha as $MgSO_4.7H_2O$

TABLE II Effect of Treatments on the Magnesium Balance in Doddabetta Soil (mg/pot)

Treatments	Initial Ex. Mg in the soil +	Mg removed by crops	Ex Mg at the end of the treatment	Fixed or leached	Percentage of Ex. Mg fixed or lost
$L_0 K_0 Mg_0$	405	84	143	+ 178	43.7
$L_0 K_0 Mg_1$	472	106	146	+ 220	46.6
$L_0 K_0 Mg_2$	539	93	145	+ 301	55.8
$L_0 K_0 Mg_3$	606	106	146	+ 354	58.4
$L_0 K_1 Mg_0$	405	94	142	+ 169	41.7
$L_0 K_1 Mg_1$	472	117	145	+ 210	44.7
$L_0 K_1 Mg_2$	539	107	145	+ 287	53.3
$L_0 K_1 Mg_3$	606	92	144	+ 370	61.1
$L_1 K_0 Mg_0$	405	74	144	+ 187	46.2
$L_1 K_0 Mg_1$	472	88	147	+ 237	51.1
$L_1 K_0 Mg_2$	539	79	145	+ 315	58.4
$L_1 K_0 Mg_3$	606	83	142	+ 381	62.9
$L_1 K_1 Mg_0$	405	79	143	+ 183	45.2
$L_1 K_1 Mg_1$	472	80	144	+ 248	52.5
$L_1 K_1 Mg_2$	539	81	143	+ 315	58.4
$L_1 K_1 Mg_3$	606	90	148	+ 368	60.7

— values mean release from non-exchangeable Mg

+ values mean fixation of exchangeable Mg

TABLE III Magnesium Balance Sheet - Amount of Magnesium Fixed and/or lost (mg/pot)

a) Lime levels

	Titukkal soil	Doddabetta soil
L_0	188.68	261.25
L_1	208.78	279.75
S. E.	4.47	2.30
C. D (P=0.06)	13.77	7.08

(b) Mg levels

	Tutukkal soil	Doddabetta soil
Mg_0	111.10	179.25
Mg_1	151.40	230.05
Mg_2	235.35	304.75
Mg_3	295.05	367.95
S. E.	6.01	3.74
C. D. (P=.05)	17.12	10.66

Mg x lime interaction

	L_0	L_1
	173.4	185.1
	215.3	244.8
	294.5	3 5.0
	36 .8	374·1
S. E.		5.3
(Mg at L)		
C. D. (P=0.05)		15.0
S. E. (L at Mg)		5.1
C. D. (P=0.05)		14.8