SOIL ACIDITY CONSTRAINTS AND EFFECTS OF LIME APPLICATION ON GROWTH OF COMMON BEAN (*Phaseolus vulgaris* L.)

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Constraints to availability of mineral nutrients under different soil acidity conditions are major effects to which plants are exposed when introduced in a new acid environment. Low pH points out shortage of available calcium, magnesium, and sometimes phosphorus and molybdenum. On the other hand, great difficulties are experienced by plants growing in alkaline soils to absorb enough iron, manganese, boron, zinc, copper and phosphate (Russel, 1949).

In order to study the effects of liming on soil acidity and on growth of common bean (*P. vulgaris* L.) increasing levels of lime were applied to two acid soils, one Haplorthox (0, 0.75, 1.50, 3.0 and 6.0 t.ha^{-1}) and one Hapludult (0, 4.0, 8.0, 12.0, and 16.0 t.ha^{-1}) to study their effects on soil acidity and on growth of common bean (*Phaseolus vulgaris* L.) growth. The experiments were conducted at University of Queensland-Australia in the glasshouse until the beginning of plant flowering, when plants were harvested. At harvest, plant tops were dried, ground and subjected to elemental analysis.

Lime and fertilizers (60, 100, 135, 102, 4.0, 0.3, 0.3, 4.0 kg.ha^{-1} of N, P, K, Mg, Cu, B, Mo and Zn as ammonium nitrate, potassium phosphate, potassium sulphate, magnesium sulphate, copper sulphate, boric acid, sodium molybdate and zinc sulphate respectively) were mixed with the soil and the mixture were incubated for four weeks before planting. The remainder of the nitrogen was split in two applications, one at 15 (30 kg N.ha^{-1}) and the other at 30 days (30 kg N.ha^{-1}) after germination.

Pots were watered daily to maintain the field capacity during the experimentation.

Soil pH (1:5 soil/water) and in 0.05M CaCl2 (1:5 soil/solution) was determined weekly in water In both, cultivated and non cultivated soils, the electrical conductivity was taken only before soil incubation and at the end of experimentation. Soil pH achieved the equilibrium after six weeks in the Haplorthox and eight weeks in the Hapludult.

Maximum accumulation of dry matter was obtained by applying approximately 3 and 8 t of lime.ha^{-1} corresponding to pH 5.0 and 6.5 in the Haplorthox and Hapludult, respectively (Table 1).

Electrical conductivity increased with increasing lime levels but in general, the electrical conductivity (EC) obtained in the cultivated soils was lower than that obtained in the non cultivated soils.

Nitrogen absorption was maximum when soils received 3 and 8 t of lime ha^{-1} in Haplorthox and Hapludult soils respectively as revealed by analysis of plant tops. Calcium absorption increased, whereas Mg and P absorption decreased with increasing liming (Russel, 1949).

Reference

RUSSEL, E.J. 1949. Soil conditions and plant growth. Longmans, Green and Co, New York, 635p.

Tabela 1. Soil pH and electrical conductivity, (mS.cm^{-1}) and plant tops dry weight in response to increasing levels of liming in two different soils".

Lime (t.ha^{-1})	pH (1:5)		EC (+plants)	EC (-plants)	Tops dry wt.
	H$_2$O	CaCl$_2$-0.05M			
Haplorthox					
0	4.8*- 4.5**	3.9*- 3.5 **	0.31	0.47	2.4
0.75	5.4 - 4.8	4.8 - 4.0	0.40	0.59	5.8
1.5	5.9 - 5.0	4.9 - 4.5	0.47	0.74	6.2
3.0	6.4 - 5.7	5.2 - 5.0	0.58	0.76	7.9
6.0	7.2 - 6.6	5.3 - 6.0	0.65	0.80	4.8
Hapludult					
0	4.7*- 4.4**	3.9*- 3.4**	0.15	0.20	2.8
4	5.1 - 5.2	4.4 - 4.4	0.17	0.28	4.9
8	5.3 - 6.5	5.5 - 5.6	0.18	0.32	5.6
12	6.4 - 7.0	5.6 - 6.1	0.19	0.37	5.2
16	7.0 - 7.2	5.9 - 6.7	0.29	0.43	4.3

(+) presence and (-) absence of plants. pHs taken before planting (+) and after harvest (**).

Table 2. Nitrogen (N), phosphorus (P), calcium (Ca) and magnesium (Mg) uptake by common bean under lime application.

Treatments	N(%)	P (%)	Ca (%)	Mg(%)
Haplorthox				
L0	3.20b	0.19a	0.09e	0.52a
L0.75	3.63a	0.17ab	0.47d	0.49b
L1.50	3.73a	0.16abc	1.10c	0.49b
L3.00	3.82a	0.15bc	1.49b	0.45c
L6.00	3.52a	0.13c	2.18a	0.41d
Hapludult				
L0	3.31b	0.20a	0.13e	0.45a
L4	3.62a	0.19ab	1.22d	0.37b
L8	3.72a	0.18bc	1.66e	0.31c
L12	3.64a	0.17c	2.26b	0.29d
L16	3.40ab	0.16d	2.62a	0.25e

The means followed by the same letter don't differ at level of 5% (P $\geq$ 0.05). Data are means of five replications.