

EFFECTS OF PHOSPHORUS PLACEMENT ON GROWTH OF COMMON BEAN (Phaseolus vulgaris L.)

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Deficiency of phosphorus is widespread in the world, limiting the production of arable crops and herbage especially in Australia, South America and South Africa. Because of the low concentration of phosphate in soil solution its availability to plants depends on rapid replenishment to the solid phase and by mineralisation of soil organic phosphorus compounds, and on diffusion through the solution to the root surface (Wild 1988).

The highly weathered soils Oxisols and Ultisols of the tropics along Andosols, are generally very deficient in phosphorus. Many of these soils fix large quantities of added phosphorus. Therefore the lands, without the application of phosphorus to sustain crop production at high levels are not possible to grow plants (Kamprath 1973).

Six rates of phosphorus (0, 50, 100, 200, 400 and 800 kg P.ha⁻¹) were applied to a P-deficient Hapludult to study the effects of phosphorus fertilizer on common bean (Phaseolus vulgaris L.). A Glasshouse experiment was conducted at University of Queensland - Australia. Phosphorus was applied as KH₂PO₄ in three ways: a) surface applied in water, b) surface applied and mixed throughout the soil mass, and c) localized placement at a depth of 5 cm. Incorporated and banded phosphorus were applied just before planting, while the surface application was made just at planting.

Water application was made daily to maintain the field capacity during the experimentation.

Soil pH (1:5 soil/water and 1:5 soil/CaCl₂) measured at the final of experimentation decreased with the application of the highest level of phosphorus.

Plants dry weight increased with increasing phosphorus levels. At low levels of phosphorus, 50 and 100 kg P.ha⁻¹, the production of dry matter in pots which received banded phosphorus was higher than that obtained in pots which received phosphorus in water solution, and phosphorus at surface and incorporated through soil mass. Application of 200 kg P.ha⁻¹ were enough to get 80% of total dry matter production and to get the critical level of phosphorus (0.22%) in the plant tops (Table 1).

Reference

KAMPRATH, E.J. 1973. Phosphorus in a review of soils research in Tropical Latin America. Ed. P.A. SANCHEZ. p.138-145. North Carolina Agricultural Experiment Station - USAID.

Table 1. Effects of rates and placement of phosphorus on growth and on phosphorus concentration in the tops, of common bean grown for 28 days in a Hapludult from Julietten which had received 6.0 t CaCO₃.ha⁻¹.

P applied rate (kg.ha ⁻¹)	pH	Methods of P application					
		Surface		Incorporated		Banded	
		Total dry wt. g.plant ⁻¹	P(%)*	Total dry wt. g.plant ⁻¹	P(%)*	Total dry wt. g.plant ⁻¹	P(%)*
0	6.58	1.39K	0.09f	1.04e	0.10f	1.10K	0.10f
50	6.56	3.14J	0.11e	3.41J	0.15J	7.38h	0.12e
100	6.43	6.00i	0.14d	7.69gh	0.16d	8.45fg	0.16d
200	6.40	9.03ef	0.22c	10.67c	0.22b	10.21cd	0.22c
400	6.30	9.60de	0.24b	12.02a	0.23b	10.85bc	0.24b
800	6.21	10.18cd	0.29a	11.34ab	0.27a	11.87a	0.23b

Values followed by a common letter are not significantly different at P ≤ 0.05.