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Experiment 89GL33. Effect of soil P supply on the early growth and nodulation of lupins.

B.D. Thomson, M.D.A. Bolland, R.W. Bell.

Location

Glasshouse at the University of Western Australia.

Treatments

1. Seed P - 0.21, 0.26, 0.43% P (from 85BA35).
2. Soils - Badgingarra sand, 8 mg P/kg soil
- North Bannister gravelly loam, 20 mg P/kg soil.
3. Harvests - 8, 15, 22 and 43 days after imbibing seed.
4. Replicates - 3.

Sowing details

Four seeds were sown at 2.5 cm depth in pots containing 4.5 kg of steam sterilized soil treated with the following basal nutrients (mg/kg soil): K₂SO₄, 121.7; MgSO₄.7H₂O, 17.5; CaCl₂, 21; Fe sequestrene, 7.2; H₃BO₃, 0.5; MnSO₄, 10.8; ZnSO₄.7H₂O, 7.5; CuSO₄.5H₂O, 5.3; Na₂MoO₄.2H₂O, 0.27; CoSO₄.7H₂O, 0.07.

Rates of P supplied were sufficient for maximum growth on the Badgingarra soil and for 30% of maximum on the North Bannister soil, respectively.

Table 6. Effects of increasing seed phosphorus concentration [0.21% of dry wt.-low (L), 0.43% of dry wt.-high (H)] and soil type on the length of tap-root and on the number and length of lateral roots of lupin plants at 8, 15 and 22 days from imbibing seed

Days from imbibing seed	Soil type	Length of tap-root (cm/plant)		Length of lateral roots (cm/plant)		No. of lateral roots (no./plant)	
		L	H	L	H	L	H
8	Badgingarra	15.7 b	14.2 a	2.3 b	* 0.2 a	5.0 b	* 0.7 a
	N. Bannister	12.8 a	14.1 a	1.9 a	* 0.4 a	3.7 a	* 1.0 a
15	Badgingarra	27.4 d	* 32.7 c	65.6 d	57.1 c	25.0 d	27.0 c
	N. Bannister	22.9 c	* 29.4 b	25.2 c	31.3 b	14.0 c	* 17.5 b
22	Badgingarra	40.2 f	* 44.6 e	137.3 e	165.5 e	48.3 e	37.0 d
	N. Bannister	31.8 e	* 36.3 d	61.1 d	* 93.6 d	18.7 c	* 28.5 c

Values within columns followed by the same letter are not significantly different ($p < 0.05$). Asterisks indicate significant differences ($p < 0.05$) between low P and high P seed.

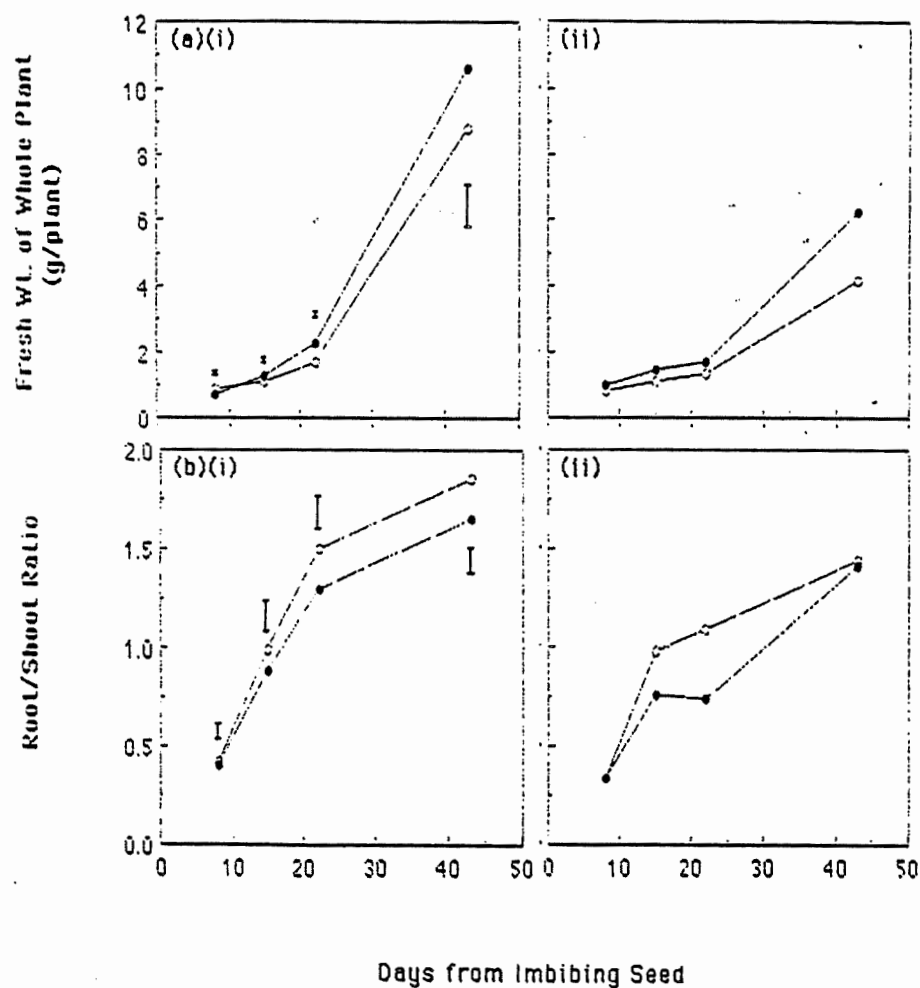


Figure 3. Effects of seed phosphorus (P) concentration (0-0.21%;●-0.43%) on (a) whole plant fresh weight and (b) root:shoot ratio of lupin plants at 8, 15, 22 and 43 days after imbibing seed for growth on (i) a P-adequate sand and (ii) a P-deficient loamy soil. Values are means of four replicates. Vertical bars represent lsd's (P = 0.05) for each harvest.

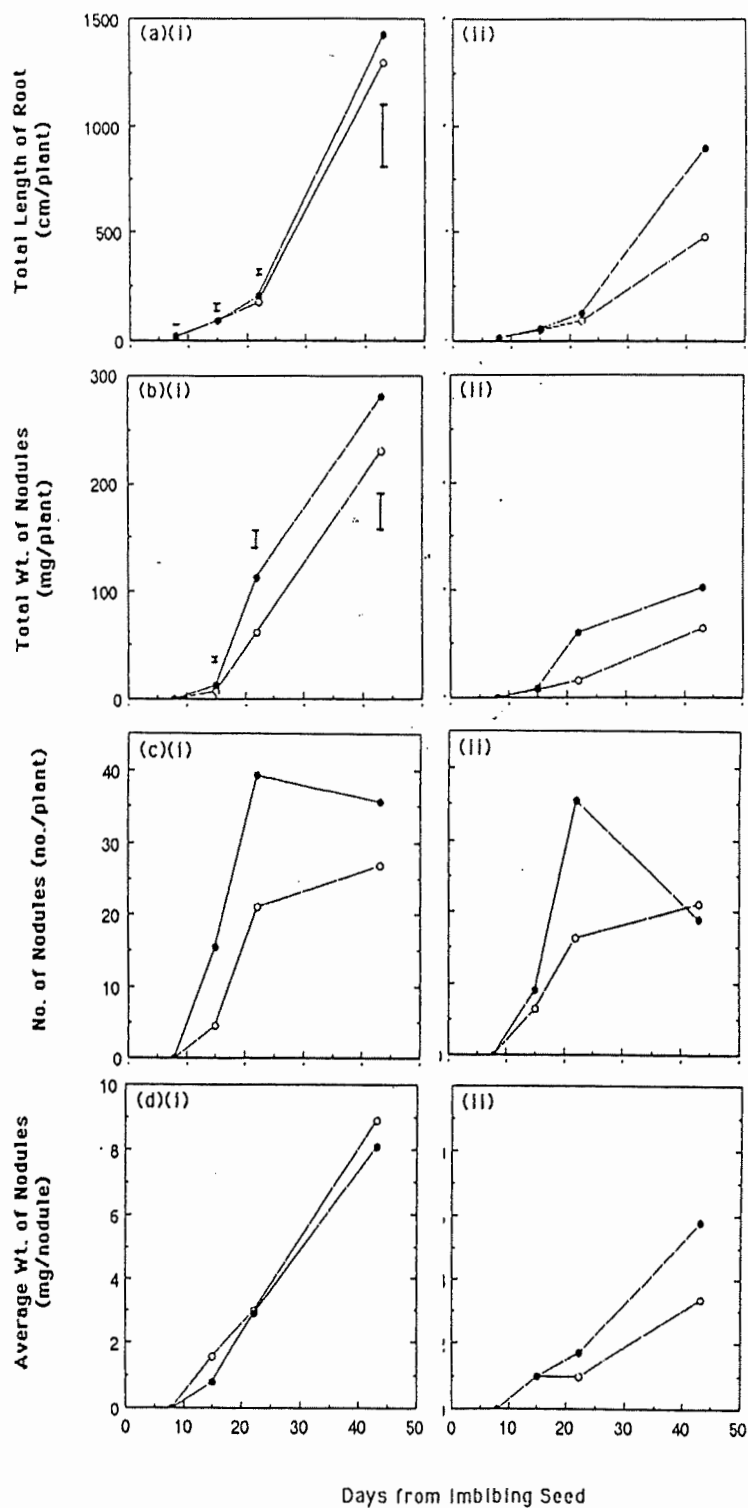


Figure 4. Effects of seed phosphorus (P) concentration (0-0.21%; ●-0.43) on (a) total root length, (b) nodule mass, (c) nodule number and (d) average mass of nodules of lupin plants at 8, 15, 22 and 43 days after imbibing seed for growth on (i) a P-adequate sand and (ii) a P-deficient loamy soil. Values as means of four replicates. Vertical bars represent lsd's (P = 0.05) for each harvest.

Comments

1. Low P in lupin seed depressed growth of seedlings within eight days on the low P Bannister soil and within 15 days on the P-adequate Badgingarra sand.
2. In soils, low P in seed depressed taproot length in contrast to its negligible effect in solution.
3. As in solution culture, low P in seed depressed numbers of lateral roots, and numbers of nodules.