## Effect of external nitrate supply on nodulation of lupins 1.Growth and nodulation of lupinus angustifolius and lupinus albus

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Lupins are grown in rotation with cereal crops to increase soil N levels, besides providing a cash crop and disease break. However, in many legumes, nodulation decreases with increasing external N supply (1,2). Field observations have suggested that nodulation of lupins is relatively tolerant of high N status (J.S. Gladstones, pers. comm.). To verify this, nodulation and growth of two lupin species at a range of nitrate concentrations were examined in a glasshouse experiment.

## Methods

Lupinus angustifolius (cv. Chittick) and L. albus (cv. Hamburg) were grown in a free-draining sandy soil. A complete nutrient solution (2 mM Mg, 3 mM K, 0.1 mM P, 10 uM B, 0.8 PM Zn, 0.3 OM Cu, 0.1 PH Mo) was applied weekly in sufficient volume to replace the existing soil solution, and so maintain constant nutrient status. Nitrate concentrations in the solutions were 0, 10, 20, 30, 40, 80 and 160 mM as Ca(NO)<sub>2</sub>, and Ca concentration was balanced with CaC1<sub>2</sub>.Treatments were dup3icated and plants were harvested 53 days after sowing.

## Results and discussion

Neither species emerged at 160 mM nitrate. At concentrations of 10 to 110 mM, shoot growth of L. albus was significantly greater than that at nil nitrate (Table 1). Root and shoot growth of L. albus was more responsive to nitrate than that of L. angustifolius, but nodulation of both species responded similarly and was severely reduced by 10mM nitrate, and completely inhibited at 40mM nitrate.

## Table 1. Effect of nitrate treatment on growth and nodulation of lupins.

Nitrate		Nodule Number		Root Dry Weight		Shoot Dry Weight	
Conc.		per plant		g plant		g plant	
(mM)	L.	angusti-	L. albus	L. angusti-	L. albus	L. angusti- L. albus	
		folius	0.007.5	folius		folius	
0		18.8	17.3	0.31	0.17	0.56	0.29
10		4.4	5.5	0.19	0.44	0.56	0.81
20		1.3	5.6	0.18	0.44	0.51	1.18
30		0.0	0.8	0.14	0.24	0.50	1.09
40		0.0	0.0	0.10	0.21	0.45	0.94
80		0.0	0.0	0.01	0.03	0.09	0.33
160		0.0	0.0	0.00	0.00	0.00	0.00
Inter	act	ion					
LSD (P=.05) 7.7*		0.17		0.15			

\*40, 80 and 160 mM results omitted from analysis (no nodules present). Combining this data with results from a second experiment (3), nodule numbers of L. angustifolius (cv. Chittick) were reduced by 1, 26 and 77% at nitrate concentrations of 2, 8 and 10 mM, respectively, compared with nil nitrate. In contrast, 6 mM nitrate did not reduce nodule numbers of chickpea (1) while nodule weight of soybean at 50 days was reduced by 22, 44, 75 and 88% at nitrate concentrations of 1.5, 3, 6 and 12 mM respectively (4). Further study is needed to confirm the lupin response at nitrate concentrations under 10 mM but it appears that, of these crops, nodulation of soybeans is most sensitive to external nitrate supply, followed by lupin, then chickpea.

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