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## Effects of applied quantity of phosphorus fertiliser on phosphorus content in plant tissues of lucerne (*Medicago sativa*) and seed yield in North-western China

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**Keywords:** lucerne, phosphorus fertiliser, tissue phosphorus concentration, seed yield

**Introduction** Phosphorus concentration in plant tissue can be a useful index of P deficiency in lucerne, P fertiliser recommendations and monitoring of effectiveness of current P fertiliser practices (Jacobsen & Surber, 1995). The objective of this study was to measure P concentration in different lucerne plant parts and seed yield in relation to P fertiliser application rates in order to improve recommendations for lucerne seed production.

**Materials and methods** The experiment was located in north-western China (39°37'N, 98°30'E, altitude 1480 m). The soil was an irrigated desert earth (Chinese soil classification), classified as silty clay soil with pH 8.5. Total soil P and available P content was 0.607 g/kg and 12.47 mg/kg, respectively. The lucerne was established with 60 cm row space and a seeding rate of 4.0 kg/ha. The experimental design was a randomised block with 3 replications of 7 P fertiliser application rates laid out in spring of 2001. Ten to fifteen plants of 15-20 cm high were taken per replicate in the regrowth period in spring of 2002; roots were 30-40 cm long. A sample of each plant part was taken by combining the plant parts of three replicates. P in each plant tissues and seeds were determined spectrophotometrically.

**Table 1** The total P content of plant parts responseto applied P fertiliser rates\*

P <sub>2</sub> O <sub>5</sub> kg/ha	Total P content (%DM)			
	Roots	Stems	Leaves	Seeds
0	0.09	0.23	0.34	0.45
60	0.20	0.27	0.42	0.56
120	0.19	0.30	0.40	0.63
180	0.21	0.31	0.41	0.64
240	0.23	0.28	0.40	0.62
300	0.20	0.29	0.40	0.65
360	0.23	0.30	0.42	0.67

\* Effects of P fertiliser application on all alfalfa plant parts were significant (p<0.001)

**Table 2** The equations of the relationship of total P content of plant parts to applied P fertiliser rates

Plant parts	Equation	Pr>F	R <sup>2</sup>	S.E.
Roots	Y=0.1138+0.000869X-1.65×10 <sup>-6</sup> X <sup>2</sup>	0.05	0.77	0.028
Stems	Y=0.2386+0.000530X-1.09×10 <sup>-6</sup> X <sup>2</sup>	0.07	0.73	0.017
Leaves	Y=0.3629+0.000405X-7.94×10 <sup>-7</sup> X <sup>2</sup>	0.28	0.47	0.024
Seeds	Y=0.4717+0.00134X-2.35×10 <sup>-6</sup> X <sup>2</sup>	0.01	0.89	0.031

**Results** Addition of 60 to 360 kg P<sub>2</sub>O<sub>5</sub>/ha resulted in a relatively greater increase in P concentration for roots than other plant parts (Table 1). The responses of lucerne seed yield and seed yield components to P application treatments in two seasons were not significant (P>0.05), addition of 120 kg P<sub>2</sub>O<sub>5</sub>/ha treatment showed highest seed yield of 794.1 kg/ha and 757.1 kg/ha in both years (data not listed). The P contents in seeds, roots and stems were highly correlated to P application rate (r<sup>2</sup> = 0.89, 0.77, and 0.73, respectively) and to a lesser extent to P content in leaves (r<sup>2</sup> = 0.47). Quadratic regression equations for roots and seeds were significant (P≤0.05).

**Conclusions** The concentration of P in roots can be a good indicator of soil P fertility. The critical concentration of P in roots to determine P fertiliser recommendations for lucerne plant growth or seed production deserves further evaluation.

### References

Jacobsen, J. S. & G. W. Surber (1995) Alfalfa/grass response to nitrogen and phosphorus application. *Communications in Soil Science and Plant Analysis*, 26, 1273-1282.