

Effect of liming acid krasnozems on the yield of poppy (*Papaver somniferum* L.)

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Growing of poppies for alkaloid production on Tasmania's krasnozems (Gn 4.11) is restricted by the contracting companies to sites with a soil pH_w (1:5, soil:water) greater than about 5.5. Currently lime is not recommended at these pH's but in pot experiments (1, 2) maximum capsule and morphine yields occurred at pH_w's of about 7.0. To confirm these results in the field, two experiments were conducted on acid krasnozems to investigate the effects of lime and gypsum on soil properties and the growth, yield and nutrient content of poppy.

Methods

The treatments of ground limestone (L=2.5, 5, 10 and 20 t/ha) gypsum (G=3.75 t/ha) and dolomite (D=4.25 t/ha) were broadcast and cultivated into the plots (4m x 15m) 15 months before sowing poppy. Sugar beet was the preceding crop. Harvests were taken at three stages from the irrigated poppy crops and leaf samples were taken at early flowering for nutrient analysis. Seed, capsule and morphine yields were determined at dry maturity. Composite soil samples were taken from surface (0-150mm) and subsoil (150-300mm) before sowing and one replicate was more intensively sampled (50mm depth increments) at sowing.

Results and Discussion

The effects of some treatments on selected plant and soil variables are given below:

Site Treatments	Forthside					Elliott				
	Nil	G	L ₅	L ₁₀	L ₂₀	Nil	G	L ₅	L ₁₀	L ₂₀
Capsule Yield (kg/ha)	367	623	780	968	1241	21	24	466	590	690
Capsule Morphine (%)	2.1	1.8	1.5	1.4	1.3	1.4	1.0	1.6	1.6	1.6
Morphine Yield (kg/ha)	7.0	10.2	11.2	13.2	15.7	0.3	0.3	7.3	9.5	11.3
pH _w (0-150mm)	5.6	5.4	5.7	5.9	6.1	5.1	4.9	5.4	5.6	6.0
pH _w (151-300mm)	5.5	5.6	5.5	5.5	5.7	4.9	4.9	4.9	4.9	4.9
Al* (0-150mm, µg/g)	2.2	1.9	0.9	1.2	1.4	31.3	29.1	6.1	3.8	3.3
Al* (151-300mm, µg/g)	2.1	1.3	1.7	1.9	1.3	35.4	26.5	26.3	28.2	17.4

Soil Al - 0.0114 CaCl₂ extractable, (3).

At both sites maximum capsule and morphine yield occurred at the highest rates of lime where surface soil pH_w > 6.0 and the top 50mm had pH_w > 6.5. Subsoil pH_w was unaffected by lime and high subsoil Al levels restricted root growth in all plots at Elliott. Leaf analysis showed Mn toxicity was not a problem and leaf N, P, Mo and B levels on L2.5 plots at both sites were considered adequate for normal growth. However, lack of published critical leaf nutrient levels for poppy allow tentative conclusions only to be drawn. Poppy yield responses to lime at both sites were attributed primarily to alleviation of Al toxicity but the response to gypsum at Forthside suggests Ca *per se* was also involved. Leaf Ca levels increased from 0.9-1.9% with increasing lime but the effects on yield, of reductions in soluble Al and increases in available Ca, were confounded by the ground limestone treatments.

Economic analysis of our Forthside results suggest that gross margins can be quadrupled from \$235 to \$1,070/ha by application of lime to krasnozems with pH_w 5.6. Further field evaluation is planned to test these treatments and their economic benefits under commercial conditions.

1. Kinoshita, K., *et al.*, 1962. Japan Nat. Inst. Hyg. Sci. 80: 158.

2. Laughlin, J.C. 1980. *Acta Hort.* 96: 227.

3. Hoyt, P.B. and Nyborg, M. 1971. *Soil Sci. Soc. Am. Proc.* 35: 236.