

## **The susceptibility of lucerne to soluble phosphate during germination**

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Previous work (1) has shown that lucerne is susceptible to injury during germination due to soluble phosphorus (P) seed coatings at rates as low as 2.5 kg P/ha (as monocalcium phosphate - MCP). The degree of injury can be partially alleviated by applying a polymer coating to the seed before coating with MCP (1). It was postulated that this effect was due to the polymer withholding toxic quantities of orthophosphate until the seed's membrane integrity was attained during imbibition (1). Studies of lucerne emergence were conducted to investigate how various treatments affected the susceptibility of lucerne to injury from MCP during germination.

### **Methods**

Four experiments examined the effects of cultivar, seed scarification, imbibition prior to planting, and time of MCP/soil contact on the emergence of lucerne. The experiments were conducted in an incubator (at 25 C); seeds were sown 10 mm deep in trays of sandy loam soil after either coating the seed with MCP or sowing it in contact with a layer of MCP at seed level.

### **Results and Discussion**

The two cultivars varied in susceptibility to seed coatings containing 3.8 mg MCP. The emergence from coated Maxidor II seed was 85% that of raw seed whilst Matador was 57%. In the same experiment, a layer of 1.75 g MCP/tray was found to damage emergence to approximately the same degree as seed coatings containing 7.2 mg MCP/seed.

Different degrees of abrasive scarification (nil, 0.5, 1.0, 1.5 and 2.0 times 'normal' scarification) resulted in slightly faster and more complete emergence of raw seed as the scarification level increased. When sown in contact with a layer of MCP, 33% of the nil scarified seed emerged compared to 21% of the normally scarified seed. This suggested that the susceptibility of the lucerne seed was related, at least in part, to its speed of water uptake.

To test the hypothesis that germinating lucerne may be able to withhold toxic quantities of orthophosphate if cellular membrane integrity is attained, seeds were imbibed for various times (0, 1, 3, 6, 12 and 24 hours [radicle emerged]) prior to sowing the seed in contact with a layer of MCP. All treatments showed equally severely reduced emergence when sown with MCP, thus rejecting the above hypothesis.

The effect of time of contact between the MCP and the soil was tested by sowing lucerne seed on layers of MCP which had been in contact with moist soil for 0, 0.5, 1, 2 or 7 days. Final emergence increased from 36% with no prior MCP/soil contact to 69, 87, 93 and 99% of control with increasing times of MCP/soil contact. This suggests that there may be a rapid change in the concentration of soluble phosphate in the vicinity of the seed soon after planting due to reversion of the MCP to less soluble forms and/or diffusion of the phosphate away from the seed zone. Hence, protective polymer coatings may act by delaying imbibition and thus permitting changes in the soluble phosphorus concentration rather than by excluding the uptake of orthophosphate ions. Further studies are being conducted to develop phosphorus coatings for lucerne seed which are effective and yet permit complete emergence.

1. Scott, J.M. (1986). Ph.D. thesis. Uni. of New England, 203 pp.