Omarama Basin Outwash Aluminuim Levels

Prepared for:

Greg Stuart,
Tara Hills Station,
Omarama.

By:

Peter Espie PhD,
AgScience Ltd,
333 Chain Hills Road
RD1 Dunedin,

December 2009

Introduction

It is proposed that deep rooting plants may be used to mitigate adverse nutrient effects from dairy effluent spread (Environment Canterbury Water Allocation proposal Williamson Holding/Killermont) on Mackenzie soils on outwash surfaces (Webb 1992) in the Ahuriri and Ohau basins.

Acidic, high aluminium soils limit the productive use of extensive, free-draining, outwash flats in the Ahuriri/Omarama basin. The most suitable legume for this 500-800 mm dryland environment, lucerne, will produce on average, 43% more than pasture (Douglas 1986), but is severely limited by sub-soil aluminium in these soils (Douglas *et. al* 1987). In an extensive survey of the upper Waitaki, lucerne growth was poor when soluble aluminium levels rose above 5 ppm and completely lacked vigour when levels were above 10 ppm. The standard topsoil pH tests did not give a reliable prediction of lucerne performance.

To investigate this further, outwash soil on Omarama and Longslip Stations were analysed for exchangeable Aluminium as part of a lime trial (Espie 1994)

Experimental Design

Mackenzie soils on the Ahuriri outwash surface were sampled at Omarama Station, opposite Tara Hills Station, and at Longslip Station adjacent to the boundary with Ben Avon Station.

This investigated the effect of increasing precipitation approaching the main divide on soil properties (Webb 1992).

At each site representative soil profiles were sampled in 7.5 cm depth increments to 30 cm, then by 10cm to 40 cm and finally by 20 cm to a total profile depth of 60 cm. Exchangeable aluminium was determined by standard methods (Webb 1992).

Results

Exchangeable aluminium levels in every horizon were at levels which equalled or exceeded levels which have been shown to limit, or severely limit lucerne growth (Figure 1, Douglas *et. al* 1987). Soil aluminium levels were higher on the moister Longslip Station.

Aluminium levels found here would also limit growth of a wide range of other pasture species. They would significantly limit root growth and the ability to uptake nutrients.

The depth profiles show high levels of exchangeable aluminium persist to 50 cm. Possible amelioration by lime application would require high application rates and this would require substantial time to take effect.

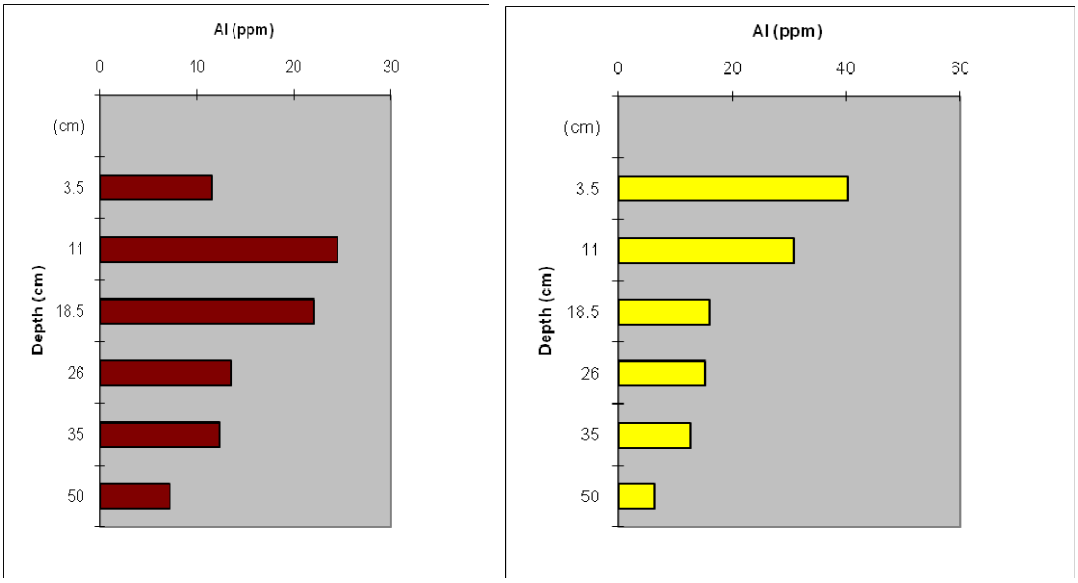

Figure 1. Exchangeable aluminium levels (parts per million) on Omarama Station (left) and Longslip Station (right) outwash soils.

Conclusion

The high levels of surface and subsoil exchangeable aluminium on Omarama/Ahuriri basin soils would adversely affect growth of pasture species and significantly reduce their effectiveness in nutrient uptake. This would increase the risk of nutrient leaching from applied dairy effluent into ground water. Effective amelioration would require substantial time to take effect.

References

Douglas, J.A. 1986. The production and utilisation of lucerne in New Zealand. *Grass and Forage Science 41*: 82-128.

Douglas, M.H., Brash, D.W., Barratt, B.I.P., Koeghan, J.M. 1987. Successful lucerne growing in inland Otago, *Proceedings of the 48th New Zealand Grasslands Association Conference: 48:* 193-197.

Espie, P.R. 1994. Omarama Basin Deep Tillage Trial. Unpublished Research Report for Omarama and Longslip Stations.

Webb, T.H. 1992. Soils of the upper Waitaki Basin, South Island, New Zealand. DSIR Land Resources Scientific Report No. 3.