Does chicory tolerate soil acidity?

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Chicory (*Chicorium intybus*) is a perennial herb with potential to produce large amounts of quality feed during spring, summer and autumn. Potentially, chicory also offers considerable advantages over annual forage crops in the management of rising water tables and nutrient leaching due to its deep tap-root. The New Zealand cultivar "Grassland Puna" has been promoted widely in NSW as a possible replacement for lucerne in some situations, particularly where soils are acidic. However, there is little information currently available that defines the relationship between chicory production and soil pH. This information would be useful to help producers plan pasture development programs for acid soils. A pot experiment was undertaken at the Orange Agricultural Institute to test the acid soil tolerance of chicory when compared to lucerne.

Methods

Soil that has previously been used extensively by NSW Agriculture for acid soil research was obtained from a Binnaway (NSW) property. This soil has low pH (4.3 in surface soil), low phosphorus (11 mg/kg Colwell P) and high aluminium saturation (41%). Puna chicory and Genesis lucerne were sown into pots previously treated with agricultural lime applied at equivalent rates of 0 (control), 0.5, 1.0, 1.5, 2.0 and 4 t/ha. The lime was only applied to the top half of the pots so root growth patterns could be determined. An additional treatment (2/2) where lime was applied at the equivalent rate of 2 t/ha to all soil in the pot was included to determine if this improved the growth of either species. Each of the 14 treatments was replicated 4 times. Lucerne seed was inoculated prior to planting. A balanced liquid fertiliser was applied at a rate to promote maximum plant growth.

Plants were sown in the first week in June and harvested after 91 days growth. Top growth was weighed and the leaf area and weight determined. After top growth was harvested, the pots were opened and the soil divided into top and bottom portions and samples taken to determine pH and measure rooting depth. Roots were extracted by washing away the remaining soil, and dried and weighed.

Results and discussion

As expected, lucerne grew poorly in the control and showed recognisable symptoms associated with aluminium toxicity. Lucerne only responded slightly to lime because, even at the highest lime rate, the pH (5.3) was still sub-optimal for growth, and there was still aluminium in the subsoil that affected root growth. No lucerne roots were found growing below the depth of lime application (approximately 5 cm), irrespective of the rate of lime applied.

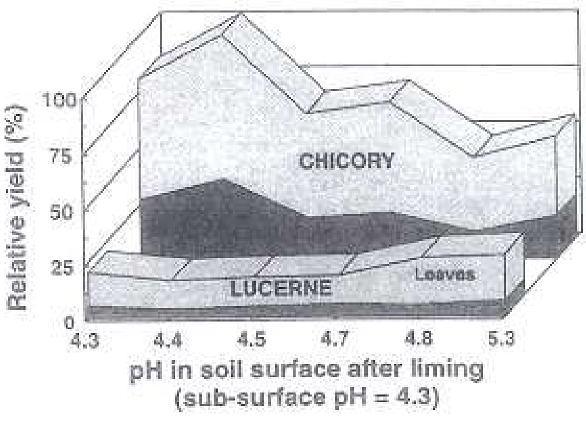

Figure 1. Effects of soil pH on the yield of leaves and roots of chicory and lucerne

In contrast to lucerne, lime application at the low rate of 0.5 t/ha (pH ($CaCl_2$) = 4.4) increased leaf and root yield of chicory, but at higher lime rates, yield of both top growth and roots was reduced (Figure 1). However, the change in soil pH did not affect the penetration of chicory roots, which extended to the bottom of the pots in all treatments

Improved chicory yield at a low lime rate suggests a response to Ca as a nutrient, whereas a yield reduction at higher lime applications may be linked to cation imbalance caused by high Ca concentrations and the shift in soil pH. Similar negative responses to lime application have been reported for acid-tolerant temperate (serradella) and tropical (stylo, cassia) legumes.

Conclusion

These preliminary results show that chicory is adapted to acid soils, and support the view that it can be safely grown without lime in the high rainfall zone on soils that are too acid for lucerne. However, the response of chicory to lime needs further study in field plots in combination with a range of fertiliser options.