

Growth of perennial grasses in an acid soil

Carol Harris

NSW Agriculture, Glen Innes, NSW

Liming will alleviate soil acidity in the surface soil layers; however, it is often difficult and expensive to correct acidity in the subsoil with lime. The use of acid-tolerant pasture varieties allows a paddock with acid subsoil to remain productive and provide for subsequent correction with lime. Many pasture species and varieties differ greatly in their tolerance of acid soils. This paper reports the relative performance of four temperate perennial grasses—cocksfoot (*Dactylis glomerata* L.), phalaris (*Phalaris aquatica* L.), perennial ryegrass (*Lolium perenne* L.), and tall fescue (*Festuca arundinacea* Schreb.)—in an acid soil under glasshouse conditions.

Methods

Shoot and root growth of cultivars of cocksfoot, phalaris, perennial ryegrass, tall fescue, and an ecotype of phalaris were measured in Al-added, unlimed, and limed soil over a 6-month period. The glasshouse experiment had three replicates arranged in a randomised block design. A bulk sample from the subsoil (10 to 20 cm) of an acid (pH_{Ca} 4.2, 41% ECEC Al.ex) red ferosol soil was collected from a property near Ebor (30°17'S, 152°25'E) in northern New South Wales. The soil treatments—A (pH_{Ca} 4.0, 44% ECEC

Al.ex), B (pH_{Ca} 4.5, 36% ECEC Al.ex) and C (pH_{Ca} 5.1, 0% ECEC Al.ex)—were achieved by adding aluminium sulphate ($\text{Al}_2(\text{SO}_4)_3 \cdot \text{H}_2\text{O}$), using unamended soil, and adding lime (CaCO_3) respectively.

Results

Shoot- and root-growth data for the four grass species are presented in Table 1. Of the four species, cocksfoot showed the greatest tolerance to very high aluminium levels, having a significantly greater number of tillers per plant and a higher shoot and root mass per plant. Phalaris had the poorest shoot and root growth of the four species. Shoot and root growth of all four species responded to lime, particularly perennial ryegrass where tiller number under nil aluminium was double that under very high aluminium.

Acknowledgments

This project was made possible through the financial support of the Acid Soil Action Program. The author also wishes to acknowledge the Singleton family at Hernani for allowing the collection of soil from their land and Mr John Delaney and Mr Len Doust for technical assistance.

Table 1. The effect of soil acidity on shoot and root growth of cocksfoot (CF), phalaris (P), perennial ryegrass (PRG), and tall fescue (TF) grown in three soils: A (pH_{Ca} 4.0, 44% ECEC Al.ex), B (pH_{Ca} 4.5, 36% ECEC Al.ex), and C (pH_{Ca} 5.1, 0% ECEC Al.ex).

Measurement	Soil A: Very High Al				Soil B: High Al				Soil C: Nil Al				I.s.d. P=0.05
	CF	P	PRG	TF	CF	P	PRG	TF	CF	P	PRG	TF	
Tillers per plant	8.0	6.0	6.6	7.3	7.8	6.2	6.9	6.9	9.6	9.1	14.2	9.9	0.78
Shoot weight (g/plant)	0.61	0.23	0.49	0.25	0.66	0.19	0.46	0.22	0.66	0.40	0.64	0.38	0.05
Root weight (g/plant)	2.28	1.17	1.58	0.90	2.14	1.05	1.43	0.87	2.14	1.53	2.32	0.99	0.16