

The effect of lime on growth and phosphorus uptake of red, white and subterranean clover on an acidic soil

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Pasture improvement is known to increase soil acidity. This acidity can greatly reduce production unless tolerant species are grown or soil remedies are used. Sub clover is known to be more tolerant of acid soil conditions than lucerne but white clover is the dominant legume on the northern tablelands of N.S.W. Three cultivars of white clover (Haifa, Ladino and Huia), two subterranean clovers (Woogenellup and Clare) and Redquin red clover were grown on a krasnozem soil with and without lime in the presence and absence of a complete nutrient application.

Methods

Rhizobium treated seed of six legumes were sown in soil having a pH of 4.2 (KC1), an Olsen R level of 13 ppm and a manganese level of 228 ppm (GC1 extract), in 18 cm diameter pots lined with polythene bags and thinned to 6 plants per pot. Lime at 5,000 ppm was thoroughly mixed with 1700 g of air dry soil/pot to which P, S, G, Ca, Mg, B, Cu, Zn and Mc were added to half the pots. The pots were watered to field capacity three times per week and the tops were harvested three times, dried, weighed and ground for analysis.

Results and Discussion

The effect of lime and nutrients on the total dry matter yield (g/pot) and phosphorus uptake (mg/pot) of four legumes are shown in the following table.

	Haifa		Redquin		Clare		Woogenellup	
	Yield	P uptake	Yield	P uptake	Yield	P uptake	Yield	P uptake
Nil	7.5	11.8	8.6	13.4	13.6	23.1	12.2	21.2
Nil + lime	13.9	30.6	18.6	30.7	18.3	39.6	13.5	27.2
Nutrients	8.5	18.0	12.5	22.1	21.2	36.1	20.3	42.1
Nutrients + lime	18.9	51.0	30.7	58.5	26.1	61.5	13.5	30.5
L.S.D. = Nutrient x variety for yield 2.17 and for P uptake 4.56 (P=0.05)								

As all white clover cultivars gave similar results, data for Haifa only, are included in the table. White clover was the least efficient species at extracting native P from this soil and only took up half as much R as the sub clovers. Red clover was only marginally better than white clover and consequently yields were much lower than sub clover. Surprisingly, Clare took up more R and out-yielded Woogenellup in the absence of lime.

The addition of lime in the absence of nutrients doubled the yield of red and white clover and more than doubled native P uptake. Lime had a smaller effect on Clare and virtually no effect on Woogenellup.

All cultivars except Woogenellup took up more R when lime alone was applied than when nutrients were applied. The same was also true for yield, except for Clare which yielded slightly less when lime alone was applied. Decreased R uptake, when nutrients including R were applied, compared to lime alone, is caused by R increasing manganese uptake, causing manganese toxicity, symptoms of which were evident during the trial especially on red and white clover.

All cultivars except Woogenellup achieved maximum dry matter production and P uptake when nutrients and lime were applied, with red clover producing the most dry matter and Woogenellup the least.

The results show that, under fertilized and unfertilized conditions, white and red clover are inferior to sub clover on this soil. Although the application of lime was more beneficial for red and white clover, only red clover out yielded the maximum yield of sub clover.