Relative Tolerance of Yellow Serradella Cultivars to Aluminium and Manganese

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Introduction

It has been estimated that there are 14 million ha of land in private holdings in NSW with surface pH (CaCl2) values less than 5.0. On this land there are no successful naturalized legumes. Aluminium (Al) and/or manganese (Mn) toxicities, phosphorus (P) and calcium (Ca) deficiencies, and nodulation failure limit productivity of improved legumes such as lucerne, clovers and medics.

Yellow serradella (*Ornithopus compressus*), a deep-rooted, Al-tolerant, self-regenerating, annual legume has the potential to meet this need on low phosphorus, sandy, acid soils where amendment with lime is impractical.

However, while yellow serradellas are generally more tolerant to soil acidity than other temperate legumes, no information is available on the relative tolerance of the current range of registered cultivars to Al and Mn.

A study was undertaken at the Agricultural Research Institute at Wagga Wagga, to compare the Al and Mn tolerances of six newly registered serradellas (Table 1) with Pitman, the standard cultivar.

Method

Top and root growth of these cultivars was measured at different Al (5, 10, 15 and 20 mg/kg) and Mn (75 mg/kg) concentrations and compared with control plants grown in acid medium (pH 4.2) without Al or Mn.

Table 1: Response of yellow serradella (*O. compressus*) to aluminium and manganese.

CULTIVAR	CONTROL YIELD		SOLUTION CONCENTRATION (mg/L)									
			ALUMINIUM								MANGANESE	
	TOPS	ROOTS	5		10		15		20		75	
	(T)	(R)	T	R	T	R	T	R	T	R	T	R
	(g DM/plant)		(Yield relative to control)									
PAROS	0.76	0.19	82	99	76	72	65	74	41	57	58	95
AVILA	0.83	0.23	64	79	50	77	40	67	29	62	29	35
TAURO	0.67	0.20	65	88	55	85	30	67	25	50	43	50
ENNEABBA	0.64	0.19	99	89	65	86	46	69	27	46	67	53
PITMAN	0.51	0.21	85	70	73	74	57	73	20	40	29	29
ELGARA	0.84	0.19	61	71	52	84	38	76	19	40	36	79
MADERIA	0.46	0.14	72	77	48	53	16	28	12	22	17	21

Results

Difference in yield potential between serradella cultivars was observed in control treatments with Avila, Elgara, and Paros producing highest yield while lowest yield was measured for Pitman and Maderia (Table 1).

To remove the effect of these differences in yield potential on assessment of Al and Mn tolerances, yield for Al and Mn treatments for each cultivar was divided by control yield. Based on comparison of these relative yields, Paros was most tolerant to high levels of Al and Mn, whereas Maderia failed to grow well at Al concentration 5 mg/kg (Table 1).

Avila, Tauro, and Eneabba showed similar tolerance to a high Al concentration (20 mg/kg), but differed in their tolerance to Mn with Avila showing least tolerance to Mn of the three (Table 1). In contrast, Elgara was quite tolerant of Mn, but did not grow well at Al concentration exceeding 15 mg/kg (Table 1).

Tolerance of these three cultivars to Al and Mn was determined by root growth. Regression analysis showed that 67% of variation in topgrowth yield at increasing levels of Al was explained by reductions in root growth.

Conclusion

The wide range of tolerance to Al and Mn reported in this study highlights the need to carefully select serradella cultivars to suit specific soil conditions as tolerance to high Al does not necessarily quarantee tolerance to Mn and vice versa.

For soils with a high level of exchangeable Al, Paros, Avila, Tauro and Eneabba should perform best, whereas on soils with high Mn levels, this study indicates that Paros and Elgara are the most suitable cultivars.