

Growth responses of annual legumes on saline soils

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Annual pastures (predominately subterranean clover) are widely grown on clay soils throughout the Murray Valley in New South Wales. Much of the area sown to annual pastures overlies shallow watertables, with associated salinisation problems. On the more saline soils establishment and productivity are affected. The relative salt tolerance of a range of annual legumes is being determined on a newly landformed saline soil with a watertable less than 2m from the surface. Yield reductions are being correlated with soil salinity measurements.

Methods

The trial is located within a bordercheck bay on a newly landformed, saline Moulamein clay. The site (10 x 196m) was chosen after a salinity survey showing E_ce values increasing from 6.03 to 18.20 dS/m in the top 60cm (average saturation percentage, 65%). Ninety plots (15m²) were established on 20 April, 1988. The experiment was a randomised block design with subterranean clover (cvv. Clare, Nuba, Trikkala), persian clover (cv. Kyambro), balansa clover (cv. Paradana), berseem clover (cv. Bigbee) and medics (cvv. Sapo, Sephi and Circle Valley). Each variety was replicated 10 times along the salinity gradient. The trial received 1 autumn and 2 spring irrigations of channel water plus good autumn rains. The plots were harvested twice. Tissue chloride levels were measured in cv. Bigbee.

Results and discussion

Table 1. Cumulative yields of annual legumes as a function of soil salinity (expressed as the mean electrical conductivity of the saturation extract of samples taken from each plot to 15cm at the first harvest; E_ce).

Rep	E _c e (dS/m)	Total yield (kg/ha DM)								
		Paradana	Bigbee	Kyambro	Trikkala	Clare	Nuba	Sephi	Saphi	C.Valley
1	1.0	2869	3617	2546	2192	2428	2638	757	1693	698
2	1.6	2991	2849	2098	2702	2011	3054	1188	1053	1457
3	2.0	2169	2605	2009	1748	3275	2671	1519	1483	1739
4	2.2	2657	3259	2378	2273	2353	4027	1357	1630	1403
5	1.3	3736	2997	2505	2400	2864	2693	1913	1139	1208
6	1.6	3674	3625	3903	1611	1384	2243	1550	1378	1386
7	1.5	2423	3046	1856	1347	2140	2430	843	988	1047
8	2.7	1627	2580	936	1443	1581	2223	675	680	348
9	4.1	1685	2610	843	703	721	793	273	105	627
10	3.9	2937	293	688	625	399	1743	30	1	249
Mean		2679	2748	1976	1704	1916	2451	1011	1015	1016

Bigbee and Paradana were the most productive species (Table 1). Paradana was the most salt tolerant, yielding over 1.5 times as much as Bigbee when soil salinities exceeded 3.0 dS/m (0-15cm). With two exceptions the yield responses to salinity fell on straight lines, differing in intercept and slope. Bigbee and Sapo both fitted a linear plateau model, with thresholds of 4.0 to 5.0 dS/m (0-15cm) respectively. Chloride levels in leaves of Bigbee taken before the second harvest ranged from 2.83 to 4.36% (g/100g), but showed no obvious trend with increasing soil salinity. The experiment is continuing in the 1989 irrigation season to verify these salinity responses.