**The effect of saline irrigation water on the growth of lucerne in northern Victoria**

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In the Shepparton Region of northern Victoria pumping of moderately saline groundwater and using it for irrigation is an essential component of salinity control. To optimize the volume of groundwater that can be used for irrigation without a decline in crop yield it is necessary to develop an understanding of the plant/soil/salinity interactions that occur in northern Victoria. The effect of a range of saline irrigation water treatments on lucerne has been investigated over three irrigation seasons.

## Methods

Lucerne (cv. Dekalb 167) plots ($30m^2$), on Lemnos loam (Dr 2.33) soil type, were irrigated in the 1981/82, 82/83 and 83/84 irrigation seasons with water of five salinities (0.1, 0.8, l.6, 2.4 and 4.5 $dSm^{-l}$). The salinity treatments were replicated four times and each salinity level had a superimposed soil modification pretreatment; being either ripped to 75 cm or not modified. Plots were harvested six times each season for yield and tissue ion analysis. Soil salinities (electrical conductivity of a saturation extract. ECe) were measured at the beginning and end of each irrigation season. Crop photosynthesis, transpiration, leaf conductance and plant water potential were measured on the 0.1 and 4.5 $dSm^{-1}$ treatments during three separate cut/regrowth cycles (Feb. 1982, Dec. 1982 and Feb. 1984).

## Results and Discussion

Yields were not affected by any salt treatment in 1981/82. In 1982/83 and 83/84 only yields of the 4.5 $dSm^{-1}$ treatment were reduced ( by up to 25%). Yield was most closely related to soil salinity in the 0-30 cm interval rather than greater depths and the relationship between yield and soil salinity was: Relative yield = 100 - 7.1 ($EC_e$ 0 -30cm - 2.3).Soil salinities increased in relation to the salinity of the applied water. The $EC_e$ for 0-30cm of the 4.5 $dSm^{-1}$ treatment was 5.8, 6.9 and 7.0 $dSm^{-1}$ after the 81/82, 82/83 and 83/84 seasons respectively , compared with 1.4, 1.1 and 0.6 $dSm^{-1}$ respectively for the 0.1 $dSm^{-1}$ treatment. Soil ripping did not affect soil salinities in the 0-30cm interval but increased water infiltration in 1981/82 and 82/83 giving yield increases of 10-15%. In 1983/84 the effect of ripping, averaged across all salt treatments, had disappeared.

Shoot Na and Cl levels tended to reflect the salinity of the applied water and reached 0.4 and 2.3% dry wt respectively in the 4.5 $dSm^{-1}$ treatments after the 81/82 season. Levels in 82/83 and 83/84 were only slightly higher. Shoot levels of other ions were only slightly affected, if at all. Overall, shoot ion concentrations were not closely related to changes in yield. Crop photosynthesis and transpiration per unit leaf area during the cut/regrowth cycles were similar for the 0.1 and 4.5 $dSm^{-1}$ treatments. Leaf conductances were also similar. However, plant water potentials always reached lower values (by up to 5 bars) on the 4.5 $dSm^{-1}$ treatment.

The results to date indicate that lucerne grown on duplex soils in northern Victoria can be irrigated with water up to 2.4 $dSm^{-1}$ without significant yield decline. With higher water salinities, as the ECe 0-30cm exceeds 2.3 $dSm^{-1}$ yield will decline. Reduced yield is not due to reduced transpiration or photosynthesis, or an accumulation of toxic ion levels, but primarily due to a reduction in soil water potential requiring the plant to expend extra energy to maintain a favourable water balance. Soil ripping improved yields at all salt levels by increasing available soil water through increased infiltration.