Growth and nutritive value of lucerne (*Medicago sativa* L.) and Melilotus (*Melilotus albus* Medik.) under saline conditions

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ABSTRACT

Dryland salinity is a major and expanding threat to agricultural land in Australia. Animal production from forages grown on saline land is perhaps its most promising economic use. Glycophytic forage legumes have been evaluated under saline conditions mainly for agronomic characteristics and, to a lesser extent, for nutritive quality to animals. Plant growth and its nutritive quality are interrelated, but a decline in yield in response to salinity may be associated with effects on the chemical constituents of the plant since soil salinity affects plant metabolism. This research aimed to investigate changes in the components of yield and nutritive value of two legumes species. Lucerne (*Medicago sativa*) and Melilotus (*Melilotus albus*) were exposed to different levels of NaCl in the range of 0 to 110 mM NaCl. The research tested the hypothesis that the components of plant nutritive value are not as sensitive to salinity as shoot biomass production since the adaptive mechanisms of the plant lessen harmful effects of the salts.

For both plant species, salinity decreased leaf and stem dry matter production, but increased leaf-to-stem ratio. In addition, salinity resulted in earlier flowering in Melilotus. Mineral composition was the most sensitive component of forage quality. Calculated sodium chloride concentrations were up to 125 g/kg DM in lucerne and 39 g/kg DM in Melilotus when irrigated with 110 mM NaCl. The concentrations of calcium and magnesium decreased in both species and approached the marginal range for animal production. Zinc concentration also decreased while potassium decreased in stems of lucerne only. The digestible organic matter (DOMD) in response to salinity varied between species. At the highest salt concentration, the whole shoot (i.e., leaf and stem) of lucerne decreased up to 4 percentage units while Melilotus increased by 6 percentage units. In lucerne, DOMD was influenced by a high concentration of soluble ash in leaf and stem and, in Melilotus, by an increase in the organic matter content of leaf and a reduction in lignin concentration in stem, which favoured higher digestibility. These results were supported by a histological study in which an increase in starch in Melilotus leaf, and a lower proportion of xylem in relation to parenchyma in stems, was measured. Crude protein concentration was not compromised and, in relation to Melilotus, coumarin concentration did not increase with salinity.

In conclusion, the reduction in DM production of species with similar salt tolerance does not necessarily correspond to an equivalent reduction in nutritive value. This research represents the most detailed study into effects of salinity on glycophytic forage legumes. Results show that

while some aspects of forage quality (e.g., minerals composition and energy) are strongly influenced by salinity, other aspects (e.g., protein) remain relatively unaffected. These findings have implications for development of productive grazing systems on saline agricultural land.

DECLARATION

I declare that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give my consent to this copy of my thesis, when deposited in the University Library, being made available in all forms of media, now or hereafter known.

21- May - 2006

Juan de Dios Guerrero-Rodríguez

Date

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