Ann. appl. Biol. (1998), **132**:507–524
Printed in Great Britain

Effects of salt on rhizobia and bradyrhizobia: a review

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(Accepted 7 April 1998)

Summary

Rhizobia and bradyrhizobia strains vary in their tolerance to salt-stress. *Rhizobium* strains (fast-growers) are more salt-tolerant than strains of *Bradyrhizobium* (slow-growers). However, salt-tolerance in both genera is dependent upon ionic species, pH value, temperature, carbon source and the presence of osmoprotectant solutes. The harmful effect of salts on growth of both genera can be attributed to the specific ion effect rather than the osmotic effect. The salt-tolerance of different strains of rhizobia and bradyrhizobia is not related to their ecological origin. Data for salt tolerance of 684 strains of rhizobia and bradyrhizobia were collected from many reports. Most of the reports confound the effects of salt and express the concentrations of salts in percentage (%), electrical conductivity (dS m^{-1}), molar concentration (M) or osmotic pressure (MPa) regardless of their differences. All the published data were compiled and recalculated from the different expressions to their equivalent molar concentration (M) of NaCl. A suggested classification of salt-tolerance of rhizobia and bradyrhizobia from the compiled data is presented.