WATER RELATIONS OF ACACIA

WITH SPECIAL EMPHASIS ON OSMOTIC ADJUSTMENT

by

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SUMMARY

Water relations of Acacia with special emphasis on osmotic adjustment

In spite of their importance in the Australian flora, acacias in Australia have received limited attention in research apart from taxonomic studies This project was designed to study one physiological aspect, namely water relations at the critical seedling stage and more specifically, osmotic adjustment.

Osmotic adjustment was defined as the decrease of osmotic potential of cell sap to more negative level as a result of the accumulation of osmotically active solutes in protoplasm rather than the concentration of cell contents due to loss of water

The aims of this study were

1. To demonstrate the existence, magnitude and variability of osmotic adjustment in *Acacia* especially South Australian species.

2. To investigate some of the solutes which accumulated when the plants were water stressed, particularly inorganic ions K^+ and Na^+ and organic compounds proline and others.

3. To seek correlations between osmotic adjustment patterns and the degree of water stress species might experience in their natural areas of distribution.

This study included glass-house, field and laboratory experiments Ten species were selected for a pot droughting experiment namely *A.anceps, A.aneura, A.gillii, A.longifolia, A.myrtifolia*, and *A.saligna; A.cyclops, A.iteaphylla, A.leiophylla* and *A.rivalis*. From measurements of water and osmotic potentials it was found that osmotic adjustment occurred in the first group but not the second. There was not a strong relationship between osmotic adjustment and the rainfall in the area of distribution of a species

Five of the species (*A.anceps*, *A.aneura*, *A.gillii*, *A.iteaphylla* and *A.myrtifolia*) were then grown in the field and monitored over summer. Four of the five showed stronger osmotic adjustment than in the pot experiment. Magnitudes were *A. anceps* 1.10 MPa, *A. aneura* 1.09, *A. gillii* 0.69, *A. iteaphylla* 1.07 and *A. myrtifolia* 1.11 MPa.

Proline concentration increased significantly in the stressed plants of most field grown species, while other organic solutes were not detected, except in *A.iteaphylla*, which unexpectedly contained phenyl-ethylamine (PEA). However, no evidence was found of a significant relationship between drought treatment and PEA concentration.

Potassium and sodium did not fluctuate with the fall of water potential in the field. For potted *A. iteaphylla* seedlings fluctuations in K^+ were also absent when the K supply was varied in Hoagland's nutrient solution. However the osmotic contribution of K and Na was between 29% and 52% of total osmotic potential in the field grown plants, a significant contribution. Which solutes did generate the observed osmotic adjustment was not determined.

The study suggested that osmotic adjustment is important in the survival of these acacia seedlings, although other factors may also be involved. The great diversity in Australian acacias and the tolerance of many to water stress may lead in future to their use as a genetic resource in developing drought-tolerant varieties.