THE PRODUCTION OF SALT TOLERANT TREES

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The southwestern part of Western Australia is under severe threat from salt encroachment across vast areas of agricultural and marginal lands. Already some 300,000 ha are so badly affected by salt that the land is useless for cropping.

My interest in arresting salt encroachment goes back many years. However I have only become involved in a positive way over the past ten years. My hope is that by encouraging the planting of salt tolerant species of native vegetation the land can be reclaimed, stabilised, and in time returned to productive use. It is well known that some species of plants are naturally salt tolerant but these plants may not suit particular areas or even the end use of the land. By selecting salt tolerant species that have a definite end use, and have been indigenous to the area, we are well on the way to successful rehabilitation.

Some nurseries have grown salt-tolerant species for many years. The methods used to select salt tolerant plants are many and varied. Simply collecting seed or vegetative material from plants growing on or close to salt scalds or saline waterways is the most common and has generally provided successful results. Seed collected from these plants is raised in the normal manner.

The other end of the scale begins as above but is taken many steps further. Researchers from the University of Western Australia and others have conducted many trials over the past few years involving salt tolerant plants (1).

METHODS

Initially a series of collecting trips were made into remote and salt affected areas to collect seed. The seed was mainly collected from single *Eucalyptus*, *Casuarina*, *Melaleuca*, and *Acacia* trees growing in "ideal" conditions. The better trees in an area that was worst affected by salt were selected. Each tree was photographed, numbered, and the seed lot labelled. The location was carefully recorded to allow future collectors to relocate the tree. Shrub species were also collected from these areas.

After returning from the trip each seed lot was cleaned, recorded, and stored in a cool room in sealed polyvinyl chloride screw top jars. Silica gel and a fungicide were added to each jar before storage.

In a trial in 1987 carried out in a rehabilitation nursery, 19 species of Western Australian eucalypts, representing a total of 48 provenances were selected, and seed from each was sown into Jiffy pots. The Jiffy pots were placed in standard punnet trays with open mesh bases. The trays rested on weldmesh benches allowing almost total air root pruning to occur, thereby avoiding tangled rootbound plants. Watering and fertilising was carried out as a normal nursery practice.

After 18 weeks the seedlings in Jiffy pots were planted into 305 mm plastic buckets. A layer of crushed rock was placed in the base of each bucket, and it was then filled with fine white sand. Four plants were planted in each bucket, which were placed into large metal trays. Each tray had a valve in the base to facilitate drainage as required. The trays with the pots in them were then placed in a glasshouse for two weeks to become established before the treatments were applied

The following treatments were used:

- C —Control. Drained and no saline solution.
- S —Saline solution, but drained.
- W —Waterlogged, but no saline solution
- SW —Saline solution and waterlogged

The control and saline solution treatments were watered automatically three times daily for 15 min. each watering. At each watering one litre of solution was used. To achieve waterlogging the trays were filled to about 1 cm above the soil surface. The solution used for the C and W treatments was Hoagland's No 2 Nutrient Solution, diluted to $^1/_5$ strength with tap water. The nutrients used for treatments S and W were NaCl, $MgS0_4$, and $CaCl_2$, in the ratio by weight of Na.Mg:Ca of 10:2:1. The concentrations were increased weekly by 7ms/cm until a concentration of 35ms/cm was reached, 35ms/cm is approximately equivalent to the concentration of sea water. The solutions in the trays were changed weekly and fresh nutrients and salt added.

The experiment ran for five weeks in January and February, 1987 in a glasshouse where the maximum temperature was 31 °C and the minimum was 18 °C

RESULTS AND DISCUSSION

From Table 1 it can be seen how each species performed under saline and waterlogged conditions.

Plants from provenances exhibiting superior tolerances to salt and waterlogging can then be selected and multiplied by tissue culture. Trials have shown that plants raised from tissue culture can be successfully grown, potted on, and normal growth rates achieved. When these plants are hardened off, they are planted out in the field and trialed. Following field trialing the successful clones are then put into normal production.

Although some of the plants used may not be well known, they are some of the most salt tolerant eucalypts known, and will contribute to the reclamation and rehabilitation of salt affected areas. Following the lowering of the water table by these species other less salt tolerant plants can be re-introduced and pockets of vegetation can be re-established.

The salt tolerant tree story does not stop here, indeed this is only a small part of the process. The pre-planting processes play an important role also. Deep ripping, furrow ploughing, mounding of rip lines, and contour grading are some of the jobs needed to be carried out to allow the young seedlings to get a successful start. The seeded or superior cloned trees cannot be expected to survive in a saline waterlogged paddock without this mechanical assistance. That, however, is another story.

Table 1. Percentage survival of seedlings from *Symphyomyrtus* eucalypt species after 5 weeks in non-saline drained (C), non-saline waterlogged (W), saline drained (S), and saline waterlogged (SW) conditions The value for each species is the mean of the provenance values. The range of provenance values is shown in brackets.

Eucalyptus Species	Number of Provenances	Survival, percent C	W	S	SW
E angustissima F Muell	1	100%	100%	100%	25%
E aspratilis Johnson et al. MS	2	100	100 (both 100)	100	31 (12-50)
E calycogona Turcz.	1	100	100	100	38
E eremophila (Diels) Maiden	1	100	88	100	25
E. halophila S & D. Carr	2	100	81 (62-100)	100	38 (both 38)
E. kondininensis Maiden & Blakely	3	100	96 (88-100)	100	12 (6-19)
E kumarlensis Brooker MS	1	100	88	100	12
E. loxophleba Benth.	3	100	96 (88-100)	100	17 (12-20)
E. micranthera F Muell, ex Benth.	1	100	62	100	12
E myriadena Brooker	1	100	100	100	31
E occidentalis Endl	12	100	100 (all 100)	100	59 (12-75)
E. platypus Hook.	1	100	100	100	0
E. plenissima (C. Gardner) Brooker	1	100	62	100	12
E quadrans Brooker & Hopper MS	1	100	62	100	6
E salicola Brooker MS	3	100	71 (50-88)	100	16 (6-31)
E. salicola (mallee form) Brooker MS	1	100	88	100	12
E sargentii Maiden	9	100	99 (88-100)	100	63 (38-94)
E spathulata Hook.	3	100	96 (88-100)	100	35 (25-44)
E yilgarnensis (Maiden) Brooker	1	100	100	100	25

This is only a simplified version of a long process and the many hours of research that has been undertaken to help stop the salt. I commend to everyone interested or involved in salt land work to make themselves aware of the work being carried out at the University of Western Australia.

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LITERATURE CITED

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