

## PRELIMINARY RESULTS OF A PROVENANCE TRIAL OF *EUCALYPTUS CAMALDULENSIS* IN A DRY TROPICAL AREA OF NORTH AUSTRALIA

D. Sun\* & G.R. Dickinson

Queensland Forest Research Institute, Department of Primary Industries, P.O. Box 210, Atherton Q 4883, Australia

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SUN, D. & DICKINSON, G.R. 1997. Preliminary results of a provenance trial of *Eucalyptus camaldulensis* in a dry tropical area of north Australia. A provenance trial of *Eucalyptus camaldulensis* was conducted in the Burdekin region of tropical north Queensland, Australia. Six provenances ranging from subtropical south Queensland to tropical north Queensland, each with and without mulch at planting, were assessed for their survival, height and DBH. There was a significant difference in survival, height and DBH among the provenances tested at age three years. However, the effect of mulch on these three parameters was insignificant. It appears that for the harsh environments of dry tropical north Queensland, provenances of tropical origins are more suitable than those from subtropical areas.

Key words: *Eucalyptus camaldulensis* - provenance trial - mulching effect - dry tropics

SUN, D. & DICKINSON, G.R. 1997. Keputusan awal percubaan provenans *Eucalyptus camaldulensis* di sebuah kawasan tropika kering di utara Australia. Satu percubaan provenans *Eucalyptus camaldulensis* dijalankan di daerah Burdekin di utara tropika Queensland, Australia. Enam provenans daripada kawasan subtropika selatan Queensland hingga ke kawasan tropika utara Queensland, setiap satu dengan atau tanpa sungkup di ladang, ditaksiran kemandirian, ketinggian dan DBHnya. Terdapat perbezaan yang ketara dalam kemandirian, ketinggian dan DBH di antara provenans yang diuji pada umur tiga tahun. Bagaimanapun, kesan sungkup didapati ketara ke atas ketiga-tiga parameter. Nampaknya, provenans yang berasal dari kawasan tropika lebih sesuai dengan persekitaran kawasan tropika kering selatan Queensland yang kasar, daripada provenans kawasan subtropika.

### Introduction

In the upper catchment areas of the Burdekin River, northeast Australia, tree establishment is a difficult process as the areas are subjected to extreme climatic variability (Sun *et al.* 1994). Summers are very hot and the majority of precipitation which falls between December and May is unpredictable and in some years totally unreliable. One way to overcome this difficulty is by choosing species which are suitable for the local conditions. *Eucalyptus camaldulensis*, which has a wide range of natural distribution, from warm humid tropical and subtropical to semi-arid and arid climates (Boland *et al.* 1984), has been found to be promising for the

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\*Present address: Bureau of Resource Sciences, P.O. Box E11, Kingston, ACT 2604, Australia.

Burdekin region (Sun *et al.* 1994, Sun & Dickinson 1995). However, because species suitability to a certain climate and soil may vary greatly with provenance (Hall 1990), it is necessary to conduct provenance trials in the region to identify appropriate *E. camaldulensis* taxa.

Studies have shown that the use of appropriate establishment techniques can substantially improve survival and growth of young trees (Gartner 1978). Ashworth and Harrison (1983) reported an increase in tree survival and early growth due to the application of mulch at tree planting. It is expected that mulch may benefit *E. camaldulensis* establishment in dry tropical areas.

This paper reports preliminary result of a trial conducted in the Burdekin region of north Queensland aiming to test the suitability of a number of *E. camaldulensis* provenances and the effect of mulch on tree establishment.

### Material and methods

The study was carried out on a site located about 43 km southwest of Ayr (19°49'S., 147°12'E., 18 m a.s.l). The average annual rainfall for the area was 893 mm with 75% of the total rainfall occurring between December and March. Mean daily maximum and minimum temperatures were 32.1 °C and 22.4 °C respectively in January, the hottest month, and 24.8 °C and 11.60 °C respectively in July, the coldest month. Frosts were rare in this area. The site was a reclaimed stock route which had been cleared of its open forest covering for many years and was in a low-lying flat area with a sandy clay soil (Donnollan *et al.* 1990).

Six provenances of *Eucalyptus camaldulensis* were used in this trial (Table 1). Each provenance received mulch and non-mulch treatments. A randomised complete block design with three replicates (blocks) was used. Each block contained 6 (provenances) × 2 (mulch treatments) = 12 plots and each plot consisted of 36 trees in 6 rows of 6 trees with an interrow spacing of 5 m and an intra-row spacing of 3 m.

**Table 1.** Seedlot details for all provenances of *Eucalyptus camaldulensis* used in the trial

Seed provenance/ source	Geographical location	Latitude	Longitude	Altitude (m)	Annual rainfall (mm)
Bullock Creek	Central Queensland	20° 46'	143° 55'	400	460
Emu Creek	North Queensland	17° 22'	144° 56'	500	800
Burdekin River	North Queensland	18° 57'	145° 03'	410	660
Quilpie	South Queensland	25° 58'	144° 35'	260	370
Charleville	South Queensland	26° 19'	146° 06'	295	450
Goondiwindi	South Queensland	28° 29'	150° 17'	213	560

Single-ridge planting mounds 30 cm high were constructed 5 months before tree planting. Seedlings of each provenance were hand planted in February 1992 with the mulch treatment applied at planting using sorghum hay. Fertiliser (19%

N, 20% P) was applied to each tree individually at a rate of 300 g per tree 2 weeks after planting. A weed-free band of approximately 1.5 m width was maintained along tree rows for the duration of the experiment using the herbicide glyphosate.

Survival, tree height and DBH (diameter at breast height) were measured at age 3 years. The provenance difference was tested using two-way ANOVA (analysis of variance). Where F-values were statistically significant ( $p < 0.05$ ), differences between each pair of the means were compared using the LSD (least significant difference) test (Zar 1984).

## Results and discussion

According to the daily weather records taken from a nearby weather station located at the Burdekin Agriculture College, the temperature and humidity at planting were extremely high at 37 °C and 90% respectively. The average maximum temperature for the first three months after tree planting was 31.6 °C. The total rainfall over the first 12 months after tree planting was 396 mm with only 25% of this falling in the first six months after tree planting. The total rainfalls over the second and third years were 516 mm and 409 mm respectively.

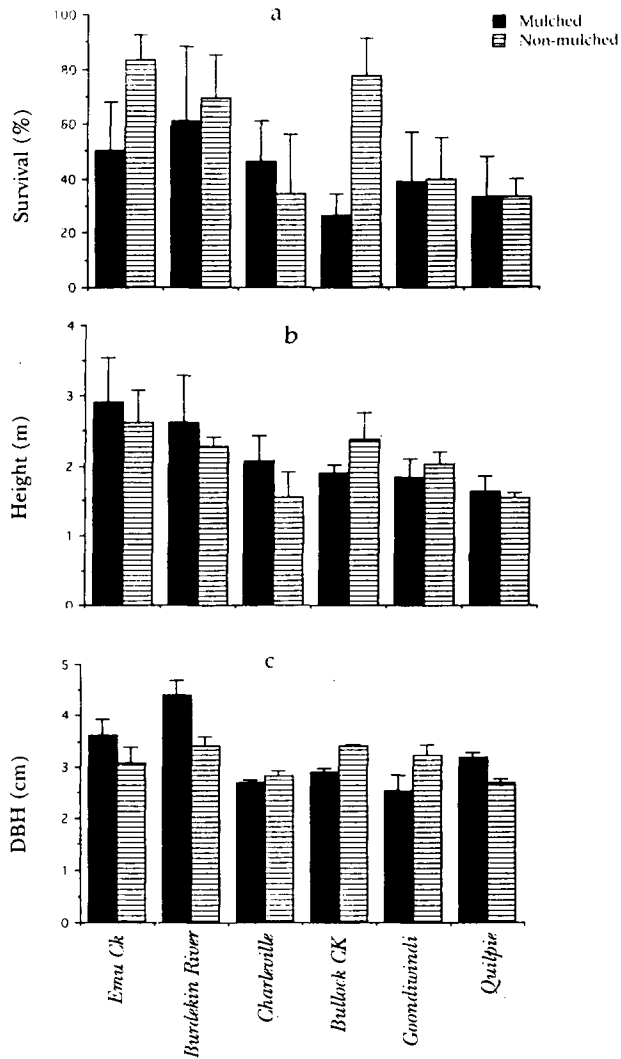
The survival at 3 years varied significantly with provenance ( $p = 0.028$ ) but not with mulching treatment ( $p = 0.262$ ) (Figure 1a). Based on the LSD test the two tropical north Queensland provenances, Emu Creek and Burdekin River (Table 1), had a significantly higher survival (mean survival of mulch and non-mulch was about 66%) than the subtropical south Queensland provenances. Quilpie provenance had the lowest survival (33%).

At age 3 years the differences in height and DBH among the six provenances were statistically significant ( $p = 0.022$ ) whereas the difference between mulch and non-mulch treatments was not significant ( $p > 0.1$ ) (Figures 1b and 1c). The interaction effect of provenance and mulching treatment was also not significant ( $p > 0.1$ ). LSD test shows that the two provenances, Emu Creek and Burdekin River, were significantly tallest (mean of mulch and non-mulch: about 2.7 m) and largest in DBH ( $> 3.7$  cm), while the provenances Bullock Creek, Goondiwindi and Quilpie were the shortest (about 1.7 m) and smallest in DBH (about 2.8 cm).

Our results suggest that *E. camaldulensis* has a high tolerance to both drought and heat. This tolerance varies significantly with provenance when grown in the Burdekin region of north Queensland indicating the importance of choosing correct provenances.

It appears that tropical provenances are more suitable for the region than subtropical provenances.

It is interesting to note that mulch did not improve tree survival and the growth of height and DBH for the provenances of *E. camaldulensis*. Evans (1982) noted that the effect of tree establishment techniques varies with the type of technique used. As there is a demand to establish trees successfully and quickly in dry tropical areas, further investigations of establishment techniques including some types of treeshelter successfully used by Applegate and Bragg (1989) and Sun *et al.* (1994) in tropical north Queensland are needed.



**Figure 1.** The growth of six provenances of *E. camaldulensis* at age 3 years with standard error bars: (a) survival, (b) height, and (c) DBH

### Conclusion

Of the six provenances of *Eucalyptus camaldulensis* tested, Emu Creek and Burdekin River are the most suitable for the region. It appears that for the harsh environments in dry tropical north Queensland, tropical provenances are more suitable than subtropical provenances.

It is suggested that mulch with sorghum hay may not be an effective technique for the establishment of *E. camaldulensis* in dry tropical areas.

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## References

- APPLEGATE, G.B. & BRAGG, A.L. 1989. Improved growth rates of red cedar [*Toona australis* (F. Muell.) Harms] seedlings in growtubes in north Queensland. *Australian Forestry* 52 : 293 - 7.
- ASHWORTH, S. & HARRISON, H. 1983. Evaluation of mulches for use in the home garden. *HortScience* 18 : 180 - 2.
- BOLAND, D.J., BROOKER, M.I.H., CHIPPENDALE, G.M., HASL, N., HYLAND, B.P.M., JOHNSTON, R.D., KLEINIG, D.A. & TURNER, J.D. 1984. *Forest Trees of Australia*. Thomas Nelson Australia, Melbourne.
- DONNOLLAN, T.E., MCCLURG, J.I. & TUCKER, R.J. 1990. *Soil and Suitability of Leichhardt Downs Section*. Land Resource Bulletin QV90002. Queensland Department of Primary Industries, Brisbane.
- EVANS, J. 1982. *Plantation Forestry in the Tropics*. Clarendon Press, Oxford. 472 pp.
- GARTNER, J.B. 1978. Using bark and wood chips as a mulch for shrubs and evergreens. *American Nurseryman* 147 : 53 - 55.
- HALL, N. 1990. Choosing the right species. Pp. 17 - 75 in Cremer, K.W. (Ed.) *Trees for Rural Australia*. INKATA Press, Sydney.
- SUN, D., DICKINSON, G. & BRAGG, A. 1994. The establishment and early growth of *Eucalyptus camaldulensis* on a saline site in north Queensland, Australia. *Agriculture, Ecosystems & Environment* 48 : 1 - 8.
- SUN, D. & DICKINSON, G. 1995. Survival and growth of a number of Australian tree species planted on a saline site in tropical north Australia. *Journal of Applied Ecology* 32 : 817 - 826.
- ZAR, J. H. 1984. *Biostatistical Analysis*. Englewood Cliffs. New Jersey.