



Spotted Gum seed orchard at Hamilton after pruning and thinning at 3.7 years

Identifying superior seed for low rainfall species

BY ROD BIRD & TIM JACKSON

The Australian Low Rainfall Tree Improvement Group (ALRTIG) has a national eucalypt breeding program to provide superior seed for farm forestry, concentrating on Spotted Gum, Sugar Gum, Red Ironbark and Swamp Yate. DPI is a partner in the program and we have completed first assessment and thinning of Sugar Gum and Spotted Gum potential seed orchards at Hamilton. These are probably the 2 major species that growers should consider for farm forestry sawlog production in the medium to lower rainfall parts of southern Australia. Each has good mature wood characteristics and a range of end-products. Sugar gum is more difficult to saw, slower to dry and more difficult to work but the wood is more durable than Spotted Gum and possibly superior as firewood. Both species grow well in the region, although Spotted Gum is more frost-tender.

ALRTIG is a co-operative of State and Commonwealth government-agencies formed in 1999 to produce genetically improved planting material for farm forestry in the low rainfall areas of southern Australia and supported by the Joint Venture Agroforestry Program. The group co-ordinates a national array of trials that cover sawlog-eucalypts (*Corymbia maculata*, *E. cladocalyx*, *E. tricarpa*, *E. sideroxylon*, *E. camaldulensis*, *E. occidentalis*), low-rainfall pines (*Pinus pinaster*, *P. brutia*, *P. radiata*) and mallee eucalypts (*E. polybractea*, *E. horistes*).

At DPI Hamilton, 108 families from 10 provenances are represented in the Spotted Gum block and 96 families from 12 provenances in the adjacent Sugar Gum. The blocks were ripped and mounded (4m spacing) and planted at the same time (2m spacings, with families planted in 5-tree row

plots), and each had 4 replicates of treatments.

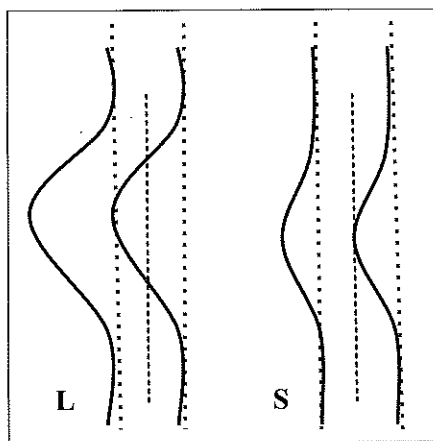
At 3.7 years, we culled the poorest 60% of trees in each family plot, thinning each site from 1250 to 500 trees/ha. After 2 or 3 more years, we will reduce that by 50%, leaving 250 trees/ha, and we will completely remove families in the lower 20-percentile range, allowing production of superior seed for farm forestry.

Tree assessment at 3.6 years included survival, health, height, diameter growth, stem erectness, stem-straightness, branch size, forking and presence of buds or flowers. Visual assessments of stem and branch characteristics were as follows:

- Forking – score of 0, 1, 2, 3, 4 or 5 for forking at base, 1st quarter, 2nd quarter, 3rd quarter, 4th quarter or no apparent forking, respectively. A fork is deemed to be >50% of diameter of main stem and

extending into the canopy.

- Stem erectness – score of 1, 2 or 3 for not vertical (>15 degrees), almost vertical (-5-10 degree lean) or vertical (no lean), respectively.
- Stem straightness – number of large and slight bends in 4-m trunk, where bends are deemed 'slight' (S) if the stem edge reaches about the stem centre-line or 'large' (L) if it reaches about the line of the opposite edge



(see figures), later classed as scores 1 (L or >2S), 2 (2S), 3 (1S) or 4 (no appreciable bends).

- Branch thickness – number of 'heavy' branches (>25% of trunk diameter at the point of insertion) on the 4-m trunk; where 2 or more branches are 'very heavy' (>50%), a further descriptor (V) is added. Data can be grouped later, e.g. into scores of 1, 2, 3, 4, 5 or 6 for trees with V (with or without 'heavy' branches), >6 heavy branches, 5-6 heavy branches, 3-4 heavy branches, 1-2 heavy branches or no heavy branches, respectively.
- Miscellaneous – we noted trees that had butt sweep or were windthrown early (W), lost top (T), coppiced (C), flowers (F), buds (B) or disease (D). We noted families that were bushy or retained a lot of low foliage.

Overall results comparing Spotted Gum with Sugar Gum are given in Table 1. Photographs of the pruned and thinned stands are also presented.

Several general points seem evident from these early results:

Fewer Spotted Gums have heavy branches (21% have >4 heavy branches

compared with 80% in Sugar Gum) – this is important when considering pruning strategies. For example, it means that self-pruning in Sugar Gums is unlikely to be sufficient to produce clearwood sawlogs (logs free of knots), while a less stringent pruning regime may be possible with Spotted Gum. Mature Sugar Gums in dense plantations invariably shed lower branches that are shaded but this will not occur early enough in thinned woodlots (or with wide-spaced trees) to allow sufficient production of clearwood. That is also a factor with Spotted Gum and, at best, pre-emptive pruning of potentially large branches will be necessary to achieve a narrow defect core. Optimists who believe that they will be able to avoid all of the expense or labour-intensive pruning practices and still produce high quality sawlogs are bound to be disappointed.

More Sugar Gums have large bends in the trunk (39% compared with 24% for Spotted Gum). These are major log faults that would result in poor recovery of sawn wood. This also means extra attention must be paid to correct other faults (such as forking) in trees that otherwise have no problems with stem straightness or erectness.

Spotted Gum has a greater tendency to fork at the base (16% compared with less than 1% in Sugar

Gum) – forking in the Spotted Gums appears to be induced by early frosting and this means that early form-pruning will be an advantage with this species. Forking higher in the tree was similar in both species. This fault is also easily removed by early form-pruning, at least to a height of 3m, where long-handled loppers are used, before a ladder is needed.

Overall differences among provenances are given in Table 2. There was also variation among families within provenances. At this stage, identification of superior provenances will enable growers to source better material in the next few years, before improved seed is available from the seed orchards. It will be interesting to see how the seedlots rank at other ALRTIG sites.

The Spotted Gum provenance from Mottle Range (the only natural stand in Victoria) performed very well (Table 2). Mumbula SF (near Bega) provenance had the best growth but also had the heaviest branching. Provenances from northern NSW (Yarrat SF and Curryall SF) had good form but below average growth. An individual family from Barclays SSO was among the best for all characteristics, with height 7.4m, DBH 10.6cm, forking 3.5, erectness 3.0, 'heavy' branches 1.2, 'very heavy'

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Assessment factor	Spotted Gum	Sugar Gum
Survival (% of trees planted)	96	96
Health (% with twig or stem canker)	0	4
Flowering (% of trees with buds or flowers)	29	67
Height (m)	6.5	6.3
Diameter at breast height (DBH) (cm)	9.1	8.8
Forking incidence (score 0-5)	2.7	3.3
Forking at base (% of trees)	15.7	0.4
Erectness (score 1-3)	2.9	2.8
No. of 'heavy' branches	2.9	6.8
% of trees with 'very heavy' branches	19	25
% of trees with no 'heavy' branches	11	0
% of trees with 1-4 'heavy' branches	68	20
% of trees with >4 'heavy' branches	21	80
Stem straightness (score 1-4)	2.5	2.2
Stem straightness (% of trees with score 1)	24	39

Table 1. Characteristics of Spotted Gum and Sugar Gum seed orchards at DPI Hamilton at 3.6 years (means of all trees)

branches 2%, and stem straightness 3.5. A family from Yarrat SF had the poorest growth with height 5.5m and DBH 7.2cm. A family from Bodalla SF had very poor form with forking 2.0, erectness 2.7, 'heavy' branches 4.4, 'very heavy' branches 69%, and stem straightness 1.4.

Among Sugar Gum provenances, Kersbrook SO material was excellent (Table 2). Provenances from Kangaroo Island (American River, Cygnet River, Flinders Chase NP) had poor form (and retained lower leaves and looked bushy) but reasonable growth, while most provenances from near the Flinders Ranges (Mt Remarkable, S Wilmington PO, Wilmington) had good form but below average growth. Majorca material had excellent growth.

The material from Wail and Lismore was mid-range and comparable with that from Wirrabara (also near Flinders Ranges), from which the Wail and Lismore



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plantations were probably derived before 1900. All provenances tested are better than those from the Eyre Peninsula, which were excluded on the basis of initial screening of earlier ALRTIG partners' trials. An

individual family from Kersbrook SO was among the best for all characteristics, with height 7.0 m, DBH 9.9cm, forking 3.9, erectness 3.0, 'heavy' branches 4.6, 'very heavy' branches 9%, and stem straightness 2.8. Several Kersbrook SO families stood out as visually superior. A Flinders Chase NP family was among the worst tested, with height 4.2m, DBH 5.9cm, forking 1.9, erectness 2.0, 'heavy' branches 9.4, 'very heavy' branches 44%, and stem straightness 1.3.

The Spotted Gums and Sugar Gums research is carried out by Rod Bird & Tim Jackson, Department of Primary Industries, Hamilton

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Provenance (No. families)	Height (m)	DBH (cm)	Forking (score 0-5)	Erectness (score 1-3)	No. of heavy branches	% trees with very heavy branches	Stem straightness (score 1-4)
Spotted Gum							
Barclays SSO (17)	6.8	9.5	2.9	2.9	2.9	21	2.6
Bodalla SF (10)	6.3	8.7	2.7	2.8	3.3	18	2.3
Curryail SF (29)	6.2	8.7	2.6	2.9	2.7	13	2.6
Kiola SF (9)	6.7	9.9	2.4	2.8	3.2	32	2.2
Mottle Range (6)	6.9	9.8	2.9	2.8	2.6	18	2.2
Mumbula SF (5)	7.1	10.0	2.5	2.8	3.4	38	2.4
Nelligen (10)	6.4	9.0	2.3	2.8	3.3	24	2.5
Wando Heights (1)	6.2	9.1	2.4	2.8	2.8	18	1.6
Wingello (12)	6.7	8.8	2.8	2.9	2.9	13	2.4
Yarrat SF (9)	6.4	8.9	2.8	2.9	2.5	10	2.6
Sugar Gum							
American River (5)	6.4	8.5	3.1	2.9	7.3	26	2.1
Cygnet River (3)	6.5	8.7	2.8	2.7	7.7	57	1.7
Flinders Chase NP (21)	6.4	9.0	2.5	2.6	8.4	45	1.9
Kersbrook SO (13)	6.6	9.2	3.8	3.0	6.2	13	2.7
Lismore (1)	6.3	8.8	3.0	2.9	5.5	30	1.8
Majorca (5)	6.6	9.5	3.5	2.9	7.3	24	2.2
Mt Burr (5)	6.4	9.3	3.2	2.9	6.4	28	2.1
Mt Remarkable (16)	5.9	8.1	3.5	2.9	6.2	15	2.4
S Wilmington PO (5)	5.9	8.4	3.2	2.9	5.6	33	2.4
Wail (3)	6.3	9.2	3.7	2.8	6.6	13	2.1
Wilmington (4)	5.8	7.8	3.4	2.9	6.3	13	2.4
Wirrabara SF (15)	6.3	8.8	3.5	2.9	6.4	17	2.1

Table 2. Mean growth and form of Spotted Gum and Sugar Gum provenances at 3.6 years

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