Bursaria for biodiversity: its attributes and propagation

Rod Bird

Of the dozen or so local species that should be the basis for re-establishment of native vegetation on the basalt plains, Sweet Bursaria (*Bursaria spinosa*) ranks with Blackwood (*Acacia melanoxylon*), Black Wattle (*A. mearnsii*), Silver Banksia (*Banksia marginata*), Drooping Sheoak (*Allocasuarina verticillata*), Swamp Gum (*Eucalyptus ovata*) and Manna Gum (*E. viminalis*), all of which were widespread on the plains and hills before European settlement.

Sweet Bursaria, known as 'Box' or *Myrtus australis* by the early settlers and travellers, was a widespread species but is now severely depleted. Remnants can be seen on many roadsides and farms, particularly in areas inaccessible to stock. Local sources include areas on Hensley Park Rd and adjacent paddocks about 4 km from Hamilton, Picnic Rd at Tarrington, land near the Old Lutheran Cemetery and RMIT on Chatsworth Rd in Hamilton, the banks on the north shore of Lake Linlithgow, the banks of the Wannon River and the Mount Napier State Park.

This species is usually seen as a shrub, although it can grow to 10 m or more in height and with a trunk of 20-30 cm diameter near the base. Trees like that can be seen off Chatsworth Road, near Hamilton.

Bursaria usually carries spines on the small branches and trunk, although some bushes are thornless. Invariably about 5% of seedlings grown in a nursery have no thorns. The species is attractive to small birds and, perhaps, not so attractive to cats and foxes, so it may be a useful plant to have in shelterbelts and gardens. It is, however, not suitable for areas close to paths or play areas, because of the sharp thorns that usually break off in the wound. One way of reducing the problem, where the tree has been planted too close, is to snip the thorns off the trunk and lower branches.

Summer-flowering species like Sweet Bursaria and Silver Banksia supply honeyeaters, butterflies, wasps and other insects with nectar, and many of these insects are agents for biological control of pasture grubs. The wasps are presumed to only work up to about 200 m from a source of nectar, giving rise to the suggestion that shelterbelts containing Bursaria should not be greater than 400 m apart. *Scolid* wasps (hairy flower wasps) or *Thynnid* wasps (flower wasps) parasitise various pasture scarabs – the female wasps burrow into the soil and lays an egg in each grub. Robber flies, Lacewings, Ladybirds, Hover Flies and Mantids all parasitise larvae. The Bee-fly larvae parasitise wingless grasshoppers. Incidentally, Bee-flies lay eggs in knot holes – where timber is removed the Bee-fly numbers are reduced – a reason for not being too tidy.

Seed collection

Bursaria flowers in the summer and produces flat, brown, seeds about 1.5 mm in diameter in seed capsules that ripen in autumn, releasing seed on hot and windy days in April. The seed can be harvested by placing an inverted umbrella beneath a branch bearing seed capsules and tapping the branch sharply with a stick to release the seeds. The capsules can be stripped by hand from the shrub but be wary of the sharp spines.

One must then dislodge the seed from the capsules because weevils will rapidly convert the seeds to dust if the material is stored without separation. The dry seed should be stored in the refrigerator in a jar to exclude water and air. A few naphthalene flakes can be added to kill any weevils. The seed will remain viable for 1-2 years but not 4. The species typically has 435-500 seeds/g with a viability of about 44-80%.

Germinating the seed

One reason for the failure of landholders to plant this important species has been the failure of nurseries to stock these plants. Nursery operators have found it difficult to grow Bursaria because it does not fit into their normal propagation routine of spring-summer sowing.

In 1987-1989 we found that Sweet Bursaria seed sown in spring (Sept-Oct) in a direct-seeding program conducted on farms mostly failed to germinate that year (see *Trees and shrubs for south west Victoria* by PR Bird, GA Kearney and DW Jowett, 1996). For 9 large sites only 3 produced seedlings at 7 months; a miserly 0.007-0.14% of the viable seed sown. Standard 28-day seed viability tests at the former ‘Seed Testing Centre’ at Burnley indicated that the seed was all "dead" but we knew this to be unlikely, since seed

left in pots germinated in the cold mid-winter the following year. Clearly there was some peculiarities to the germination process. Was there a daylight length factor, or a need for cold stratification?

We set up experiments to resolve the question as to how best to germinate the seed in nursery practice and what needed to be done to use it successfully in direct-seeding. That research, conducted opportunistically over several years when seedlings were required to be produced in our nursery, is outlined below.

Project 1: Confirming the 'natural' pattern of germination of Bursaria seed

Seed was collected at Tarrington on 8 April 1989 and stored at room temperature until sown on 03 May. Germination was assessed periodically thereafter (Table 1).

The sowing mix here (and in subsequent projects) was 50% 'Debco' pine bark-sand mixed with 50% coarse sand to improve drainage. Seeds were propagated in 'Forestry Tubes' in 4 replicates of 100 seeds spread over a rack of 12 or 20 tubes.

Table 1. Germination of Bursaria (% of seed sown) in relation to time after sowing in 1989

Seed collected	Date sown	Percent of sown seeds germinated					
		Rep	13 June	30 June	13 July	18 July	4 August
Tarrington 8 Apr. 1989	3 May 1989	1	0	emerging	20	36	35
		2	0	emerging	31	47	56
		3	0	emerging	32	47	57
		4	0	emerging	19	30	40

The mornings in 1989 when frosting was likely to have occurred were:

- 20-21 May (Terest. T -0.3 & -2.5°C; Min. T 0.0°C)
- 31 May-03 June (Terest. T -1.5, -2.1, -4.8 & -2.2°C; Min. T -1.8 & 0.4°C)
- 21-29 June (Terest. T -2.0, -1.0, -2.0, -4.4 & -1.0°C; Min. T -1.0 & -1.5°C)

The seedlings emerging on 30 June were apparently primed by frosts or day length.

Project 2: Effect of cool storage and seed age on the germination of Bursaria seed in 1993

Seed was collected at Hamilton on 12 April 1993 and Tarrington on 8 April 1989. Several treatments were imposed, as shown below. Sowing mix was 50% Debco pine bark-sand mix with 50% sand, or 100% sand.

Table 2. Effect of some seed storage factors on germination of Bursaria in 1993

Seed source	Pre-sowing storage & sowing mix	Date sown	Percent of seeds germinated				
			13 Jun	30 Jun	13 Jul	10 Aug	7 Sep
Hamilton 12 April	Air conditioned room – Debco	22 April	0	20	67	69	69
	Air conditioned room– Debco	21 May	0	0	5	79	80
	Air conditioned room – Sand	21 May	0	0	4	75	76
	Dry, in refrigerator – Debco	21 May	0	0	2	73	72
	Wet, in refrigerator – Debco	21 May	0	30	57	78	81
	Dry, in refrigerator – Debco	20 Aug.	no germination by late Dec. 1993				
Tarrington 1989	Room temp (from 1989) – Debco	April/May	no germination by late Dec. 1993				

The mornings in 1993 when frosting was likely to have occurred were:

- 26-30 April (Terest. T -1.0, -2.0, -2.3°C, ; Min. T 1.7 & 1.0°C
- 4-6 May (Terest. T -2.3, -4.2, -0.5°C; Min. T 1.7 & -2.0°C)
- 10-20 May (Terest. T -2.4, -0.3, -0.4, -3.0, -0.8, -3.4°C; Min. T 0.5, 0.0, 1.4, 1.2, -0.9°C)
- 26 June-5 July (Terest. T -1.8, -1.9, -1.6, -3.0, -2.8°C; Min. T 1.5, -0.8, 0.6°C)
- 23-24 Aug. (Terest. T -0.4, -0.5°C; Min. T 5.0°C)
- 3-5 Sept. (Terest. T -0.7, -2.0°C; Min. T 1.4, 2.9°C)

- 11-15 Oct. (Terest. T -2.6, -2.3, -1.9, -1.2°C; Min. T 1.1, 1.0, 0.6, 1.7°C)
- 7-10 Nov. (Terest. T -2.0, -1.8, -2.9°C; Min. T 1.1°C)

The results indicate a very viable seed collection and no impact of cool storage treatment on germination. Most of the germination occurred in July and August, perhaps in response to the frosts in late June. Late sowing (in August) produced no seedlings that spring-early summer, despite some periods of frost. Lastly, the 4-year-old Tarrington seed was dead.

Project 3: A comparison of room and refrigerator storage on seed germination in 1994

Seed used for this comparison was collected on 12 April 1993 in Hamilton and stored for a year at room temperature or dry in a refrigerator at about 3-5°C. It was then sown on 31 March 1994. The objective was to test the viability of seed after one year of storage and to see if cool storage was beneficial.

The same materials and methods were used here as in previous projects. Duplicate replicates were used but only mean values are presented in Table 3.

Table 3. Germination of Bursaria in relation to time of year after sowing in 1994

Pre-sowing storage treatment	Date sown	Percentage of seeds germinated				
		1 June	14 June	28 June	13 July	27 Aug
Room temp	31 March 94	2	25	63	68	69
Dry, in refrigerator	31 March 94	1	15	71	76	79

The mornings in 1994 when frosting was likely to have occurred were:

- 21 April (Terest. T -1.6°C; Min. T 0.2°C)
- 30 Apr.-13 May (Terest. T -1.9, -3.8, -0.6, -2.2, -2.5, -3.3°C; Min. T 0.7, -0.7, 1.5, 0.5, 1.9, 0.2°C)
- 01-11 June (Terest. T -1.8, -1.4, -0.5, -1.4, -2.6, -4.0, -1.5°C; Min. T 1.8, 1.1, 2.5, -0.1, -1.0, -1.9, 1.2°C
- 28 June-02 July (Terest. T -4.1, -2.0, -3.5, -3.5, -1.1°C; Min. T -1.9, 0.7, 0.0, -1.3, 1.2°C)
- 16-26 July (Terest. T -1.5, -4.5, -3.2, -5.3, -5.0, -1.2; Min. T 2.3, -1.4, 0.6, -3.0, -1.7, 2.6°C)

The year-old seed was highly viable. Storage dry in the refrigerator (at 3-5°C) appeared to give slightly better germination than simply storing it at room temperature.

As a consequence of some severe frosts in 1994 there was plenty of opportunity to produce freezing conditions on the tubes to promote germination. There was a possibility that germination was conditional on day length, with the shortest daylight hours the main signal.

Project 4: Effect of refrigeration treatments and smoke water on Bursaria germination in 1999

Seed was collected from the Wannon River, upstream from Wannon Bridge, on 11April 1999. The sowing mix was 50/50 coarse sand and 'fern' sand and 100 seeds comprised each test replicate. The seeds in each treatment replicate were spread over 20 tubes in a tray.

This work entailed the following treatments:

- Seed stored dry in a refrigerator for 3, 4 & 5 months and sown in July, Aug. & Sept., resp.
- Seed stored damp in refrigerator for 1 month (from mid-June, mid-July, mid-Aug.) then sown
- Seed stored damp in refrigerator for 3 month (from mid-Apr., mid-May, mid-June) then sown
- Commercial smoke-water treatment – seeds were soaked in a diluted smoke-water:water solution (1:9) for 12 or 24 hrs. Seeds were sown in late August and early September.

Seedlings in some of the tubes were potted on in the summer of 2000 but others were left to see what might germinate in the winter of 2000. Those extra germinants are shown in the last column of Table 4.

The control treatment (6 replicates) gave a germination percentage of 44, with first shoots mostly emerging on 08 June after sowing on 19 April. The frosts in April or May appear to have been sufficient to break the seed dormancy. There were frosts through to November but, for seeds sown later than 14 July, these did not appear to have much impact (not severe enough?).

Table 4. Germination of Bursaria in relation to time of year after sowing and other factors in 1999

Treatment	Replicate	Date of sowing	Date of first shoots	Date of max. no. of seedlings	Max. percentage of seedlings	Percentage germinated in June-July 2000
Control	1	19/04	8/06	16/07	47	not counted
	2	19/04	15/06	28/07	41	
	3	19/04	8/06	22/09	52	
	4	19/04	8/06	7/09	32	
	5	19/04	8/06	22/07	31	
	6	19/04	8/06	7/09	61	
stored dry 3 months	1	14/07	1/09	29/09	50	
	2	14/07	1/09	4/10	60	
stored dry 4 months	1	10/08	22/09	10/11	23	
	2	10/08	22/09	10/11	18	
stored dry 5 months	1	7/09	5/11	24/11	15	
	2	7/09	5/11	24/11	18	
3 mths damp from 20/4	1	14/07	7/09	25/10	11	
	2	14/07	7/09	24/11	12	
3 mths damp from 18/5	1	10/08	22/09	1/12	5	4
	2	10/08	-	-	0	3
3 mths damp from 15/6	1	7/09	17/11	17/11	1	18
	2	7/09	5/11	17/11	2	25
1 mth damp from 15/6	1	14/07	1/09	18/10	33	
	2	14/07	1/09	18/10	42	
1 mth damp from 13/7	1	10/08	14/09	18/10	41	13
	2	10/08	14/09	25/10	20	14
1 mth damp from 10/8	1	7/09	17/11	24/11	3	6
	2	7/09	24/11	24/11	3	6
Control for smoke water	1	26/08	-	-	0	11
	2	26/08	10/11	10/11	1	10
	3	26/08	10/11	10/11	1	4
1st 12 hr smoke water	1	26/08	5/11	24/11	4	8
	2	26/08	18/10	17/11	16	4
	3	26/08	18/10	1/12	5	11
1st 24 hr smoke water	1	26/08	25/10	7/12	2	2
	2	26/08	1/12	1/12	1	2
	3	26/08	1/12	1/12	1	3
2nd 12 hr smoke water	1	7/09	10/11	10/11	5	21
	2	7/09	1/12	1/12	1	17
	3	7/09	10/11	10/11	6	12
2nd 24 hr smoke water	1	7/09			0	6
	2	7/09	24/11	24/11	1	11
	3	7/09	17/11	17/11	2	8

The mornings in 1999 when frosting was likely to have occurred were:

- 18-27 April (Terest. T -0.2, -3.2, -1.5, -0.8, -3.6, -3.8, -2.5, -4.9, -2.0°C; Min. T 2.8, 2.3, 1.9, 3.1, -0.8, -1.6, -0.8, 0.7, 0.8°C)
- 16-17 May (Terest. T -2.0, -2.5°C; Min. T 1.2, -1.0°C
- 12 June (Terest. T -4.5°C; Min. T -0.5°C)
- 23-28 June (Terest. T -2.5, -2.0, -1.0, -2.0, -1.0°C; Min. T -0.8, 1.5, 2.0, 0.1, 2.3°C)
- 25-26 July (Terest. T -3.0, -5.5°C ; Min. T -0.6, -1.5°C)
- 29 July- 07 Aug. (Terest. T -2.3, -3.1, -2.9, -3.5, -3.0 -3.1°C; Min. T 2.3, 1.9, 1.9, -1.4, -1.6, -0.5°C)
- 28-29 Aug. (Terest T -3.5, -2.0°C ; Min. T 0.6, 1.6°C)
- 13-20 Sept. (Terest. T -1.5, -0.5°C; Min. T -0.5, -0.5°C)
- 16 Nov. (Terest. T -2.3°C; Min. T 0.8°C).

The conclusions from this research were:

- Smoke-water treatments had no effect on germination of Bursaria seed.
- Storing seed damp in the refrigerator for any period of time had no positive effect on germination.
- Seed stored dry in the refrigerator rather than at room temperature had little effect on germination.
- The later the seed was sown the poorer the response.
- Day length did not appear to be the mechanism controlling germination.
- For tubes retained over summer, some extra germination resulted in the next June-July period.

Project 5: Research with Bursaria seeds sown in October, November or December 2003

The aim was to further test whether damping seeds and storing at approx. 2-5°C for varying periods (1-4 months) prior to sowing would promote germination in spring or summer – i.e. outside the normal germination period in winter. Germination in summer is normally required for production of seedlings in a nursery, if those plants are to be ready to plant in winter or early spring.

The seed was from Lake Linlithgow, collected in April 2002 and stored in a bulk airtight container in a refrigerator at 2-5°C. Later, the seedlots (100 seeds per treatment) were placed in flat plastic containers. Seedlots receiving wet/cold treatment were dampened in boiled water, with a little sand added to cover. The sand had been sterilised earlier by heating in an oven at 200˚C. The containers were then placed in cardboard shoe boxes (to exclude light) in a refrigerator at about 2-5˚C.

The experiment tested the following treatments:

- Duration of treatment – 1, 2, 3 or 4 months for seeds stored wet or dry in the refrigerator
- Time of sowing in relation to time of application of cold storage treatment – seeds were sown directly after removing from the refrigerator:
    - 2 months duration: Aug.-Oct. (A) *v* Sept.-Nov. (D), sown in Oct. and Nov., resp.
    - 3 months duration: Aug.-Nov. (B) *v*. Sept.-Dec. (E), sown in Nov. and Dec., resp.

From mid-Jan 2004 until mid-April 2004, half the replicates were allowed to dry out (SD sub-treatment). These trays were replaced under watering in mid April.

Table 5. Germination percentage of Bursaria seeds in 2003 and 2004

Treatment			Percentage of seeds germinated in 2003 and 2004							
	Date	Sub-treatment	Dec	Jan	21 May	7 Jun	17Jun	19Jul	28Jul	Max
A	16 Aug.-10 Oct.	SD			29	31	33	28		33
	(2 mths)	SD			20	34	39	36		39
	Wet	W			19	27	25	21		27
	Sown 10 Oct. 03	W			15	25	27	23		27
	16 Aug.-10 Oct.	SD			6	3	2	2		6
	(2 mths)	SD	1	1	13	11	11	9		13
	Dry	W	1	1	2	11	10	6		11
	Sown 10 Oct. 03	W	3	3	11	10	11	7		11
B	16 Aug.-7 Nov.	SD			64	40	38	22		64
	(3 mths)	SD			50	41	45	32		50
	Wet	W			1	10	15	6		15
	Sown 7 Nov. 03	W			8	17	15	7		17
	16 Aug.-7 Nov.	SD			41	45	49	33		49
	(3 mths)	SD			42	48	33	21		48
	Dry	W			15	30	24	14		30
	Sown 7 Nov. 03	W			12	13	12	8		13
C	16 Aug.-4 Dec.	SD			22	43	36	22		43
	(4 mths)	SD			6	36	37	28		37
	Wet	W			3	20	19	10		20
	Sown 4 Dec. 03	W			3	37	21	14		37
	16 Aug.-4 Dec.	SD			16	34	34	27		34
	(4 mths)	SD			51	67	61	46		67
	Dry	W			2	24	21	9		24
	Sown 4 Dec. 03	W			35	37	35	33		37
F	7 Nov.-4 Dec.	SD			24	47	38	23		47
	(1 mth)	SD			27	49	45	36		49
	Wet	W			3	13	5	3		13
	Sown 4 Dec. 03	W			8	21	18	13		21
D	13 Sept-7 Nov.	SD			52	57	51	46		57
	(2 mths)	SD			24	46	44	36		46
	Wet	W			22	22	16	10		22
	Sown 7 Nov. 03	W			14	34	30	18		34
E	13 Sept.-4 Dec.	SD			26	47	46	32		47
	(3 mths)	SD			5	52	50	37		52
	Wet	W			3	15	6	2		15
	Sown 4 Dec. 03	W			1	17	11	8		17
G	Sown 23 Apr. 04	Apr			0	46	58	17		58
	or 28 May 04	Apr			0	41	73	28		73
	Control seed check	May				0	0	9	70	70
		May				0	0	6	74	74

SD = summer dry (mid-Jan to mid-April); W = pots kept damp throughout

There were 4 replicates of each main treatment (2 replicates for each sub-treatment). The 100 seeds per replicate were spread over 20 tubes prepared with a potting mix comprising one third peat and two thirds sand, plus 1 g of Osmocote slow release fertiliser pellets. The seeds were lightly covered with sieved fine potting mix and the trays put under sprinklers in the outdoor nursery.

The tubes were monitored into the winter of 2004 to detect any late germination. There was some loss of seeds over the 12 months as a result of accidental loss when removing weeds from the tubes or rotting in potting mixture kept continuously damp. As a check on the viability of the seeds sown, untreated seed from the original bulk source (stored dry in the refrigerator) was sown in 24 April/28 May 2004.

The mornings in Oct.-Dec. 2003 when light frosting may have occurred were:

- 22 Oct. (Min. T 1.9°C)
- 04 Nov. (Min. T 1.9°C)

The mornings in 2004 when frosting may have occurred were:

- 08 Mar. (Min. T 0.9°C)
- 11-12 May (Min. T -0.8, 0.3°C)
- 29 May (Min. T 1.3°C)
- 06 June (Min. T 1.5°C)
- 17 June (Min. T 1.5°C)
- 08 July (Min. T 0.3°C
- 17-22 July (Min. T 1.9, 1.7, 1.7°C)
- 18-19 Aug. (Min. T -0.4, 0.7°C)
- 02-06 Sept. (Min. T 1.0, 1.3, 0.8, 1.4, 2.0°C)
- 12 Sept. (Min. T -1.0°C)

Conclusions from the 2003-04 experiments:

- Neither pre-sowing wet or dry refrigeration (2-5°C) improved germination in summer.
- Damping off of seedlings accounts for some of the difference between pots left dry over summer (SD) compared with those watered throughout the trial (W). Damping off was noted at the 7 June inspection (some seedlings were cut off at the base) – counts later were often lower than in June. Further damping off occurred later. The estimate of max. germinations are therefore minimum estimates.
- If a cold treatment is to replicate the effect of a severe frost in the field then probably the seed should be exposed to some duration of freezing to break dormancy.
- Alternatively, the species can be reproduced by sowing the seeds in summer, waiting for germination after the first frosts and then carrying those small plants through another year.

Project 6: Freeze-treatment to promote Bursaria germination in 2009

In March 2009 Bursaria seed was collected from Hensley Park Rd and sown then in pots, in order to produce seedlings for various tree-planting projects. We were surprised to find germination occurring a couple of weeks after early frosts in April and May, in contrast with our previous experience when germination mostly occurred in mid-winter but not in late spring or summer. The mornings when frosts were likely were 30 April-05 May (Min. T -0.8, 1.2, 1.6, 1.3°C) and 11-12 May (Min. T 1.3, 2.0°C). No detailed records were made of this sowing but our observations were sufficient to prompt an investigation into simulating the effect of frosts by freezing the Bursaria seed – and thus be able to germinate the seed from early spring-early summer.

In previous years we did not detect any effect of seed storage, damp or dry, at refrigerator temperatures of 2-5°C. Freezing appeared to be required.

The seed was sown into small pots containing sand and soil in late November 2009. The pots were placed in the open and watered regularly. Germination was noted about 24 Dec.
The experiment comprised 3 replicates (each of 100 seeds) of each treatment:

[1] control (previously stored in a refrigerator at 2-5°C)
[2] dampened seed put in freezer overnight and sown next morning
[3] dry seed put in freezer overnight and sown next morning

The average maximum germination (as a percentage of seed sown) was:

[1] 14%
[2] 23%
[3] 43%

There were mornings in Dec. 2009 when morning temperatures were low but frosting was unlikely; the lowest Min. T were 5.0°C (4 Dec.), 4.9°C (14 Dec.), 4.5°C (11 & 15 Dec.) and 4.2°C (22 Dec.) before final counts were made on 24 Dec 2009. Those temperatures are within the range of refrigerator storage that was shown earlier to be of little consequence.

The result for the control treatment [1] was higher than found in earlier work (e.g. Table 2), despite the apparent absence of frosts. There was a clear improvement in germination as a result of freezing, particularly for the seed stored dry in the freezer. The actual totals for germination were higher in the freezer treatments because some damping off had occurred before the count was made.

The test was repeated by putting freezer-treated seed that had been previously stored dry in the refrigerator for 2 months into pots and observing the outcome. No counts were made but the visual effect indicated an even more pronounced benefit for seed frozen dry rather than wet. Whether a longer period of storage in the freezer would increase the germination has not been tested.

Conclusions:

- Substantial improvement in germination percentage can be obtained simply by exposing the dry seed to a night in the freezer before sowing.
- There was no advantage in dampening the seed before freezing – the results actually indicate that it is detrimental.

Conclusions from the Bursaria germination research at PVI

In the past, very few nurseries have grown Bursaria, probably because of the difficulties in getting it to germinate.

Direct-seeding of Bursaria in the spring has also proved to be a failure. Poor germination in the year of sowing, and weed competition in the following year when seeds might germinate, are the major causes of the failure.

Intensive research on direct-seeding was conducted in SW Victoria from 1987-89: see *Trees and shrubs for south west Victoria* by PR Bird, GA Kearney and DW Jowett (1996). Over 9 large farm sites, seed sown in Sept. or Oct. in 3 different areas (Basalt Plains, Glenthompson & Dundas Tablelands) in 1987-1989, only 3 sites had any Bursaria seedlings when counts were done at 7 mths. As a percentage of the viable seed sown that amounted to a paltry 0.007, 0.023 and 0.144%. That can be contrasted with a few of the other 37 species sown, e.g. Drooping Sheoak 0.9-29%, Blackwood 3.4-26%, River Red Gum 0.04-3.67% and *M. decussata* 0.003-2.29% (Bird, Kearney & Jowett 1996).

The research conducted at PVI has shown that the germination of Bursaria seed can be substantially increased by freeze-treatment, so that seedlings can readily be produced in the usual late-spring-summer production run that are large enough for planting out in the next winter or spring. For direct-sowing in late winter-early spring, the seed needs to be freeze-treated before sowing.

If landholders want to grow this species – and it is an essential component for biodiversity – then they should provide the nursery with seed, which can be collected in late March or early April. They must also inform the nursery operator that the seed needs to be put in the freezer overnight before sowing.

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