PROPAGATION OF BANKSIA COCCINEA BY CUTTINGS AND SEED

MIKE BENNELL

Blackhill Native Flora Nursery
Athelstone, South Australia

GAIL BARTH,

South Australian Department of Agriculture
Adelaide, South Australia

INTRODUCTION

Banksia coccinea is one of a number of Western Australian species being developed for commercial cut-flower production. Reliable methods of vegetative propagation are required so that selected individual plants can be clonally propagated and trialed by research institutions and growers.

This species is reputedly propagated by cuttings by some nurserymen but so far no published information is available on the best methods. Generally this species, along with several other desirable banksia species, has a reputation of being difficult-to-root and commercial practice is seedling production. (Note the effect of temperature on seed germination of *B. coccinea* at the end of this paper).

George (2) states that cuttings of many banksia species, including *B. ericifolia*, *B. spinulosa*, *B. pulchella*, *B. nutans*, *B. integrifolia*, and *B. seminuda*, strike root without auxin treatment and that, in some cases, the application of auxin may be lethal. Other authors have reported that auxins promote rooting in some banksia species. Watkins and Shepherd (3) found that *B. occidentalis* rooted best following a 10-sec. dip in a 3,500 ppm solution of indolebutyric acid (IBA). Cuttings of *B. spinulosa* var. *collina*, *B. integrifolia*, and *B. burdettii* rooted under mist following treatment with a concentrated IBA solution (1).

Propagation of many species and cultivars of the South African PROTEACEAE is routinely done by striking cuttings. Cuttings are treated with an auxin, usually IBA at 4,000 to 8,000 ppm dissolved in a 50% ethanol solution (4).

The beneficial effects of auxins in promoting root initiation on cuttings and the great variation among species in their response to auxin concentration has been widely noted. The present experiment was undertaken to determine the optimum concentration of IBA to promote root initiation in *Banksia coccinea*. Also the effect of cutting wood maturity (soft versus semi-hardwood) on rooting was examined.

Materials and Methods. Experiments were conducted at Blackhill Native Flora Nursery, Adelaide, South Australia during spring, 1985. Cutting material was collected from cultivated trees of *B. coccinea* being grown on a commercial cut-flower plantation at Blewitt Springs, South Australia. The semi-hardwood cuttings were taken from wood which grew during the previous spring growth flush.

The cuttings were stored in a refrigerator overnight and were prepared and treated on the following day. Prior to preparation and treatment the cuttings were dipped in a 5% sodium hypochlorite solution for approximately 30 seconds and subsequently washed in water. Cuttings were prepared by stripping the lower two-thirds of leaves and cutting the basal end at a node. The base of each cutting was wounded by making 2 longitudinal cuts 1 to 2 cms in length, penetrating the bark. The basal 1 cm of cuttings was dipped in IBA solutions (50% ethanol) for 5 seconds.

The following treatments were included in this trial:

A) Terminal semi-hardwood cuttings prepared with the apical bud removed. A range of IBA concentrations from 0 to 16,000 ppm was used.

B) Softwood cuttings prepared as above and treated with 0 to 12,000 ppm IBA.

C) Basal semi-hardwood cuttings collected 20 to 30 cm from the shoot apex. Auxin was applied at 2,000 and 6,000 ppm.

Each treatment consisted of 25 cuttings placed in 6 in. pots containing a 1:1:1 mix of peat/perlite/sand. Cuttings were placed under intermittent mist with bottom heat at 25°C. The glasshouse temperatures were maintained at 30° day, 15° night. Cuttings were lifted and examined for rooting at 12 and 18 weeks.

Results. The results obtained at the 12 and 18 week assessments are presented in Table 1.

The effect of IBA concentration on rooting of *B. coccinea* cuttings was found to be significant by analysis of variance. The 8,000 and 12,000 ppm IBA treatments gave a significantly higher rooting percentage than the control or 2,000 ppm IBA treatments. Maximum rooting was 88% at 12,000 ppm IBA (at 18 weeks), with 8,000 ppm giving 84%. Also, the higher IBA concentrations were found to result in a significantly higher number of roots per cutting. The length of roots (as determined by measuring the longest root per cutting) was not significantly affected by the IBA concentration.

A lower percentage of cuttings rooted was recorded for basal cuttings at 18 weeks (60% versus 84% at the 8,000 ppm IBA treatment); however, the difference was not statistically significant.

Table 1. Rooting of *Banksia coccinea* cuttings at 12 and 20 weeks.

Type of cutting	Treatment (ppm IBA)	Percent rooted 12 wks	Percent rooted 18 wks	Mean No. roots/cutting at 18 wks.	Mean length roots/cutting at 18 wks.
Terminal Semi-hardwood					
1.	0	12	44	1.6	4.3 cm
2.	2,000	12	40	1.6	4.6
3.	4,000	40	64	2.4	5.2
4.	8,000	60	84	3.8	5.1
5.	12,000	56	88	3.2	5.4
6.	16,000	44	48	5.2	4.4
				(Significant) (LSD = 2.3)	(not signif.)
Terminal Softwood					
7.	0	0	0	All softwood cuttings were severely damaged by fungal infection with a resultant high mortality.	
8.	2,000	8	16		
9.	8,000	20	32		
10.	12,000	10	12		
Basal Semi-hardwood					
11.	2,000	16	44	2.2	4.6
12.	8,000	48	60	3.1	4.5
				(not signif.)	(not signif.)

Root initiation was noted to occur under the bark either on the base of the cutting or along the wound. Callus development was slight in most cases, with small nodules developing under the edge of the bark.

A relatively high rooting percentage (44%) was obtained for the control (0 ppm IBA) after 18 weeks; however, root development and percent rooted was better when IBA was applied.

Recommendations. The results of this trial show the benefits of applying IBA at concentrations of 8,000 to 12,000 ppm to semi-hardwood cuttings. All available cutting material should be utilized regardless of position on the stem. It is suggested that cuttings be wounded and inserted in a porous mix under intermittent mist with bottom heat. Care should be taken that mist systems are well-adjusted and leaves do not remain permanently wet, as banksias are inclined to drop leaves during long rooting periods.

It is suggested that in commercial practice, cuttings be struck in individual tubes and care taken when potting-on so as not to disturb the roots. In our trials up to 50% of the cuttings died when potted on, probably due to root disturbance necessitated by recording of the data.

In nursery practice we recommend that a low phosphorus (0 to 2%) slow-release fertilizer be incorporated in the potting-on mix. In our experience cuttings developed rapidly, producing two or three

30 to 40 cm shoots at 6 months. Rooted cuttings may be field-transplanted once they have hardened after moving from the greenhouse. If they are to be held longer in the nursery, care should be taken to keep the plants actively growing by regular repotting as necessary. Plants that are stopped by nutrient or water stress seem to quickly yellow and fail, or are slow to renew growth when transplanted.

SEED PROPAGATION

At present, *Banksia coccinea* is almost exclusively propagated from seed. Until clonally propagated plants become widely available, this method is likely to remain the usual means of commercial propagation.

Temperature is one of several factors which may influence seed germination and, to date, its effect on seeds of the majority of Australian species is poorly understood. *Banksia coccinea* is one of many being studied in an on-going seed testing program being undertaken at Black Hill.

Materials and Methods. The Flora Research Section at Black Hill has recently developed a seed testing machine enabling seed testing over a 10 to 35°C range, at either constant or alternating temperatures.

Banksia coccinea seed obtained from a commercial seed merchant was tested at the following constant temperatures, i.e., 10, 15, 20, 25, 30, and 35°C, and alternating temperatures (18 hr day/6 hr night), i.e., 35/25, 30/20, 25/15, and 20°/10°C. Germination experiments were carried out in the dark.

Results and Discussion. The number of seeds germinated (G) and the time to achieve 50% of the maximum number germinated (T50) is listed in Table 2.

Table 2. Effect of temperature on *B. coccinea* seed germination.

Treatment (°C)	G[1]	T50[2]
10	28	18
15	32	13
20	32	24
25	30	43
30	6	54
35	0	
35/25	0	0
30/20	16	56
25/15	31	37
20/10	31	24
LSD	10.6	4

[1]100 seeds/treatment
[2]days

The following temperatures resulted in a similar number of seed germinated (approximately 30%) i.e, 10, 15, 20, 25, 25/15 and 20°/10°C. There was no significant effect of temperature on the number germinated over the 10° to 25°C range. However, temperatures above 25°C severely inhibited germination.

Temperature did have a significant effect on the rate of germination over the 10 to 25 C range. The optimum temperature is approximately 15°C with T50 = 13 days. This temperature was significantly better than all others. Germination at a temperature of 25°C or greater required 40 or more days to reach the T50.

Recommendation. Seed of *B. coccinea* should be germinated at a temperature of 12 to 18°C. Germination should occur within 20 days.

LITERATURE CITED

1. Cho, J. J. 1983. *Phytophthora* root rot of banksia: range and chemical control. *Plant Disease*, 65(10); 830–833.
2. George, A. S. 1985. The Banksia Book. Kangaroo Press, N.S.W., Australia
3. Watkins, P. A. and R. W. Shepherd. 1982. Propagation of some West Australian plant species. Proc. National Technical Workshop, Production and Marketing of Australian Wildflowers for Export. Western Australian Department of Agriculture.
4. Vogts, M. 1982. South Africa's Proteaceae—Know Them and Grow Them. Publ. C., Struik, Cape Town, South Africa