Propagation and Early Production of Bunchberry (*Cornus canadensis* L.)

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Bunchberry (*Cornus canadensis* L.) stem cuttings were rooted for 9 weeks in peat and perlite medium (1 : 3, v/v) under fine mist after a 7-sec quick dip treatment of 0, 1000, 3000, 5000, 7000, or 9000 ppm K-IBA water solutions. Rooting percentage (82% to 88%) was not influenced by K-IBA treatment but subsequent root development was enhanced by 3000 and 7000 ppm K-IBA. Rhizome initiation and extension was inhibited by 7000 and 9000 ppm K-IBA. Therefore, 3000 ppm K-IBA optimized root and rhizome development and was used as the cutting treatment to compare production of bunchberry from greenhouse-forced cuttings in April to field-collected cuttings in June. By the end of September, April-stuck cuttings had produced more shoots than had June-stuck cuttings; but in either case, rooted cuttings having rhizomes at transplant more consistently produced greater numbers of new shoots than those cuttings without rhizomes. Marketable 9-cm band pots of bunchberry can be produced in one season if cuttings are taken in April and have rhizomes at the time of transplant.

INTRODUCTION

Bunchberry (*Cornus canadensis* L.) is a perennial groundcover native to New England and has a circumpolar distribution. It is commonly found growing in the forest understory, on hummocks in bogs, and in open fields (Dirr, 1990). Bunchberry commonly colonizes open areas (Alaback, 1984) and has become a serious weed in commercial lowbush blueberry fields of New England and Canada (Hall and Sibley, 1976). Bunchberry is also a traditional food and medicinal plant used by Native Americans (Eastman, 1992).

Bunchberry possesses many characteristics that make it suitable for use as an ornamental plant. It produces showy white inflorescences above the foliage in spring and summer, similar to those of *Cornus florida* but smaller (Del Tredici, 1984). Bunchberry provides dense, dark green foliage cover throughout summer, and in late summer produces large terminal clusters of attractive bright red fruit. In autumn, the foliage of some individuals turns deep burgundy before dying back to the ground, while others retain this burgundy foliage throughout the winter. These features warrant greater use of bunchberry in the landscape.

Bunchberry spreads laterally by vigorous, perennial rhizomes extending up to 30 cm per year (Hall and Sibley, 1976). A clump or clone of bunchberry is actually a single plant consisting of a dense mat of individual stems connected by these underground rhizomes. This system of rhizomes is the portion of the plant that overwinters to produce new shoots the following spring. Each stem generally bears a terminal whorl of four or six leaves and one or more nodes bearing reduced leaves and lateral buds. Individual stems are usually 4 to 6 inches in length.

Bunchberry, though not grown commercially on a large scale, has traditionally been propagated by seed, division, or by transplanting sod pieces collected from the field (Dirr, 1990). Witt (1987) outlined his production of bunchberry for use as a holiday potted plant. He propagated bunchberry from divisions and stem cuttings, asserting that IBA application was unnecessary for rooting stem cuttings; however no data were provided. Our propagation studies focus mainly on producing bunchberry by rooting stem cuttings, a propagation practice not commonly used for this plant and one that has not been tested experimentally to date.

The purpose of the following studies was to provide propagation and cultural information to facilitate commercial production of bunchberry. Several other propagation and production studies are currently in progress, addressing such issues as IBA application, propagation method, time of propagation, and fertilization techniques and levels.

PROPAGATION STUDY

Materials and Methods. The objective of this study was to assess the effects of K-IBA concentration on rooting and rhizome production of bunchberry. Softwood cuttings were taken from three bunchberry clones growing in a commercial lowbush blueberry field (Ellsworth, Maine) on 18 June 1997. In a randomized complete block design, blocked by each of three clones, 120 cuttings (40 subsamples per clone) were treated with one of six K-IBA solutions: 0, 1000, 3000, 5000, 7000, and 9000 ppm. Cuttings were randomly assigned, within the blocks, to the six treatment groups and treated with K-IBA (dissolved in water) as a 7-sec quick dip. After air-drying, the cuttings were stuck in a poly rooting flat (40 cm × 40 cm × 12.7 cm) containing a medium of peat and perlite (1 : 3, v/v) and placed in a tunnel covered with 4-mil white polyethylene shaded with 40% shade cloth (120 to 140 $\mu E\ m^{-2}\ s^{-1}$, 23 to 29 C daytime temperature) for 9 weeks. Cuttings were physically blocked by clone within the mist tunnel to remove the variation due to position within the tunnel. A mist emitter (Floodjet TK-VS10, Spraying Systems Inc. Wheaton, IL, 47 psi) at one end of the poly tunnel propelled a fine mist over the cuttings periodically. Mist was controlled by a timer (45 sec every 10 min), which maintained a high level of humidity within the chamber during the day. Mist ran from sunrise to sunset. Cuttings remained under mist for 9 weeks until some had developed visible rhizome shoots, at which time they were evaluated for rooting percentage, root area, total number of rhizomes produced per cutting, and total length of rhizomes produced per cutting. Data analysis was performed on transformed data using the ANOVA and Fisher's LSD procedures of SAS.

Results. Rooting percentage ranged from 82% to 88% and was not affected by K-IBA concentration (Table 1). However, cuttings treated with 3000 or 7000 ppm K-IBA produced larger root systems than those in the control or any other treatment.

The average number of rhizomes produced per cutting was reduced by increasing K-IBA concentration. The 7000 and 9000 ppm treatments yielded significantly fewer rhizomes compared to the control and 1000 ppm K-IBA treatment. The two highest K-IBA concentrations reduced rhizome length compared to the 1000 ppm treatment. In this case, however, control cuttings produced similar rhizome lengths to those of 7000- and 9000-ppm-treated stems.

Table 1. *Cornus canadensis* L. percent rooting, root ball area, rhizome quantity,and rhizome length as affected by K-IBA concentration.

K-IBA concentration (ppm)	Rooting (%)^{x,z}	Average root ball area (cm^2)^w	Average number of rhizomes per cutting^y	Average rhizome length (cm)
0	88.3 a^v	22.5 b	0.67 a	1.58 ab
1000	85.8 a	31.0 b	0.76 a	2.05 a
3000	84.2 a	36.8 a	0.60 ab	1.26 ab
5000	87.5 a	32.0 b	0.62 ab	1.21 ab
7000	81.7 a	38.2 a	0.44 b	0.81 b
9000	81.7 a	34.5 b	0.26 b	0.52 b

[V] N = 120

[W] Root ball area calculated as the length of root ball (cm) multiplied by the width of root ball (cm).

[X] Analysis of variance performed on arc-sine transformed data.

[Y] Analysis of variance performed on log-transformed data.

[Z] Mean separation within columns by Fisher's Protected LSD ($p \leq 0.05$).

Discussion. Although rooting percentage was unaffected by K-IBA application compared to the control, as reported by Witt (1987), K-IBA application at levels of 3000 and 7000 ppm can increase root growth and the size of the root system produced. Based on this, K-IBA application may be recommended to enhance the growth and establishment of the root system. An additional consideration, however, is the effect of K-IBA on rhizome growth. Higher levels of K-IBA such as 7000 and 9000 ppm appear to be inhibitory to rhizome number and length. A concentration of 1000 or 3000 ppm K-IBA is therefore recommended to maximize root growth while minimizing inhibition of rhizome production and elongation.

PRODUCTION STUDY

Materials and Methods. The objective of this study was to compare production time for bunchberry plants propagated from greenhouse-forced material taken as stem cuttings in April to plants produced from cuttings taken from field-grown plants in June. Four bunchberry clones were identified in two lowbush blueberry fields. Portions of each clone were harvested as sod pieces in Oct. 1996 and placed in flats (10 cm x 50.8 cm x 38.1 cm) which were then overwintered in cold storage (90 days, dark, 2.8C) and subsequently moved to a heated greenhouse (set at 18C, ambient photoperiod) in Feb. 1997. The flats were irrigated as needed until new growth reached the softwood stage. Stem cuttings (2 to 3 nodes, cut to the soil line) were taken from this material on 10 April 1997. On 10 June 1997 cuttings were harvested from the same four clones from the portions left in the field.

Cuttings on both dates were treated with 3000 ppm K-IBA for 7 sec, stuck into a flat containing peat and perlite (1 : 3, v/v) and handled as described in the previous section. After 10 weeks under mist, cuttings were separated into categories based on root mass and rhizome status: cuttings with large root systems and above-ground rhizome shoots, below-ground rhizome shoots, or no rhizome shoots (rated 1, 2, and 3, respectively) and cuttings with small root systems and no rhizome shoots (rated 4).

Twenty cuttings from each collection date and rating (5 cuttings per clone) were transplanted into 9 cm x 9 cm x 10.8 cm band pots (16 to a flat) containing peat and perlite (1 : 1, v/v) (pH 3.5 to 4.0). In a randomized complete block design, blocked by each of four clones, the plants were grown under greenhouse conditions (470 to 570 $\mu E\ m^{-2}s^{-1}$, 40% shade cloth over the entire greenhouse) and fertilized twice weekly with 20 : 20 : 20 Peters General Purpose soluble fertilizer (Scotts-Sierra, Marysville, OH) at 300 ppm N until the end of September when they were assessed for mean number of shoots per cutting and number of cuttings producing new shoots. Because there was a significant interaction between collection date and initial rating, the effect of rating will be presented separately for each collection date.

For both studies, data were subjected to analysis of variance using the General Linear Model of SAS (Release 6.07, SAS Institute Inc., Cary, NC. 1992). Treatment effects were separated by Fisher's Protected LSD (Table 1) and Duncan's Multiple Range Test (Table 2). Percentage data in the first study were arc-sine transformed and count-based data in both studies were log transformed for statistical analysis, but are presented as the original data.

Results. Of cuttings taken in April, those with rhizomes, rated 1 or 2, produced more shoots by the end of the first season than those without rhizomes, rated 3 or 4 (Table 2). However, for cuttings without rhizomes, those possessing more extensive root systems (rated 3) produced more shoots than those with small root systems (rated 4). Cuttings taken in April produced more new shoots than did those taken in June.

For June cuttings, those rated 1 and 2 still produced more shoots than those rated 3 and 4. There was no difference, however, in new shoot production between cuttings with large root systems (rated 3) and cuttings with small root systems (rated 4). Thus, the advantage of a large root system to shoot production is lost when cuttings are taken later in the season.

Initial rhizome status also affects the number of cuttings producing new shoots by the end of the season. Cuttings with rhizomes at the end of rooting (rated 1 and 2) formed new shoots 90% to 100% of the time, regardless of cutting time (Table 2). For those without rhizomes, only 45% to 60% with good root systems and 30% to 45% with poor root systems produced new shoots by the end of September. Therefore, it may not be worthwhile to transplant rooted cuttings without rhizomes, since a low percentage of them produce rhizomes by the end of the first season.

Discussion. Production of new shoots during the first season is important because new shoots indicate the presence of rhizomes. If no rhizomes are produced in the first season, as was the case for some cuttings rated 3 and 4, the plants will fail to produce growth the following spring. Starting from single stem cuttings, the most successful plants (those produced from rooted cuttings rated 1 and 2) filled the majority of the band pot and would be marketable by the end of their first season. Production of new shoots on rooted cuttings of bunchberry during the first season is influenced by the time of propagation and the rhizome status of the cutting at the time of transplanting. The presence of rhizomes at the time of transplant increases mean shoot number and the percentage of cuttings producing new shoots.

Table 2. New shoot production as affected by cutting collection time and initial root/rhizome rating in *Cornus canadensis* L.[W]

Initial rating (1-4)	Root and rhizome status	Mean number of new shoots per cutting[Y]		Cuttings producing new shoots from rhizomes (%)	
		Collection time		Collection time	
		April[Z]	June	April	June
1	Heavy rooting, aboveground rhizomes	2.36 a[X]	1.40 a	100	100
2	Heavy rooting, belowground rhizomes	2.15 a	1.37 a	95	90
3	Heavy rooting, no rhizomes	1.43 b	0.81 b	60	45
4	Light rooting, no rhizomes	1.00 c	0.81 b	30	45

[W] Cuttings evaluated and transplanted on 20 June for April cuttings and 15 Aug. for June cuttings.

[X] N=20.

[Y] Analysis of variance performed on log-transformed data.

[Z] Mean separation within columns by Duncan's Multiple Range Test ($p \leq 0.05$).

Acknowledgment. This research was supported by funds provided by the Maine Agricultural and forest Experiment Station under provision of the Hatch Act. MAFES contribution No. 2221. We wish to thank Bradly Libby, Karen Casey, Christopher Tash, and William Jenkins for their assistance.

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