ROOTING OF LINGONBERRY, *VACCINIUM VITIS-IDAEA*, STEM CUTTINGS[1]

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Abstract. Studies were conducted on the effects of propagation medium, IBA treatment, seasonal timing of cutting collection and cutting age on rooting of lingonberry stem cuttings collected from native stands near Fairbanks, Alaska. Cuttings rooted best in a milled peat medium under intermittent mist. Rooting percentages were not improved by treatment of cuttings with 0.3 percent IBA powder. Optimum rooting percentages were obtained from cuttings of one-year-old, or current season's growth, collected in September. Following two growth cycles, all rooted cuttings failed to produce new rhizomes.

Vaccinium vitis-idaea L. is a woody, evergreen shrub of circumpolar distribution that is commercially important as a fruit crop, a medicinal plant, and a landscape ornamental ground cover. Two major subspecies have been identified: the lowland subspecies, *vitis-idaea*, occurs in Europe and northern Asia and hybridizes with the arctic-montane subspecies, *minus*, in the mountains of Scandinavia. Subspecies *minus* grows in North America and Europe and is the race found in Alaska. Initial work with vegetative propagation was reported from Scandinavia, presumably with the subspecies, *vitis-idaea*. Lehmushovi (3) found that hardwood cuttings collected in spring prior to bud break and stuck into milled peat in a mist propagation bench gave the greatest rooting percentages. Results of treatment with IBA were inconsistent. Hall and Shay (1) reported 82 percent rooting of stem cuttings collected from 14 Newfoundland clones that were propagated in mid-September under intermittent mist. In Holland, lingonberries are propagated commercially by stem cuttings collected in autumn (November-December) and held in cold storage until January or February. Cuttings are propagated in a mist bench in a peat/soil mixture and produce roots in approximately two weeks (Old Farm Nurseries, pers. comm.).

Plants resulting from rooted stem cuttings exhibit reduced rhizome production that limits their natural vegetative spread (4,5). Because of this characteristic, propagation by stem cuttings is not recommended for plants used in fruit production. Certain ornamental cultivars (e.g. 'Koralle') are propagated specifically by stem cuttings or layering in order to maintain the proper plant form (Old Farm Nurseries, pers. comm.).

Experience with propagation by stem cuttings of North American sources of lingonberries is limited, and it is not known how closely related are the two subspecies. In addition, there is some indication from commercial propagators that certain strains, perhaps of the ssp. *minus*, may produce abundant rhizomes from cuttings. The purpose of this research was to study seasonal patterns of rooting and the effects of age of wood, IBA treatment, and medium on rooting of *Vaccinium vitis-idaea* ssp. *minus*. In addition, the potential for rooted cuttings to produce rhizomes was evaluated.

[1]Received for publication June 4, 1985.

MATERIALS AND METHODS

One-year-old hardwood cuttings of *Vaccinium vitis-idaea* ssp. *minus* were collected from native stands near Fiarbanks, Alaska in September, 1983, and leaves were removed from the lower one-third of each stem. Cuttings either were treated immediately with 0.3 percent IBA powder or were left untreated and stuck into flats of 6 different sterilized media, including (a) a 1:1 (v/v) mixture of milled *Sphagnum* sp. peat and vermiculite; (b) milled *Sphagnum* moss; (c) propagation grade perlite; (d) milled *Sphagnum* sp. peat; (e) sharp builder's sand; (f) or #3 vermiculite. Flats were placed in an intermittent mist propgation bench under natural daylight conditions and with a minimum greenhouse air temperature of 21°C. This experiment consisted of four replicates of 12 treatments with 80 cuttings per treatment in a completely randomized design. Cuttings were checked twice, after 4 and 8 weeks, for evidence of rooting, and the rooting percentage was recorded for each treatment. After 8 weeks the number of roots per rooted cutting were counted, and rooted cuttings were potted into containers of milled peat. Subsequent cutting survival was evaluated 2 months later, and the potential for rooted cuttings to produce rhizomes was evaluated one year later.

In 1984, cuttings were collected from native stands near Fairbanks and immediately put into age classes: current season's growth, one-year-old wood, and two-year-old wood. Collections were made twice monthly throughout the snow-free season from 5 May through 24 September. Prior to the 5 June collection, the current season's growth was too small to handle and was discarded. Leaves were removed from the lower one-third of each cutting, and they were stuck, untreated, into flats of milled *Sphagnum* sp. peat. Flats were placed in an intermittent mist propagation bench under natural daylight conditions with a minimum greenhouse air temperature of 20°C. This experiment was a completely randomized design with four replicates of three cutting ages collected on 10 sample dates with 50 cuttings per treatment. Cuttings were checked twice, after 4 and 8 weeks, for evidence of rooting, and the rooting percentage was recorded for each treatment. After 8 weeks the number of roots per rooted cutting was counted, and rooted cuttings were potted into containers of milled peat. Subsequent cutting survival was evaluated 2 months later.

RESULTS AND DISCUSSION

The rooting percentage of one-year-old stem cuttings was greater in the milled peat medium after 4 weeks (Table 1). Cuttings in all other media had less than 50 percent root production. Rooting percentages were slightly higher on IBA-treated cuttings than untreated cuttings for all media, except milled peat, in which no significant difference was found. After 8 weeks, there was no significant interaction between medium and growth regulator treatment. Rooting was greatest in milled peat, followed by the sand and vermiculite treatments. Rooting was poorest in perlite. Perlite provided little mechanical support for the short cuttings (average length, 2.5 cm.), and cuttings dried out rapidly after being stuck in the medium.

The number of roots per rooted cutting after 8 weeks did not differ significantly among the media or growth regulator treatments (Table 1). Frequently only one or two threadlike roots were initiated per cutting, and these roots rapidly formed a mass of secondary branches. Additional roots developed

Reprint from the International Plant Propagator Society's *Plant Propagator*. 1985. 31(4):7-9.

on the stem after cuttings were removed from the propagation bench and were potted into containers of milled peat. Cutting survival following rooting was high, averaging 90 percent or greater for all treatments. One year later, after two growth cycles, none of the rooted cuttings showed any evidence of rhizome production.

Table 1. Effects of rooting medium and IBA treatment on rooting of one-year-old stem cuttings of lingonberry (80 cuttings per treatment).

Medium and IBA treatment	Percent rooting 4 weeks	Percent rooting 8 weeks	Average number of roots per rooted cutting
IBA-treated			
Peat/vermiculite	25.0 b*	75.0 b	2.0 NS**
Sphagnum moss	34.4 ab	68.7 bc	1.5
Perlite	28.1 b	43.8 d	1.3
Milled peat	43.8 a	87.5 a	1.8
Sand	37.5 ab	75.0 b	2,0
Vermiculite	28.1 b	75.0 b	2.0
Untreated			
Peat/vermiculite	12.5 c	62.5 bcd	1.8
Sphagnum moss	28.1 b	71.8 b	2.0
Perlite	0.0 c	56.3 cd	1.5
Milled peat	50.0 a	90.6 a	2.5
Sand	6.3 c	84.4 ab	1.8
Vermiculite	6.3 c	87.5 a	1.6

*Mean separation within columns by Duncan's New Multiple Range test, 5% level.
**No significant difference among means in same column.

These results are similar to those of Lehmushovi (3), who found that milled peat provided the best rooting medium (85%) when compared to a mixture of 1/3 sand and 2/3 peat (65%), or a corresponding mixture of humus and peat (55%). Lehmushovi also reported that treatment of cuttings with IBA increased rooting by as much as 15 percent over untreated cuttings, with a 6000 ppm liquid dip solution giving the best results. By contrast, final rooting percentages of cuttings treated with 0.3 percent IBA powder did not differ significantly from percentages of untreated cuttings (Table 1). Rooted cuttings from Alaska plants also were similar to Swedish (5) and Finnish (4) cutting sources in that rooted cuttings failed to produce new rhizomes.

Rooting percentages of cuttings taken from current season's growth and collected from 5 June through 5 August averaged less than 40 percent after 4 and 8 weeks in the propagation bench (Table 2). During this time cuttings deteriorated rapidly, usually becoming black within one week of being stuck in the bench. This period of poor rooting corresponded to the time of maximum vegetative growth in lingonberries. Growth in shoot length usually is most rapid during June, and 90 percent of the growth in length occurs by 25 August (2). Only the more mature current season's growth collected in late August and September rooted well. Rooting was most rapid on cuttings collected on 24 September. Ninety percent of the cuttings had roots after 4 weeks in the propagation bench.

Rooting percentages of one-year-old cuttings collected shortly after snowmelt on 5 May were very low, but rooting increased to 80 percent on cuttings collected just prior to bud break on 19 May (Table 2). Percentages remained relatively high through the 20 June collection date, which corresponded to a period of vegetative bud swell, initial leaf expansion, and rapid shoot growth. Rooting of cuttings declined during July and early August but increased from 20 August through September. Like cuttings of current season's growth, the greatest rooting percentage and the most rapid rooting occurred on cuttings collected on 24 September.

Table 2. Seasonal patterns in rooting of different aged lingonberry stem cuttings (50 cuttings per treatment).

Collection Date	Rooting percentage after 4 weeks: Current season's growth	One-year-old wood	Two-year-old wood
5 May	-	10 d	2 d
19 May	-	60 b	22 b
5 June	2 d*	62 b	26 b
20 June	0 d	46 c	14 cd
7 July	0 d	8 d	6 cd
20 July	0 d	4 d	4 d
5 August	34 c	6 d	0 d
20 August	28 c	38 c	20 bc
9 September	60 b	68 b	32 ab
24 September	90 a	82 a	40 a
	Rooting percentage after 8 weeks		
5 May	-	26 cd	10 de
19 May	-	80 ab	44 b
5 June	2 e*	74 b	34 bc
20 June	6 e	74 b	68 a
7 July	24 d	12 d	22 cd
20 July	26 cd	26 cd	12 de
5 August	38 c	34 c	2 e
20 August	78 b	86 ab	68 a
9 September	98 a	94 a	62 a
24 September	96 a	100 a	70 a

*Mean separation within columns by Duncan's New Multiple Range Test, 5% level.

Two-year-old cuttings showed the same seasonal pattern of rooting as one-year-old cuttings, but the final rooting percentage was lower for nearly all collection dates (Table 2). Like the two previous cutting types, the cuttings collected on 24 September from two-year-old growth rooted most rapidly and had the highest final rooting percentage. Only 40 percent of cuttings from two-year-old growth had rooted after 4 weeks, whereas rooting from one-year-old and current season's growth was more than 80 percent after 4 weeks.

The average number of roots per rooting cutting ranged from 1.0 to 2.5 and did not differ significantly among collection dates or cutting age groups. Root quality was similar to the previous study on rooting media in which all cuttings produced few, but well-branched, roots. Rooted cutting survival was greater than 90 percent for all treatments 2 months after cuttings were potted into containers of milled peat.

In Finland, Lehmushovi (3) found rooting percentages to be highest in cuttings (unspecified age) collected in mid-April shortly after snowmelt and in mid-May (average 89.5 to 86%, respectively). Percentages declined throughout the summer, but increased in October. In 1971, October rooting percentages (84%) approached April rooting levels (83%), but in 1972, rooting percentages were 96 and 43 percent for cuttings collected in April and October, respectively. A similar seasonal rooting pattern was found with one-year-old and two-year-old growth of Alaska

plants, but rooting was slightly higher in autumn than in spring (Table 2). Cuttings of current season's growth did not exhibit the same seasonal rooting pattern as older wood. Rooting increased throughout the season and reached the highest level in September.

In conclusion, rooting of lingonberry (Vaccinium-vitis-idaea ssp. minus) cuttings is best on a milled peat substrate under intermittent mist. Treatment of cuttings with 0.3 percent IBA powder does not improve rooting percentages. One-year-old wood and current season's growth provide the best cutting material when collected in autumn. Cuttings of one-year-old growth also may be collected in spring just prior to bud break for optimum rooting percentages. The type of medium used, the collection season, and the age of the cutting material are important considerations in root initiation, but these factors do not appear to have significant influence on subsequent root development and cutting survival. Claims by commercial propagators that certain strains of lingonberry produce abundant rhizomes from rooted cuttings has not been substantiated. Further experiments with more extensive collection of lingonberry germplasm are required.

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