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Propagation of Thornless Blackberries by One-node Cuttings[1]

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Abstract. **Thornless blackberries (*Rubus* sp.) were propagated throughout the year by rooting leafy 1-node cuttings. Differences in ease of rooting among cultivars were evident with 'Smoothstem' generally being the most difficult and 'Black Satin', SI-US 68-6-6, and SI-US 68-6-17 being the easiest to root. Treatment with 0.3% indolebutyric acid in talc sometimes improved rooting slightly. Although more and longer roots developed when sand was the rooting medium, roots were brittle and broke off easily when the cuttings were handled. Cuttings rooted nearly as well in 1 peat:1 perlite mix, had a more fibrous root system, and were easier to handle in transplanting. Rooting was as successful under a plastic tent as under intermittent mist. Node location along the cane did not influence rooting of the cuttings as long as the succulent tissue at the stem tip was not used.**

Several genetically thornless blackberries have been developed in the USDA breeding program (1, 3). These cultivars and selections are complex hybrids of several *Rubus* species. Widespread acceptance of these cultivars has been slowed by the purported difficulty in propagating them commercially. Although they tip-layer readily, relatively few plants can be produced from each stock plant. In addition, weed control among the layers is a problem. Propagation by cuttings has not been reliable enough to satisfy the demand for plants. Apparently commercial practice has been to use long 2- or 3-node hardwood or semihardwood cuttings. An *in vitro* micropropagation technique has been developed for thornless blackberries (2) but this may be too expensive for commercial application at this time. In addition, the potential for mutation during *in vitro* culture has not yet been completely evaluated. Our purpose in this study was to devise a simple, rapid, and inexpensive method for commercial propagation of thornless blackberries.

Materials and Methods

A series of 10 experiments was conducted with softwood or hardwood cuttings taken from plants growing in the field, in a screenhouse, and in the greenhouse. Cultivars and selections used were 'Smoothstem', 'Thornfree', 'Black Satin', 'Dirksen Thornless', SI-US 64-39-2, SI-US 68-6-6, and SI-US 68-6-17. The type of cutting and the cultivar or selection used for each experiment are specified in the results.

For most experiments, 1-node softwood stem cuttings, as distinct from leaf-bud cuttings, 5 to 8 cm long having the bud about 1 cm from the distal end were used. One-node hardwood cuttings were prepared in the same way and 3-node hardwood cuttings were prepared with the basal cut immediately below a node or 3 to 4 cm below a node. The leaves on softwood cuttings were trimmed to about one-half original size to conserve space in the propagation bench. Cuttings were treated with indolebutyric acid (IBA), 0.3% in talc, in 2 experiments.

Rooting media tested were 1 peat:1 perlite (by volume); perlite; 1 peat:1 sand; sand; peat pellets (Jiffy-7)[3]; Oasis rootcubes; and Kys-cubes. All rooting media were drenched with a solution of Aqua-Gro in water before the cuttings were inserted.

Rooting was done in a mist bench with a mist cycle of 6 sec/6 min or 2 sec/6 min from about 7:00 AM until about 5:00 to 7:00 PM depending upon the time of year. Greenhouse temperatures were maintained at a minimum of 18°C with the maximum rising as high as 35° during the summer. Cuttings in all experiments were kept on long days by means of a light break (incandescent lamps) from midnight until 2:00 AM.

Experiments were started in February, March, June, September, November, and December. Experiments were set up either as factorials with a split-plot design or as randomized complete blocks. Treatments of 10 cuttings were replicated from 2 to 10 times depending on the experiment with 5 or more replications in all but 2 experiments. Data were subjected to analysis of variance and differences between means were evaluated with Duncan's multiple range test.

Data were collected after 4 or 5 weeks for softwood cuttings (Fig. 1) and after 6 weeks for hardwood. Data taken included the number of cuttings that were rooted, alive but not rooted, and dead. Rooting was evaluated as light, medium, or heavy. Those cuttings with medium or heavy rooting were considered acceptable, i.e. they would survive if potted immediately, hardened off and transferred from the mist bench. Those with light rooting would require further time in the propagation bench before potting.

Results

Softwood cuttings. Tip cuttings and those from very soft tissue for 1 or 2 nodes proximal to the tip did not root well and often died or rotted. The effect of the position of the node along the stem was tested with cuttings taken from 8 consecutive nodes, the most distal of which had a leaf at least 2 cm long. Node position did not affect the percentage of cuttings rooted (48% to 64%, N.S.) or the percentage of cuttings acceptable (42% to 54%, N.S.). No gradient in rooting along the stem was evident.

Differences were found in ease of rooting among cultivars and selections (Table 1). 'Smoothstem' generally had the poorest rooting response and 'Dirksen Thornless' was only slightly better, except in 1 experiment (Table 1). 'Smoothstem' and 'Dirksen Thornless' seemed to be especially sensitive to overwatering in other experiments. 'Black Satin', SI-US 68-6-6, and SI-US 68-6-17 rooted well in all trials and 'Thornfree' rooted nearly as well in most trials.

Cuttings of all 4 cultivars and selections SI-US 68-6-6 and SI-US 68-6-17 rooted as well under a plastic tent without mist (82%) as they did under intermittent mist (85%). No significant interaction was found between cultivar or selection and propagation environment (mist or plastic tent).

Use of IBA had a slight but significant stimulatory effect on

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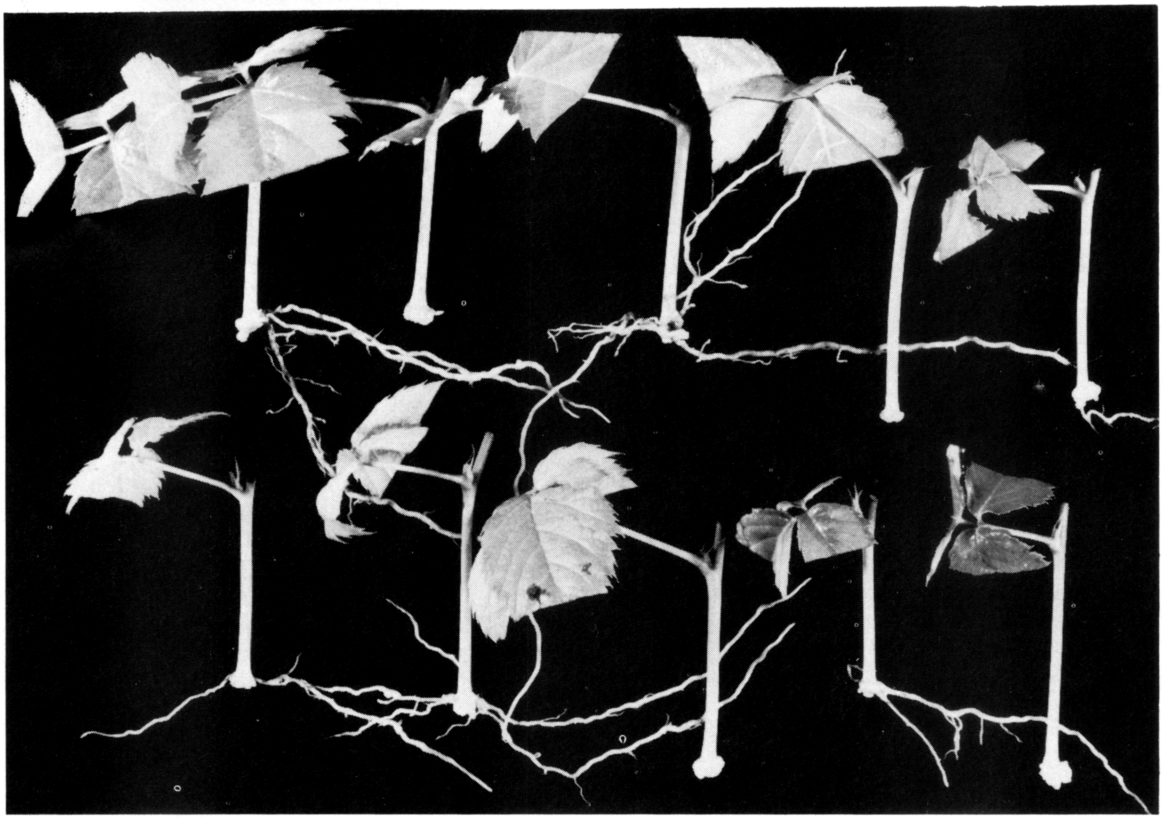

Fig. 1. Rooting of one-node softwood cuttings of 'Smoothstem' thornless blackberry after 30 days.

percentage rooting and percentage cuttings acceptable for 'Smoothstem' in one experiment (Table 2) but had no effect on either 'Smoothstem' or 'Black Satin' in another experiment (data not shown). The remaining cultivars and selections were not tested for response to IBA.

'Smoothstem' cuttings rooted equally well in sand, perlite, peat-perlite, sand-peat, and Oasis root-cubes (Table 2). Those rooted in sand had the most extensive root systems, but the roots were coarse and brittle with a tendency to break when the cuttings were handled. There were no significant differences among the other 5 rooting media in percentage of cuttings acceptable. However, cuttings rooted in perlite were difficult to handle for the same reason as those rooted in sand. Cuttings rooted in peat-perlite, as well as those rooted in sand-peat, had a fibrous root system that withstood handling very well. Roots on cuttings rooted in root-cubes or Kys-cubes were somewhat fibrous and were not disturbed by handling. No interaction was found between IBA treatment and rooting media (Table 2).

Rooting in peat pellets was evaluated in 3 experiments. In the first, 'Smoothstem' and 'Black Satin' cuttings rooted much better in peat-perlite (81% and 94%, respectively) than

Table 1. Rooting of 1-node softwood cuttings of thornless blackberries propagated under intermittent mist without IBA treatment in 3 experiments.

Cultivar or selection	Cuttings rooted (%)			Cuttings acceptable[z] (%)		
	Peat pellets[y]	Peat-perlite (1:1)		Peat pellets[y]	Peat-perlite (1:1)	
		Expt. 1[x]	Expt. 2[w]		Expt. 1[x]	Expt. 2[w]
Smoothstem	22 b[v]	70 b	93 b	18 b	48 c	76 b
Thornfree	–	88 a	96 ab	–	78 b	91 a
Black Satin	70 a	98 a	100 a	62 a	92 ab	96 a
Dirksen Thornless	32 b	60 b	100 a	28 b	45 c	95 a
SI-US 68-6-6	78 a	100 a	–	76 a	98 a	–
SI-US 68-6-17	80 a	95 a	–	66 a	75 b	–
Mean	56	85	97	50	72	90

[z]See text for explanation.

[y]Cuttings taken June 5 and evaluated July 10, 5 replications.

[x]Cuttings taken Sept. 22 and evaluated Oct. 20, 4 replications.

[w]Cuttings taken Dec. 1 and evaluated Jan. 5, 10 replications.

[v]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. Rooting of 1-node softwood cuttings of 'Smoothstem' thornless blackberry propagated under intermittent mist in several rooting media with and without IBA treatment.[z]

Rooting medium	Cuttings rooted (%)			Cuttings acceptable[y] (%)		
	IBA	Check	Mean	IBA	Check	Mean
Perlite	94	94	94 a[x]	66	64	65 b
Peat-perlite (1:1)	94	82	88 ab	62	50	56 b
Sand	100	94	97 a	92	78	85 a
Sand-peat (1:1)	90	84	87 ab	62	56	59 b
Oasis root-cubes	94	92	93 a	74	56	65 b
Kys-cubes	80	74	77 b	66	54	60 b
Mean	92*[w]	87	89	70**	60	65

[z]Cuttings taken Nov. 11 and evaluated Dec. 16, 5 replications.

[y]See text for explanation.

[x]Mean separation within column of rooting media means by Duncan's multiple range test, 5% level.

[w]Differences between IBA treatment means significant at P = 5% (*) or 1% (**).

Table 3. Rooting of hardwood cuttings of thornless blackberries propagated under intermittent mist in peat-perlite (1:1).[z]

Cultivar or selection	Cuttings rooted (%)		Cuttings acceptable[y] (%)		Cuttings dead (%)	
	1 node	3 nodes	1 node	3 nodes	1 node	3 nodes
Smoothstem	52 bc[x]	12 d	30 bcde	7 e	38 dc	75 ab
Thornfree	30 cd	18 d	10 e	13 de	2 f	77 a
Black Satin	65 ab	65 ab	40 abcd	48 abc	12 f	30 e
Dirksen Thornless	78 a	47 bc	52 ab	33 bcde	3 f	53 cd
SI-US 68-6-6	78 a	30 cd	65 a	22 cde	10 f	60 bc

[z]Cuttings taken Feb. 21 and evaluated April 6, 6 replications.

[y]See text for explanation.

[x]Mean separation within each variable by Duncan's multiple range test, 5% level.

in peat pellets (7% and 42%, respectively) with a mist cycle of 6 sec/6 min. Shortening the mist cycle to 2 sec/6 min in the second experiment resulted in 86% of the 'Smoothstem' cuttings rooting in both media. 'Thornfree' cuttings included in this second experiment rooted only 56% in peat-perlite and 36% in peat pellets; this difference was not significant, although the difference in rooting between the cultivars was (P = 0.1%). This was the only experiment with softwood cuttings in which 'Smoothstem' rooted better than 'Thornfree'. In this second experiment, the peat pellets were placed on peat-perlite in the mist bench.

In a third experiment with 3 cultivars and 2 selections and performed at the same time as the second experiment, the peat pellets were left on plastic trays supplied by the manufacturer. Although drainage holes were present in the plastic trays, the peat pellets retained more moisture than they did when placed on peat-perlite. The percentage of cuttings rooted and acceptable was much lower for 'Smoothstem' in this third experiment (see data for peat pellets in Table 1). In addition, rooting was poorer in the peat pellets in this third experiment than in peat-perlite in other experiments for all of the cultivars and selections for which comparable data are available (Table 1).

Hardwood cuttings. Rooting of 1-node hardwood cuttings in peat-perlite (Table 3) was generally poorer than that of comparable softwood cuttings (cf. Table 1). Only 'Dirksen Thornless' rooted as well from 1-node hardwood as from softwood cuttings.

Differences among cultivars for percentage of cuttings rooted, acceptable, and dead were statistically significant (P = 0.1%). One-node cuttings had a significantly higher percentage of cuttings rooted (P = 0.1%) and acceptable (P = 5%) and lower percentage of cuttings dead (P = 0.1%) than 3-node cuttings. Since the interaction between cultivar and node number was significant for all 3 variables (P = 5% for percentage cuttings rooted and acceptable, P = 0.1% for percentage cuttings dead), the interaction means, but not the main effect means, are presented in Table 3.

One-node cuttings rooted better than 3-node cuttings except for 'Black Satin' and 'Thornfree' (Table 3), and a much higher percentage of 3-node than of 1-node cuttings died in the propagation bench. Percentage of cuttings acceptable was quite variable, so that only with SI-US 68-6-6 were the 1-node cuttings significantly better than the 3-node. Among cultivars, 'Black Satin', 'Dirksen Thornless', and SI-US 68-6-6 tended to root best and to have the fewest cuttings die in the propagation bench. In a separate experiment conducted at the same time as the one reported here, 1- and 3-node cuttings of SI-US 64-39-2 responded similarly to 'Black Satin' (Table 3), except that about 20% fewer cuttings rooted or were acceptable and 20% more cuttings died.

Discussion

Thornless blackberries were easily propagated with 1-node softwood cuttings. This technique maximized the number of cuttings that could be obtained from stock plants, since the location of the node along the cane had no significant effect on rooting. In addition, these softwood cuttings rooted better than 1-node, and much better than 3-node, hardwood cuttings. Further, rooted hardwood cuttings with 1 node were easier to handle than those with 3 nodes. The latter were placed in the propagation bench with only 1 node above the rooting medium, and rooting occurred both from the nodes in the medium and from the base of the cutting. This made it difficult to remove the cuttings from the medium and to plant them in containers.

Treatment of cuttings with IBA had relatively little effect on the 2 cultivars tested, even though the effect was significant in one instance. Whether this treatment would be worthwhile for routine propagation of these cultivars and selections is questionable. If IBA does accelerate rooting, then its use might be worthwhile to shorten the time that the cuttings are in the propagation bench.

Softwood cuttings rooted satisfactorily in most of the media tested. However, the cuttings were sensitive to overwatering, particularly those of 'Smoothstem'; thus it is important to select a well-drained rooting medium. When a rooting medium is used that retains moisture well, such as peat-perlite or peat pellets, then for maximum rooting the mist cycle must be reduced to the minimum that prevents the leaves from drying out. The poorer rooting obtained with certain of the media shown in Table 2 could be a result of too much water. Such an effect was clearly seen in the superior rooting in peat pellets when the mist cycle was reduced and the pellets were placed so that drainage was improved.

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