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Why Not Tame the Wild Blueberry?

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INTRODUCTION

Bears, birds, and blueberries work together. In time women and children and their families also became part of this ancient ecosystem. The women and the kids brought berries home from scattered spots in the woods. A few men took an interest. Money and business had been invented, a game the men played, later joined by many women. Now the world is full of people with money to trade for good things to eat, like wild blueberries, avoiding head-on competition with the bears.

In pursuit of that money, some Maine trees were taken out to let the blueberry patches spread and join. This eventually resulted in beautiful acres of blueberries, but eventually is a long time while the kids grow up and scatter. Patience has its limits. The trees try to come back, grasses and other plants drift in. When cleared out they come back quicker than the berries spread, and the question becomes: "How to speed the spread?"

It takes little effort with a spade to see that a young blueberry plant has grown out from an older one that has sent out a rhizome, an underground rooted stem. Suppose we dig out some of those long rhizomes and plant them where we want blueberries. Unfortunately it just doesn't work well.

Blueberries differ from radishes and tulips. One doesn't just drop something in the ground and enjoy the results. Blueberries do grow from seed, which is how the blueberry patches in the woods originated, but the seeds are so small that few people notice them. Although we have in fact produced fruit-bearing lowbush blueberry plants from those tiny seeds, here we report on studies of different methods of propagating lowbush blueberry plants. These methods could be used for introducing blueberry plants into existing fields to improve field cover, or to start a blueberry field from scratch.

The seeds in our study were germinated not in the ground, but on water agar gel under sterile conditions as in medical laboratory work. The emerging plantlets were kept under constant temperature and 16 hours per day of measured artificial light followed by 8 hours of darkness. Eventually they were big enough and vigorous enough to be moved out of the greenhouse into our experimental field for comparison with plants produced by two other laboratory methods.

In growing the plants for the comparison, we were guided by earlier experiments with application of liquid fertilizer (21-7-7) at the rate of 100 pounds of N per acre in one shot or divided into applications every 16, 12, eight, or four days. With eight-day frequency, plants attained at least 10 times the size of unfertilized plants. In growing plants for comparing ways to make wasted space produce crop, we fertilized weekly, increased the nutrient content gradually, and stopped fertilizing after four and a half months.

The simpler of our two other methods for establishing or re-establishing blueberry production used softwood cuttings from productive plants, chemically treated to form roots and grown to outplanting size under tight control of temperature and light in the greenhouse.

Micropropagation, the costliest method, starts with leaf buds from plants one hopes to duplicate exactly. With the right treatment in lab and greenhouse, the buds produce multiple shoots that are then rooted and grown into plants of outplanting size, genetically identical to the plant they came from, with no shuffling of the genes. This procedure has been shown to produce a plant that is more "juvenile" or seedling-like in growth characteristics.

THE FIRST STUDY

Both from stem cuttings and by micropropagation we grew plants of two different genetic combinations (clones), each a known success in its own right. Two-year-old plants of each combination, 16 of them that had been started as rooted pieces of stem and 16 of each that had been started in test tubes, were planted out in random placement two feet apart and mulched with three inches of sawdust. Even before growth in the field, the micropropagated plants of both clones had outstripped those from stem cuttings. They had more branches, wider-spreading ones (Figure 1), on more stems than the plants from cut stems (Table 1).

Most important for spreading, the surviving micropropagated plants of one of the two genetic combinations all grew rhizomes that first summer. From the other clone, rhizome production was also somewhat better with micropropagation, yet 73% of its 11 rooted cuttings that survived a summer in the field also put out rhizomes. In general, the micropropagated plants were more consistent rhizome producers.

We also had about 50 other plants from each of the two propagation groups of one clone that were given a second summer of growth in the field. They began that second field year with little difference in flower buds between micropropagated and stem

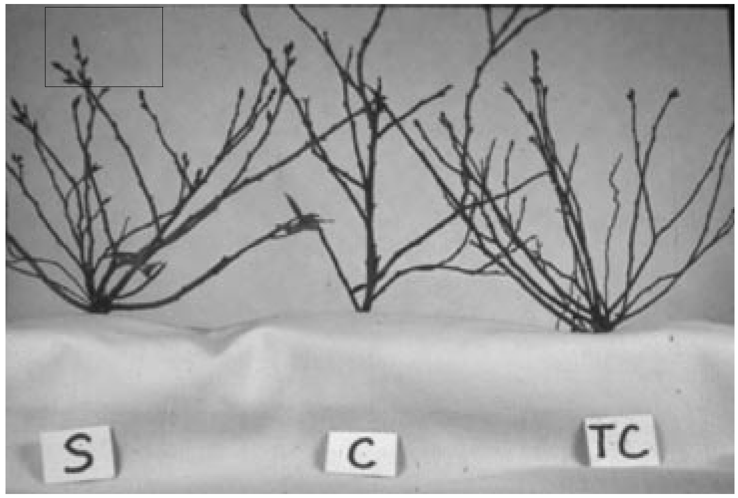

Figure 1. Two-year-old plants from seed (S), stem cutting (C), and micropropagation (TC).

cuttings, and they finished it with little difference in berry weight suggesting the micropropagated plants made a quick conversion from juvenile non-flowering phase to an adult reproductive phase (Table 2). More pertinent, perhaps, to the objective of promoting spread was what happened underground that second season: the micropropagated plants produced almost four times as many rhizomes as the ones from cut stems, longer and heavier. Above ground, with 37% more flower buds, they looked more promising.

A SECOND STUDY

In bringing seedlings into the comparison, we worked not just with two genetic identities, but with five selected clones. Perhaps too anxious to make this comparison, the micropropagated plants were not subcultured several times, which we now

Table 1. Effect of tissue-culture and stem-cutting propagation on characteristics of two clones before and after one season's field growth.

Characteristic	Clone 7062 Micro-propagation	Clone 7062 Stem cuttings	Clone 7062 Different	Clone 7915 Micro-propagation	Clone 7915 Stem cuttings	Clone 7915 Different
Before outplanting						
No. stems	10[1]	2	Yes	7	2	Yes
No. branches						
Primary	22	9	Yes	23	7	Yes
Secondary	9	10	No	18	12	No
Tertiary	1	3	Yes	5	4	No
No. flower buds	<1	26	Yes	4	18	Yes
No. vegetative buds	532	272	Yes	379	120	Yes
No. vegetative buds buried	176	47	Yes	69	6	Yes
After one season of field growth						
No. rhizomes	7	<1	Yes	5	2	Yes
Rhizome length (mm)	69	9	Yes	47	35	Yes
Rhizome dry weight (g)	<1	<1	No	<1	<1	No
Stem dry weight (g)	4	3	No	4	3	No

[1]Each value represents an average of 16 plants.

Table 2. Effects of tissue-culture and stem-cutting propagation on characteristics before and after a second season's field growth of clone 7062.

Characteristic	Micropropagation	Stem cuttings	Different
No. flower buds (May)	51[1]	65[2]	No
Berry fresh weight (g)	43	37	No
No. flower buds (September)	183	134	Yes
No. rhizomes	20	6	Yes
Rhizome length (mm)	12	10	Yes
Rhizome dry weight (g)	4	1	Yes
Stem dry weight (g)	23	21	No
Area covered (cm^2)	740	692	No

[1]Each value represents an average from 50 micropropagated plants.
[2]Each value represents an average from 46 plants propagated from stem cuttings.

feel is necessary to induce the juvenile characteristics. Plants were established side by side in sets of one plant from micropropagation, one from a cut stem, and a third that had grown from a seed (Figure 1). The seedling was produced by applying pollen from a little brush to the stigmata of a flower on a plant genetically identical with the other two plants of the set. When moved outside after six months in the greenhouse, the micropropagated and stem-propagated plants had about the same number of new stems (Table 3). The seedlings had more branches and more vegetative buds that would be buried during planting and could give rise to rhizomes (DeGomez and Smagula 1990). By the end of the one summer in the field, it was the seedlings that had the largest number of rhizomes, but the plants of all three origins had pushed out rhizomes equally far.

CONCLUSION

Areas without blueberries are soon overrun with weeds. These unproductive areas could be planted, increasing the yield per acre and making

Table 3. Effects of propagation by seed, micropropagation (without subculture), or stem cuttings on characteristics of five lowbush blueberry clones (clones 7062, 2827,Ca510, 8Ells, and 1Ells[1]) before and after one season of field growth.

Characteristic	Seed[2]	Micropropagation	Stem cuttings
Before outplanting			
No. stems	1 a[3]	2 b	2 b
No. branches			
Primary	5 a	2 b	3 b
Secondary	2 a	<1 b	<1 b
Tertiary	<1 a	0 b	0 b
Internode length (mm)	5 a	6 a	8 b
Leaf area (cm^2)	5 a	8 b	13 c
No. flower buds	0 a	1 a	5 b
No. vegetative buds	137 a	48 b	50 b
No. vegetative buds buried	44 a	19 b	11 c
After one season of field growth			
No. rhizomes	3 a	<1 b	<1 b
Rhizome length (mm)	6 a	4 a	5 a
Rhizome dry weight (g)	<1 a	<1 a	<1 a
Stem dry weight (g)	2 a	<1 b	2 a

[1]Clone 7062, n = 144; clone 2827, n = 144; clone Ca510, n = 144; clone 8Ells, n = 84; and clone 1Ells, n = 36.
[2]Each value represents an average of 186 plants.
[3]Values across rows are not different if followed by the same letter.

it harder for weeds to invade. What plants to put in? You must weigh the advantages and disadvantages of each type of plant propagation. Seedlings are the least expensive source of plants and offer diversity, but yields will average less than asexually propagated plants (Aalders et al. 1979). Rooted softwood cuttings will give plants with the same high potential yield as the parent from which the cuttings have been taken. Cuttings, however, exhibit an adult flowering growth habit with less branching and less potential for consistent rhizome production during the critical early years of establishment. Micropropagation, the most expensive choice, offers a compromise between seedlings and cuttings, with a growth habit like seedlings after subculture has induced juvenility and the ame ultimate yields as the source plant.

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