

**DIRECTIONS FOR
BLUEBERRY CULTURE,
1921: BULLETIN NO.
974, OCTOBER 15, 1921**

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FREDERICK V. COVILLE

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UNITED STATES DEPARTMENT OF AGRICULTURE



BULLETIN No. 974



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DIRECTIONS FOR BLUEBERRY CULTURE, 1921.¹

By FREDERICK V. COVILLE, *Botanist*.

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EARLY EXPERIMENTS WITH BLUEBERRIES.

The experiments which have led to the present publication were begun in 1906. The work of the first four years resulted in a publication entitled "Experiments in Blueberry Culture," issued in 1910.² This work was widely distributed, and a copy came into the hands of Miss Elizabeth C. White, New Lisbon, N. J. Miss White at once perceived the significance of the experiments and the importance of testing their application to the waste lands surrounding her father's cranberry bogs. An informal agreement of cooperation resulted. In 1913 this was replaced by a formal contract, the object of which was to provide suitable conditions for a field test of the blueberry hybrids produced in the course of the experiments at Washington, D. C. The location of the testing plantation is at Whitesbog, 4 miles east of Browns Mills, N. J., in the sandy, peaty, acid soil of the pine barrens. Up to the present time 16 acres have been planted with 27,000 different hybrid seedlings. Thus far, about 18,000 of these

¹ Revised by the writer from "Directions for Blueberry Culture, 1916," which was published as United States Department of Agriculture Bulletin 834.

² The publication mentioned, issued as Bulletin No. 193 of the Bureau of Plant Industry, gave a detailed account of the principles of blueberry culture, including the soil requirements and peculiarities of nutrition of the blueberry plant and the details of the growing of seedlings. It contained 100 pages of text, with 18 plates and 81 text figures. It was reissued in 1911. Both editions are now out of print.

hybrids have fruited and four of them have been selected and approved as worthy of introduction into agriculture. Propagation material from these four hybrids has been placed in the hands of nurserymen for commercial propagation.

Miss White has also brought together at Whitesbog a very remarkable collection of selected wild blueberry plants. Several of these have been used as breeding stocks in the blueberry development work carried on by the department.

In the present bulletin are included such results of the experiments and experience at Washington, Whitesbog, and other points as constitute a brief practical guide for persons desiring to take up blueberry culture.

SPECIAL REQUIREMENTS.

Success in blueberry culture rests especially on the recognition of two peculiarities in the nutrition of these plants: (1) Their requirement of an acid soil; (2) their possession of a root fungus that appears to have the beneficial function of supplying them with nitrogen.

If blueberries are planted in a soil with an alkaline or neutral reaction, such as the ordinary rich garden or fertile field, it is useless to expect their successful growth. In such a situation they become feeble and finally die. Blueberries require an acid soil, and they thrive best in that particular type of acid soil which consists of a mixture of sand and peat.³ (Pl. I.)

Good aeration of the soil is another essential. It is commonly but erroneously supposed that the highbush or swamp blueberry (*Vaccinium corymbosum*), the species chiefly desirable for cultivation, grows best in a permanently wet soil. It is to be observed, however, that the wild plants of the swamps occupy situations which, though perhaps submerged in winter and spring, are exposed to the air during the root-forming period of summer and autumn; or, when growing in permanently submerged places, they stand on a hummock or in a cushion of moss which rises above the summer water level and within which the feeding roots of the bush are closely interlaced. In actual culture, moreover, it has been found that the swamp blueberry does not thrive in a permanently wet or soggy soil.

Although some species of *Vaccinium*, such as the common lowbush blueberry of the northeastern United States, *Vaccinium angustifolium* (called *V. pennsylvanicum* by some authors), grow and

³The degree of soil acidity best suited to blueberries is about specific acidity 100, corresponding to a hydrogen ion concentration, $P_{H}=5$. See a paper by Edgar T. Wherry, "Soil Acidity and a Field Method for Its Measurement," published in the technical Journal Ecology, vol. 1, pp. 160 to 173, July, 1920, with a colored plate. The same subject is treated more fully by Dr. Wherry in the general appendix to the Smithsonian Report for 1920, also with a colored plate, under the title "Soil Acidity—Its Nature, Measurement, and Relation to Plant Distribution."

fruit abundantly in sandy uplands that are subject to drought, the swamp blueberry grows best in soils naturally or artificially supplied with adequate moisture.

These, then, are the three fundamental requirements of successful blueberry culture: (1) An acid soil, especially one composed of peat and sand; (2) good drainage and thorough aeration of the surface soil; and (3) permanent but moderate soil moisture. Under such conditions the beneficial root fungus which is believed to be essential to the nutrition of the plant need give the cultivator no concern, for even if the necessary fungus were wholly lacking in the soil of the new plantation each healthy bush set out in it would bring its own supply of soil-inoculation material.

Next in importance to soil conditions is a convenient location with reference to a good market. The berries should reach their destination without delay, preferably early in the morning following the day of picking. To secure the best prices they should also reach the market before the height of the main wild-blueberry season. A situation to the south of the great areas of wild blueberries in northern New England, Canada, and northern Michigan is therefore desirable. One of the most promising districts for blueberry culture is the cranberry region of New Jersey, for there an ideal soil occurs in conjunction with an early-maturing season and excellent shipping facilities to the markets of Philadelphia and New York.

Situations liable to late spring freezes, such as the bottoms of valleys, should be avoided, for although the blueberry plant itself is seldom permanently injured by such a freeze its crop of fruit may be destroyed.

It has been observed that in or around bodies of water, such as cranberry reservoirs or cranberry bogs temporarily flooded to prevent frost or insect injury, the wild bushes often produce normal crops of blueberries in seasons in which the wild crop of upland blueberries has been destroyed by late spring freezes. Proximity to such bodies of water is evidently advantageous.

In regions subject to very low winter temperatures a blanket of snow sufficiently deep to cover the bushes often protects them completely, when twigs not covered by the snow are winterkilled. In the very cold February of 1918 the fruiting twigs of lowbush hybrids at Whitesbog, N. J., unprotected by snow, were killed by temperatures of about 12° below zero F. Both parents of these hybrids were uninjured at Greenfield, N. H., where the temperature went down to 30° below zero, but the plants there were covered with deep snow. Another observation made in the same season on Crotched Mountain, N. H., merits attention in this connection. Wild-blueberry bushes 6 to 7 feet high, the tops of which projected through

the snow, bore no fruit on the exposed tops in the following summer, while the sides and bases of the same bushes, which had been covered with snow, yielded the usual abundance of berries. The dead fruit buds still remained on the winterkilled twig tips at the exposed tops of the bushes.

IMPORTANCE OF SUPERIOR VARIETIES.

In the southern United States and in the Middle West blueberries are not ordinarily distinguished from huckleberries, but in New England the distinction is very clearly drawn. The name huckleberry is there restricted to plants of the genus *Gaylussacia*, the berries of which contain 10 large seeds with bony coverings like minute peach pits, which crackle between the teeth. The name blueberry is applied in New England to the various species of the genus *Vaccinium*, in which the seeds, though numerous, are so small that they are barely noticeable when the berries are eaten. It is probable that the comparatively low estimation in which this fruit is held in the South is largely due to the lack of a distinctive popular name and the consequent confusion of the delicious small-seeded southern *Vacciniums* with the coarse large-seeded *Gaylussacias*. It is the culture of the small-seeded blueberries only, as distinguished from the large-seeded huckleberries, that is here advocated.

From the market standpoint the features of superiority in a blueberry are sweetness and excellence of flavor; large size; light-blue color, due to the presence of a dense bloom over the dark-purple or almost black skin; "dryness," or freedom from superficial moisture, especially the fermenting juice of broken berries; and plumpness—that is, freedom from the withered or wrinkled appearance that the berries begin to acquire several days after picking.

Although blueberry plantations may be formed by the transplanting of unselected wild bushes or by the growing of chance seedlings, neither of these courses is advocated, because neither would result in the production of fruit of an especially superior quality. Seedling plants, even from the largest berried wild plants, produce small berries as often as large ones. The cultivator should begin with the purchase of a few plants of selected hybrid varieties or by the transplanting of the best wild bushes, selected when in fruit for the size, color, flavor, and earliness of the berry and the vigor and productiveness of the bush. These he should propagate by layering, by division, and by cuttings. Through a combination of these methods, a valuable old plant can often be multiplied by several hundred at one propagation, the fruit of the progeny retaining all the characteristics of the parent.

In making selections among wild bushes it is an excellent plan to preserve for future reference about a dozen of the largest berries in

a tightly stoppered wide-mouthed bottle containing a mixture of 1 part of formalin, or 40 per cent formaldehyde, to 15 parts of water. Each bottle should contain berries from only a single bush or, in the case of a plant that spreads by the root, from a single patch. Care should be taken not to rub the delicate "bloom" from the berries. A small twig bearing two or three leaves, from the same plant from which the berries were taken, should also be placed in the bottle. The Department of Agriculture would be glad to receive such samples and identify them for the sender. Some of the bushes thus located might prove to be of value in the blueberry breeding work of the department.

Great interest has developed recently in Florida on the subject of blueberry culture. Extravagant and misleading statements have been published and thousands of ordinary wild bushes have been sold at high prices, the purchasers being led to believe that the plants were of specially selected or adapted varieties. One company, located near Tampa, published as the frontispiece of a blueberry advertising pamphlet a natural-size illustration of a quart box of one of the United States Department of Agriculture selected hybrids, without designating it as such. The reader of the pamphlet would naturally believe that the bushes the firm was selling would produce such berries as were shown in the illustration. The real success of a single blueberry plantation near Crestview, in northwestern Florida, set with selected plants from the near-by woods, is chiefly responsible for the present wave of blueberry exploitation in that State. The best advice that can be given at present to those desiring to experiment with blueberry culture in Florida is to make certain that any plants they buy are as represented by the seller, to be sure that alleged improved varieties are not in reality ordinary wild blueberries, perhaps inferior to wild bushes that the purchaser might find in his own neighborhood by careful search. The selected hybrids described in this bulletin are of northern parentage and probably will not thrive in Florida because Florida winters are not sufficiently cold to give these plants the chilling they require in winter.⁴ The United States Department of Agriculture has already begun the breeding of improved blueberries from species native in Florida, but it greatly desires better southern breeding stocks than it now possesses. Those interested in the advancement of blueberry culture in Florida are especially urged to make selections among their wild blueberries in accordance with the general directions given in the two preceding paragraphs.

⁴ For an account of the experiments that led to this conclusion, see "The Influence of Cold in Stimulating the Growth of Plants," published in the *Journal of Agricultural Research* for October 15, 1920, vol. 20, pp. 151 to 180, with 16 plates.

PROPAGATION.

While grafting or budding is almost indispensable in experimental work with blueberries, bushes propagated by these methods are not suitable for permanent commercial plantations, because such bushes are continually sending up new and undesirable shoots from the stock. Budding, however, is the best known means of producing a large quantity of cutting wood from a valuable selected blueberry hybrid. It is useful also in testing the quality of a new variety, for a budded blueberry when properly handled comes into bearing two years from the time of budding and doubtless will continue to yield for several years, until the budded stem becomes old and decrepit.

BUDDING.

The best season for budding the blueberry is from the middle of July to the middle of August. The ordinary method of shield budding,² with a T-shaped cut and dry and unwaxed raffia wrapping, has proved the most successful of all the methods tried. (Pl. II.) In selecting budwood, attention should be paid to the following points: A bud forms at the base of each leaf; at first the scales covering the bud are green; when they are a little older they become straw colored, and later brown. When the buds have reached this brown stage they are of the proper age for use. All three stages may occur at the same time on a single branch, and in such a case the upper part of the branch should be discarded. A bud is more easily handled if the tiny leafstalk is left attached to it. Provision for this is easily made by cutting off the blades, but not the stalks, of the leaves when the branches that are to be used for budwood are removed from the parent bush. Care should be taken to discard the large fat flowering buds that occur toward the ends of the branches. In most blueberry plants, however, these flowering buds do not develop until after the budding season.

When blueberry buds are to be inserted the same day on which the budwood is cut, the sticks require no other treatment than to be kept in the shade in the folds of a moist clean towel. The budwood is easily ruined, however, by continued subjection to the high temperatures prevalent at the midsummer budding season. Any budwood that has been cut should therefore be kept on ice at night or at any other time when it is not in actual use.

In carrying blueberry budwood long distances, excellent results have been secured by the use of a thermos bottle. The bottle, opened, and the budwood, in clean moist wrappings and with additional moist packing material, should be kept on ice for several hours

² This and other methods of budding are described in Farmers' Bulletin 157, "The Propagation of Plants," by L. C. Corbett.

until thoroughly chilled. Just before the journey is to begin the chilled budwood and packing material is placed in the bottle and the bottle closed. Immediately on arrival at its destination the bottle should be opened and the contents kept chilled in an ice box until used. By this method blueberry budwood has been kept in perfect condition for more than a week, and probably that period can be much prolonged.

The best wood on which to bud is the lower portion of vigorous basal shoots of the season, especially those from plants that were cut to the stump in the preceding winter or early spring. On such shoots the bark can be lifted with ease much later in the season than on older stems. In taking the bud from the stick of budwood the cut is made just deep enough to leave a thin layer of wood attached to the middle of the bud slice. The raffia should be tied rather tightly, so that the juice almost begins to be squeezed from the soft bark. Special care should be taken that the raffia wrapping does not become wet and fermentation ensue between the raw surfaces of bud and stock. Plants budded in a greenhouse should therefore be watered on the surface of the ground; not on the foliage. In the case of outdoor plants liable to be wet by the rain the bud wrappings can be effectually protected by the use of a piece of strong paraffined paper about 6 inches square made into a little cone about the stem just above the bud wrappings and securely tied there with raffia, the lower part of the cone hanging down around the stem like a little skirt, keeping the rain away from the bud and its wrappings. (Pl. III.)

Union of the bud with the stock should take place in two to three weeks. As soon as the budded stem has increased in diameter sufficiently to cause pronounced choking by the raffia, all the wrappings should be removed. Otherwise the choked stem may be broken off by the wind. If choking does not occur the wrapping may be allowed to remain until spring.

Before growth begins in the following spring the stem is cut off above the inserted bud, which is still dormant. Only the inserted bud should be allowed to grow, all other growth from the stock being promptly rubbed off as soon as it starts. (Pl. IV.) Under this treatment the shoot from the inserted bud is very succulent and heavy, and a wind easily breaks it from the stock, but slice and all. To prevent this, the growing shoot, beginning at a length of 6 to 8 inches, should be tied at intervals to a strong stake.

In greenhouse experiments a growth of more than 8 feet has been obtained in the first season from an inserted bud on a vigorous plant, and when the shoot has been made to branch repeatedly by removing the growing tips (Pl. V) as many as 70 cuttings have