

Presented by Elizabeth C. White at the meeting of
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New Lisbon, N. J.

DEVELOPMENT OF THE CULTIVATED BLUEBERRY.

Millions of dollars worth of blueberries are sold every year. Practically all of these are gathered from swamps, hillsides and wild pastures, where they grow without human aid. May we not count the commercial importance of this unimproved fruit as an indication of the immense popularity that awaits the better blueberries which are now being developed?

Blueberries have been cultivated in a few places for several years. There are small fields in Indiana, Florida and other States.

REQUIREMENTS OF GROWTH

Attempts to cultivate blueberries have most frequently failed however because the plants were set in soil of neutral or alkaline reaction which is best ~~suited~~ ^{for} to most garden crops.

Blueberries require an acid soil, preferably one composed of peat and sand. This is the most important discovery made by Mr. Frederick V. Coville of the U. S. Dept. of Agriculture, who has made a careful study of the fundamental laws governing the growth of blueberries.

Of equal importance to their welfare is a well controlled supply of water. The blueberry roots must have a continual supply of both moisture and air. It is easy to understand that blueberries need plenty of water - we see them growing in swamps and very wet places; but, under New Jersey conditions at least, their need of good drainage is less apparent. Every thriving wild blueberry bush, however, no matter how watery its environment, has access to some tussock of moss or heap of loose partially decayed vegetation through which both air and blueberry rootlets freely penetrate.

A third important law explained by Mr. Coville is the need of cross pollination. Many blueberry plants are entirely sterile to their own pollen; ^{plants} on other berries may set when self-pollinated but if so they are slow in developing, never reach full size, and the seeds and resulting plants lack vitality. Another fact not generally realized is that low temperatures are necessary to stimulate various phases of the development of the blueberry.

For successful breeding and propagating it is ^{important} ~~essential~~ to know the amount of chilling a plant or cutting must experience before it will start normally. Blueberry seeds will not germinate till the nights attain a certain low temperature, and pollination of the flowers cannot be successfully accomplished if the night temperatures are too high. In outdoor culture,

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of course, normal seasonal temperatures provide these conditions.

CO-OPERATION IN DEVELOPING BLUEBERRY CULTURE.

After reading Mr. Coville's bulletin "Experiments in Blueberry Culture" I wrote the Department of Agriculture offering to co-operate in further experiments. The letter was based on the idea that my father and I could contribute experience that would be valuable in the development of this new culture, and that when tamed blueberries would make for us a valuable secondary crop. Our primary crop is cranberries - for three generations we have grown them at Whitesbog. All along the dams and about the margins of the cranberry bogs the high bush blueberry or swamp huckleberry as we call it in New Jersey grows wild. Blueberries and cranberries are close kin.

For ten years we have worked in close co-operation with Mr. Coville. When his breeding work developed so that it was desirable to try the seedling plants in the field, the trial grounds were rented at Whitesbog. I believe the co-operation of science with experience in commercial culture of a closely allied fruit has hastened the development of better blueberries.

In this co-operative development my part has consisted chiefly in the selection of fine wild plants; and in developing methods of field culture and of propagation on a commercial scale.

WILD STOCKS.

In locating good bushes I have depended almost entirely on the people who pick wild berries for market, and large size of the berry was the only point considered in making the first selection. To begin with we accepted plants with berries half an inch in diameter, but they were so easily found that we quickly raised our standard to 16 mm or about 5/8 of an inch. Over a hundred plants were located within twenty miles of my home in New Jersey. Two of them bore some berries over 19mm or 3/4 of an inch in diameter.

We made an effort last year to locate in other parts of the country plants with berries 3/4 of an inch in diameter, or just the size of a cent. We offered \$50.00 each for such plants, packed according to directions and delivered to the nearest express office - we to pay the transportation. The offer was advertised widely and I received hundreds of samples, none of which approached the best New Jersey berries in size. Surely little New Jersey has no monopoly of blueberries as large as a cent, and I hope members of this Society will interest themselves in locating such bushes. Our \$50.00 offer still holds good and

the plants would be of great value in the breeding work, especially if they came from New England, about the Great Lakes, from North Carolina or from some other blueberry center, the climate of which differs appreciably from that of New Jersey. If you are inclined to help in this search please remember that only plants with berries nearly or quite 3/4 of an inch in diameter are wanted; and don't! Oh! please don't! inspire all your friends with an ambition to send samples of the best berries they ever saw; even when said berries are less than 1/4 inch across; - It takes too much time to carry out the remains.

CHARACTERISTICS OF INDIVIDUAL PLANTS.

I visited in their original location most of the hundred odd plants selected between 1912 and 1916, either while in fruit or when dug during the dormant season. Each was divided into many pieces which were used for propagating. From each original plant there were thus obtained from five to five hundred little new plants. The young plants from each original bush have been kept entirely separate and each lot has its own peculiar set of characteristics, entirely distinct from the characteristics of any other lot. In very many cases the young plants show characteristics which explain peculiarities attributed to accident when observed in the original plant. Thus:- Earlin was the tallest plant I ever dug, over 12 feet high, and the youngsters are a leggy, gawky lot. Haines No. 9 though gnarly and seemingly very old had an appearance of vigor which led me to believe the young plants would be clean cut and aristocratic; but no! every one, as soon as it is past its infancy, looks old and gnarly. The original Adams plant grew on the bank of a brown stream which at high water had washed bare several large roots which were bent at right angles on themselves; a mere accident of circumstance apparently, and yet every Adams plant of two years old or over that I have dug, unlike other blueberry plants, has had a number of its larger roots bent at right angles. Rubel was a large plant, beautifully symmetrical, with smooth bark and a fine well balanced appearance, and under cultivation Rubel plants have proven uniformly fine, well balanced and vigorous.

The individual characteristics which make every seedling blueberry plant distinct from every other are innumerable. In connection with the fruit the important differences include size, color, flavor, texture and time of ripening. The berries on one plant may be gone before those on another begin to ripen.

Of greatest importance is the varying ability of plants to resist injury by frost. A remarkable example of this was observed early in my blueberry work. It was past the middle of May when a hard freeze came. Such an event spells disaster for cranberry growers, and the following day my father and I were investigating the extent of the damage when we observed two large blueberry bushes growing so close together that their

branches intermingled. On one the young leaves, flowers and buds were uninjured; while on the other they were completely blackened as by fire.

Our selected plants varied in their resistance to frost injury, and the most tender have been discarded. None of them however were very susceptible - we unwittingly secured resistant plants because most of them were located in years when wild blueberries were seriously injured by frost.

Of the hundred odd plants originally selected for the size of their berries, only six proved worthy of propagation for commercial fruit production. These are known as the Rubel, Harding, Sam, Dunfee, Adams and Grover; each name perpetuating that of the discoverer of the original plant.

BREEDING.

Mr. Coville is using these selected plants as parents in his breeding work. Besides those from New Jersey he has a few from other states. His methods of carrying on this work in the greenhouses at Washington are very interesting. The plants which he desires to cross are chilled, either in a refrigerator or out of doors in winter. They are then forced in a house ^{with care} ~~where the heat is~~ regulated to ~~give the~~ necessary temperatures. If one plant develops faster than its destined mate it is held back by being placed in a frame where the temperature is kept slightly above freezing by an electrically controlled refrigerating machine.

The flowers are hand pollinated. A careful record of date, pollen parent etc. is written on a tiny tag which is attached to each pollinated flower.

The seedlings resulting from this careful tedious work are cared for in Washington till a year old. They are then sent to the trial grounds and set in the field about September first. The second summer in the field they usually produce a few berries, and the third summer a crop worth picking for its commercial value.

Low bush hybrids resulting from a cross of Brooks, a high bush (*Vaccinium corymbosum*) from New Hampshire, with a selected low bush ~~blueberry~~ (*Vaccinium angustifolium*) from the same state, have been carried to the second generation. The very interesting results, from the breeders standpoint, Mr. Coville will discuss in a future publication.

From a practical standpoint these low bush hybrids promise to be very valuable. Among them are plants yielding fruit which ripens in New Jersey as early as that of the native wild low bushes. The berries of the latter are small and insipid but the berries of some of the early low bush hybrids are large and of fine flavor. For New Jersey they promise excellent

berries ready for market from June 15th to 20th.

Among other hybrids plants can be selected which will carry the blueberry season, in New Jersey, up to or beyond the first of September.

What are probably the best of the hybrids are known as 620 A and 830 C. They were selected from upwards of 3000 seedlings of the Brooks-Sooey cross. Brooks, I have already explained, is a New Hampshire high bush. Its largest berries are 14 mm or more than 1/2 inch in diameter. Sooey is a high bush from New Jersey, the largest berries of which reach 16 mm or about 5/8 of an inch. On each of the two seedlings the largest berries reach a diameter of 18 mm. The berries of 830 C are later and average a little larger than those of 620 A. Since the parents of these hybrids were crossed the better wild plants have been found. Some of the plants resulting from crosses of these produced their first berries last summer. (1920) Among these one berry 20 mm in diameter was found. With this satisfactory progress I believe that the best results of the breeding work rest in the future and look forward to blueberries an inch in diameter.

CULTURAL METHODS.

We now have at Whitesbog about twenty five acres set with blueberries - Twenty with seedlings from the Department and five with plants raised from cuttings of the wild bushes.

The land we are using is in the so-called Pine Barren region of New Jersey, and has never been cultivated before. It was considered useless. It is sandy, and the sand is overlaid with a peaty layer from two to eight inches thick. Before plowing it is occupied by a variety of bushes, many of them of the heath family, including several species of blueberries and huckleberries.

In preparing this land for cultivation we cut and burn the brush and plow under the peaty turf, leaving the white sand on top. It is desirable to plow the land a year or more before planting and work it occasionally with a disk harrow in order to thoroughly kill the original growth. So much of this consists of unselected blueberries that they come up close to the better plants and get overlooked by the men who hoe.

The plants from the Department, when set in the field, have mostly been as large as they could be grown in a two inch pot. They are set 4 ft. apart in rows 8 ft. apart. There is little doubt that this spacing will be found too close for some varieties and too wide for others - but all our plants ~~so far~~ are ^{yet} on trial.

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We practise clean culture so far as the shortage of labor permits. The new land on which manure has never been used is not very weedy, but the young plants need hoeing two or three times during the summer, and frequent use of the cultivator helps maintain good aeration of the soil, so essential to vigorous growth.

IRRIGATION AND DRAINAGE.

One important *consideration* which makes blueberries an especially good auxiliary crop for us is the fact that we have developed ^{system at} an elaborate irrigation and drainage ~~system~~ for our cranberries, much of which can be used for the blueberries with but little additional expense. The cranberry bogs and blueberry fields are underlaid with a hard pan two feet or so below the lower level of the peat. Irrigation is provided by the percolation of water through the soil above this hard pan from reservoirs, which are maintained at a level some feet higher than the bogs and fields. These reservoirs influence the water content of the soil for a mile and more below them. In the cranberry bogs drainage is cared for by open ditches but in the cleanly cultivated blueberry fields open ditches have not proved practical. Every shower washes in sand and stops the flow of water. We have therefore installed tile drains. These are mostly satisfactory but in periods of heavy rain during the growing season there is too much surface water. This checks the growth of the plants and we must find some way of caring for it.

FERTILIZING.

For each of the past two years our cranberry fertilizer has been applied to the blueberries at the rate of 500 lbs. per acre and the results have been excellent.

For eight years the N. J. Agricultural Experiment Station has carried on, at Whitesbog, experiments in fertilizing cranberries. The results show that applications of fertilizer are desirable on certain kinds of cranberry land, while on other kinds of cranberry land even small amounts ^{of fertilizer} produce too much vine growth and decrease ~~the~~ the yield of fruit.

I suspect that, with blueberries as with cranberries, on deep peat soils fertilization could easily do damage.

PRUNING.

Our knowledge of pruning blueberries is rudimentary; but we are very sure it is desirable. We remove some of the older branches thus giving more light, air and root service to the new shoots which start every year from the base of vigorous blueberry plants. ^P Last summer I tried a short cut in pruning some low bush hybrids which promises well for this class of plants. As soon as the berries were picked we

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mowed off the plants with an old horse mower, plowed and cultivated close to them and gave them a liberal application of fertilizer. This was done about the third week of July and now the plants have a nice lot of new sprouts with fruit buds for a fair crop next summer.

INSECTS AND DISEASES.

The great quantities of wild blueberries which are produced in many parts of the country are proof of the comparative freedom of these plants from the ravages of insects or disease. This does not mean that blueberries have not a multitude of enemies, but that in their natural environment the balance of power favors the blueberries. As we bring them under cultivation we make conditions more or less artificial. It is not natural to have great fields of blueberries only. Then they will undoubtedly be planted on soils and in situations that are not so perfectly suited to their needs as those which the wild plants occupy as the result of their successful struggle with other vegetation. This changing of the balance of nature will in time probably result in giving advantage to some one of the insects or diseases to which blueberries are subject.

In the plantation at Whitesbog, where we are working with native plants under almost natural conditions, we have had very little trouble with either insects or disease.

The only thing against which we are taking specific preventative measures is a borer, the life history of which is much the same as that of the raspberry borer. The adult beetle, during July, girdles a new shoot from one to four inches below the tip. She scarifies the bark in two irregular bands, approximately one quarter inch apart, and between them deposits an egg, the shape and color of a miniature banana an eighth of an inch long. This soon hatches a minute larva which proceeds to bore its way down the stem. The first summer it only goes two or three inches, but the following summer it grows and travels much faster, making holes at intervals through which the frass is discarded. The stem dies, frequently with fruit ready to ripen. The borer grows to be an inch or more long and continues down into the base of the plant below the ground level, neatly cutting off the stem which it has killed two or three inches above the surface.

We guard against this damage by breaking off the wilting tips several inches below the girdle. We have been doing this for several years and it is interesting to note that now the larger percentage of wilted tips is found on the margins of the fields. This is probably because the margins are subject to infestation from the uncared for wild plants in the neighborhood, while our work has protected most of the field.

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The infant blueberry industry has two great safeguards against the development of any insect or disease to the point of being a pest.

One is the interest with which the potential pests are being studied by the men who have helped solve so many disease and insect problems for cranberry growers. Of these Dr. C.L. Shear of the U. S. Dept. of Agriculture is most notable among the pathologists, and chief among the entymologists is Mr. H. B. Scammell, who made a study of cranberry insects for the U. S. Dept. of Agriculture. While stationed at Whitesbog Mr. Scammell caught the blueberry fever. He is now in commercial cranberry work and is preparing to become one of the pioneer blueberry growers.

The second safeguard is the fact that individual blueberry plants vary in their power to resist the attacks of some, if not all kinds, of both insects and disease, and this is taken into consideration in the selection of varieties. Among the insects which attack the blueberry is one which deposits its eggs in the stems; galls thereupon grow in which the larvae develop. Year after year I have noted individual wild blueberry plants covered with these galls, while the other plants in the same thicket remained clean or with but very few galls.

Among the blueberry diseases which are under observation is one which transforms nearly mature fruit into shrivled mummies instead of the luscious berries they would normally become. Certain plants whose other good points led us to consider them as a start for future varieties were found especially susceptible to this mummy berry disease and were discarded.

HARVESTING AND MARKETING.

In addition to cultural problems we have had to consider those of picking, packing and marketing blueberries. The picking is mostly done by the wives and children of our Italian laborers, who are paid 6¢ a quart. The berries are picked directly into ordinary quart berry boxes, which they are then roughly graded according to the size and color of the berries on top. Each box is covered with paper. For the poorer berries this is plain, but the covers for the better grade carry our name and brand. The boxes are packed in the ordinary 32 qt. crates.

We have not as yet picked at one time a whole crate of any one of the varieties of blueberries selected for commercial fruit production. The majority of the berries marketed have been from the seedling plants under trial. These, being from selected parents, are much above wild berries in average size

and quality. The fruit from each bush, however, is different from that of every other bush, and much of it is very ordinary. P In considering the marketing problems we have tried to look forward to the day when we could furnish thousands of crates of blueberries, thoroughly dependable in their superior size and quality.

Last summer about half of the crop of 500 crates went to hotels, restaurants, steamboat lines etc. which ordered regular shipments, once or twice a week, at a flat price per crate for the season. These regular customers received the best of the berries, and the others were sent to a commission house in New York. For the latter we averaged nearly or quite as good a price as from the regular customers. The average price received last summer was approximately \$12.00 per bushel F. O. B.

who

It is encouraging that the regular customers have been buying cultivated blueberries for several years are constantly increasing their orders. They tell us that even at last year's high prices blueberries were the most economical fruit they served. There is no waste - no hulls, no seeds of appreciable size, and blueberries keep well. One customer who two years ago took two crates twice a week last summer took eight crates once a week. He says that our blueberries keep so well that the saving in transportation charges of one shipment over two is well worth while.

FUTURE PROSPECTS.

We believe that commercial blueberry culture has a great future - that in a few years it will be yielding large revenues from thousands of acres that are now waste land.

The most serious check on the rapidity of this development will probably be the difficulty of securing plants of the better varieties. You know ten years ago "they" said blueberries could not be started from cuttings. Mr. Coville's careful work has proven that "they" were wrong. We have proven that blueberry cuttings can be started with less elaborate equipment than that employed by Mr. Coville, but it is not yet plain sailing by any means, and our losses are heavy. Last year they were 75% of all the cuttings put in.

With this handicap it is a slow process to work up a considerable stock of plants from a single fine wild bush or a single selected pedigreed seedling. This is true even though we bud extensively to provide a large amount of cutting material. By the way - these budded plants are not practical for commercial fruit production. Even when set with the union well under the surface of the ground they continually send up sprouts from below it. This necessitates removal of the

sprouts two or three times during the season, which, for a considerable area, is impractical.

This year we are making nearly our whole stock of better plants into cuttings. There will be approximately 100,000 of them, and we believe we can avoid many of last year's pit falls. We are confident that there are no insuperable difficulties in the way of producing large quantities of the best plants; but while these difficulties are being overcome there will, for a few years certainly, be a shortage of plants.

HOME GARDENS.

These better blueberries are very desirable in the home garden both for their berries and their beauty.

It is a comparatively simple matter to provide comfortable quarters for blueberries in most home gardens. The requisites you remember are an acid peaty soil, good drainage and a constant supply of moisture. Peat may be defined as vegetable matter decomposing under conditions which arrest the decomposition at a comparatively incomplete stage. For providing peaty conditions in the home garden partially rotted sawdust may be used, or partially rotted oak leaves or pine needles or other leaves which rot slowly. Leaves, such as maple, which rot quickly will not answer the purpose.

In lighter well drained soils the addition of six or eight inches of this partially decomposed vegetable matter dug into the soil would be sufficient preparation. The peaty material provides both plant food and the required acidity. In heavy soils it is safer to dig a trench three or four feet wide and about a foot deep and fill with a mixture of 2/3 sand to 1/3 of the peaty material. The after care consists of the maintenance of a mulch of leaves about the plants and adequate watering.

BEAUTY.

Blueberries have no thorns and for all the year round beauty few plants can compare with them.

In the spring the young shoots and leaves of many blueberry plants are a rich bronzy red. At this season the trial fields and the hedges of wild bushes along our dams show the greatest variety of rich and delicate tintings. One plant has dark bronzy leaves and white flowers, the next displays its clusters of pink buds against the daintiest green. Other plants show a harmony of pink buds with ruddy leaves or a contrast of green and white. A cold spring brings the greatest variation of color. Then, in early May perhaps, comes a day as warm as mid-summer, and as with a touch of magic all the blueberry plants assume their work-a-day dress of green. For a few days longer the air is filled with an elusive spicy fragrance and the fine

high orchestra of the bees; then the plants settle down to the serious business of perfecting the fruit.

The blueberry fields are never more lovely than just before the berries are ready to pick. The blue of the ripe berries and the pink of those that are ripening contrast charmingly with the rich green foliage. Before the berries are all picked the year's sprouts begin to show above the tops of the plants. These start at or near the ground, and on well established vigorous plants grow from three to four feet in a season. Through August and early September these nodding plumes are the most conspicuous feature of the blueberry fields.

With the first frost the reds flame up again. Most of the plants are brilliant in autumn coloring, some astonishingly so. As the same plants hold the same place each year in the autumnal color scale there is great possibility of choice for ornamental purposes.

In winter the color charm of the blueberry fields does not fail. The young wood of most of the plants has red bark, varying in intensity of color with the individual plant. All our fields of blueberries are irregularly set with rather scrubby Jersey Pine ^{trees.} Though not fine specimens, they are richly, softly green and as they rise in groups, measuring degrees of blue distance in this flat country as do hills elsewhere, they are charming. The blueberry ~~twigs~~ ^{twigs, above the snow, make a red} stretch of tawny Indian grass and a few small oaks still holding their brown leaves add more warm tones and ~~with~~ a perfect dome of azure sky complete a rarely colored winter landscape.

to a rosy haze

Tracery, which in the distance softens

CONCLUSION.

Blueberries are found from the Gulf coast to Labrador and Alaska; in swamps and high on mountain sides. The better varieties we are developing in New Jersey may not be well suited to all localities. The methods employed at Whitesbog, however, I am sure are well suited to developing better blueberries for every locality where they are already found. These methods include selection of the best local bushes, and testing them under cultivation with Mr. Coville's underlying principles well in mind. Then if they prove worthy he will be glad to cross the best of them with the best plants from other localities.

I trust that what I have said may attract some pioneers to this new branch of horticulture and that you will remember we are in the market for wild blueberry plants with berries as large as a cent.