The Production of Blueberries on a Commercial Scale

and

The Rise of the Evergreen Coast Blueberry as a Cut Greenery

by

Wallace Wheeler
Preface

This thesis was prepared in an effort to sum up the factors that lead toward a new industry in the coast counties of the northwest - namely, the production of blueberries on a commercial scale and the rise of the Evergreen Coast Blueberry (Vaccinium ovatum) as a cut greenery.
Introduction

Although the blueberry has been long recognized as a delicious fruit when eaten fresh or canned, only in recent years, comparatively speaking, have any great strides been made toward producing this fruit on a commercial scale. The slow progress is due to the abundance of the fruit in its original state; lack of knowledge of soil requirements of the plants; and the great difficulty experienced in propagation. The demand for the Evergreen Coast Blueberry (Vaccinium ovatum) as a cut greenery is supplied at the present time almost entirely from the bushes found in the wild state.

Review of Literature

The present status of the blueberry industry is largely due to the efforts of Dr. F. V. Coville of the United States Department of Agriculture who began his studies in 1907. Dr. Coville worked in conjunction with Miss Elizabeth White, who donated the land and collected the blueberry plants (in the wild state) that were used in the improvement work.

Stanley Johnston, of Michigan State College Agricultural Experiment Station, has had good results in rooting soft-wood cuttings in solar and box frames and poor results when the cold frame was used.

Charles S. Beckwith and Stanley Coville, of the New Jersey Agricultural Experiment Station, have propagated hardwood
cuttings successfully using the cold frame covered with glass.

Dr. G. M. Darrow, of the United States Department of Agriculture for the past years, carried on research work at Oregon State College. He interested the people of the west in the blueberry industry.

Henry C. Williamson, Jr., in his work concluded March 31, 1932 at Oregon State College, found that one year old hardwood cuttings, cut in November, and propagated under cold frame conditions, gave the best results.

D. J. Crowley, of the Washington State College Experiment Station, has found that the two eastern species, Vaccinium corymbosum and Vaccinium virgatum, are adaptable to conditions in western Washington as are most of the varieties produced by Dr. Coville at Whitesbog, New Jersey, which are either selections from the wild plants (mainly Vaccinium corymbosum) or hybrids made from these selected plants. Mr. Crowley has propagated hardwood cuttings in the cold frame and softwood cuttings with as high as 80 per cent rooting when the cuttings were made and planted, in a cold frame using sand as a medium for rooting, between June 15th and July 10th.

Botany

The blueberry is included in the genus Vaccinium of the family Vacciniaceae, or the Huckleberry Family. The fruits of the genus Vaccinium have numerous small, inconspicuous seeds, and are the Blueberries while the true huckleberry (Gaylussacia spp.) has ten large hard seeds or nutlets in the fruit. There are no true
Fig. 1 - Drooping Flower Cluster of the Blueberry.

Fig. 2 - Emasculated Flower Bud

--- Smooth Style

--- Stigma

Fig. 3 - Pollen Grains x 200 diameters.
huckleberries in Oregon.

The fruits of the commercial blueberry plants are borne in clusters on the wood of the second season's growth. The fruit is generally globular but varies greatly with the different varieties, as does the flavor, acidity, and juice content. Examination of several samples showed that the fresh fruit was 80 percent water, 7.5 by weight sugar, and .38 acid.

The bushes may be deciduous as the Eastern Blueberry (Vaccinium corymbosum) or evergreen as our Coast Evergreen Blueberry (Vaccinium ovatum Pursh).

Plants thrive best in areas of good drainage, but occasional high water seems to do no damage to the plants and probably is beneficial.

From the standpoint of plant improvement it is noted that the presence of a mycorrhizal root fungus is commonly considered necessary for maximum development and thrift of the blueberry plant. The fungus may easily be introduced by making root cuttings of old plants that carry this fungus.

Beckwith and Coville have determined that blueberries require cross pollination to set a full crop of berries. Therefore, a planted field should contain at least two inter-planted varieties to ensure a full crop. Along with this phase of the work might be mentioned the fact that the flower parts are so constructed that self-pollination is almost impossible. From figure 1, page 91, you will note that the flowers droop downward causing the pollen from the anthers to slide over the smooth style of the pistil without coming in contact with the receptive
surface of the stigma. Due to this condition it is essential that insects (mainly bumble-bees) do the cross pollinating if a full crop of berries are to set.

Native Blueberries of Oregon

Vaccinium ovatum Pursh - Coast Evergreen Blueberry.
Evergreen species; berries one-fourth to one-third inch in diameter; black; with or without bloom. Common in open woods, berries much gathered by Indians. Found along the coast. It is the species used for cut greenery.

Vaccinium occidentale Gray. Berry black with a bloom; in wet places, Vancouver Island, B.C.; through the Cascade Mountains mostly on the eastern side southward to California.

Vaccinium macrophyllum Piper - Huckleberry - tall shrub. Fruit without a bloom, dark wine-colored or nearly black. In forests in the mountains at 1,000 to 1,200' altitude. Excellent fruit which is gathered in large quantities.

Vaccinium ovalifolium Smith. Tall shrub; berries globose, black with a bloom, acidulous. Common in deep woods at low altitudes in the mountains, rarely at sea level.

Vaccinium deliciosum Piper. Low shrub; berries globose, black with a bloom, sweet. Abundant in alpine meadows at about the limit of trees in the Cascade Mountains.

Vaccinium scoparium Leiberg. Low shrub; berries light red; in mountains 1,500 to 2,000 m altitude.

Vaccinium caespitosum Michx - Western Blueberry. Low shrub - two feet; berries black with bloom which makes them
appear to be bright blue; one-third to one-half inch in diameter. In swamps along the coast. The berries of these species are gathered in the fall and sold to the fresh market or to canneries.

Blueberries in Cultivation

Two species, Vaccinium corymbosum and Vaccinium virgatum, which is a native of the southeast and cultivated chiefly in Florida, are in commercial cultivation. Vaccinium corymbosum (Eastern Blueberry) is the blueberry which Dr. Coville brought into cultivation beginning his work in 1907 in conjunction with Miss Elizabeth C. White at Whitesbog, New Jersey. A great number of blueberry plants were selected by Miss White and through the work of Dr. Coville, using the collection as a foundation stock, most of the following selected or hybrid plants were placed on the commercial market: Adams, Cabot, Dunfee, Greenfield, Groves, Harding, Jersey, June, Katherine, Pioneer, Rancocas, Rubel, Sam, Stanley, and Scammel.

J. D. Crowley, of the Washington State College Experiment Station, reports that from his experiments with the above varieties Cabot, Harding, Katherine, Pioneer, Sam, Rancocas, Rubel and Scammel are best adapted to the growing season of western Washington in such areas as Pacific and Grays Harbor counties, or elsewhere where the summers are comparatively cool.

In selecting varieties for commercial planting one must consider the length and time of fruiting (which should be before the wild berries come to the market); size; quantity; flavor and
Plate I: Cabot in Bearing

(Photo New Jersey Agr. Exper. Sta.)
Cir. 229

Plate II: Sam in Bearing

(Photo New Jersey Agr. Exper. Sta.)
Cir. 229
Plate III Fruit of the Katherine Blueberry, A Selected Hybrid.

(From U. S. Dept. Agr., Bul. 974)

Plate IV. Fruit of Wild Blueberry of N. J.

(From U. S. Dept. Agr., Bul. 974)
shipping quality of the berries; the adaptability of the plants to the area in which they are to be planted; markets to be supplied whether fresh or cannery; and the general growth habits of the plants.

It is needless to go into a description of the commercial varieties here; anyone desiring this information will be sent a descriptive circular by writing to Whitesbog Blueberry Nurseries at Whitesbog, New Jersey.

**Hybridization and Selection**

**Hybridization.** Although simple in fundamentals it is surprising the lack of knowledge that the average person has of this simple process. It might be well to note here that none of our western species of Blueberries have been crossed with the eastern species. This is a field of investigation for someone.

**Techniques of Crossing.** Crossing, whereby hybrids are secured, varies with the types of plants, yet the same general procedure is followed in all. In crossing, the male organs (anthers) must be removed before the anthers open to shed their pollen. Generally the sepals and petals are removed leaving only the pistil which is to be pollinated with the pollen taken from the variety which you desire to cross. To protect the emasculated bud clusters from being pollinated by another species than the one which you are crossing, a paper bag is tied over the plant part (emasculated bud cluster) which is to be pollinated.

Two common ways of collecting pollen are by fastening a paper bag over the immature flowers of the desired variety which
you wish to cross; the pollen matures and is released from the anthers into the bag. The second way is to cut the flower and scrape the mature pollen grains into a dish.

This collected pollen is then applied to the receptive stigma of the pistil with a small brush, the finger, or a lead pencil with a long flat point. Where much of this work is done the brush, pencil, et cetera, should be sterilized in alcohol.

The paper bags are replaced covering the emasculated bud clusters which have been artificially cross-pollinated from another variety. After one or two weeks, when the danger of foreign pollination of the pistils has passed, the paper bag is removed and a cloth sack is replaced to catch the fruit which develops from the crossing. The sack allows the flower cluster unrestricted access to air, sun light, et cetera.

The seeds that develop from the cross pollination are generally stratified over winter and planted in early spring. From the thousands of hybrid plants probably one or two will have the desired characteristics which the producer is striving for.

In Dr. Coville's work he cultivated the Eastern Blueberry (Vaccinium corymbosum) from the many thousands of hybrids raised from seed three known as Cabat, Katherine, and Pioneer were up to the standards which he required. He made 50,000 crosses.

Selection. In this method the most suitable wild plants are selected, propagated and reselected until plants most desirable for commercial use are segregated. Some of the plants characteristics which a producer will strive for are: plant form; size; color; taste; eating, canning, keeping quality of berries; fruit
bearing time; adaptability to certain soils; ease of propagation; and resistance to disease and frost. Six plants selected by Dr. Coville and Miss White are: Adams, Harding, Sam, Dunfer, Rubel, and Grover.

**Necessity of Growing Plants in Proper Soil and Moisture Conditions**

It is useless to try to grow blueberry plants in a soil that when analyzed does not fulfill the requirements of a good blueberry soil type. The type which most investigators have agreed upon to be the best is a topsoil of peat mixed with rather coarse sand and a subsoil of clay or hardpan within three or four inches of the surface.

In most soils, soil acidity is the chief limiting factor. For most successful commercial planting the soil type indicated above gave readings of pH 5.0 - 5.6 for the first foot and from pH 5.0 - 5.2 for the second and third foot, using Southern Blueberry plants while Dr. Coville states that for Northern Blueberries a soil having a reaction of pH 5.0 is best adapted to culture of these plants. Soils nearly neutral or alkaline in reaction are unsuitable for blueberry growing.

The best soil type is very similar to that found in the cranberry bogs. The soil for best blueberry culture must have good drainage and probably some irrigating during the driest part of the season. Charles S. Beckwith and Stanley Coville state that for best results the water should be held eighteen to twenty-four inches below the surface.
Oregon Soils

The soil types in the coast counties of Oregon, although no experimental work has been carried on, appear to be very favorable for blueberry culture. Many of our coast areas are now the home of many acres of wild blueberry plants.

For an example, I have chosen Coos County and especially the area surrounding the town of Coquille, Oregon. From the soil map you will note that the pH of the soil types in that area range from pH 4.8 (peat) to three soil types of pH 5.5. Mr. W. L. Powers, of the Oregon State College Soils Department, reports that most of the soil types of the Coquille area could be easily drained.

Improvement in Plant Growth and Fruit Yield by Use of Fertilizers

Fertilizer studies have brought out the fact that the proper use of fertilizer will greatly increase the yield of blueberries and start new growth much earlier. Results indicate that the nitrogen must be in available form for the plant to use and the fertilizers must have an acid reaction. A mixture composed of 300 pounds of nitrate of soda, 300 pounds of dried blood, 1,200 pounds of rock phosphate, and 200 pounds of sulfate of potash applied as large as 600 pounds to the acre gave good results. A mixture of 170 pounds of nitrate of soda, 230 pounds of dried blood, 340 pounds of steamed bones, 340 pounds of phosphate rock, and 170 pounds of 28 per cent potash to the acre nearly tripled the yield. The starting of new growth was marked;
on fertilized plots August 10th growth started and by August 18th was eight inches long, while none of the unfertilized plots on August 21st had started new growth. The new growth is an important factor because it is needed to produce the crop of the following year.

J. D. Crowley, of the Washington State College Experiment Station, reports that an application to peat soils of 100 pounds of nitrate of soda, 200 pounds rock phosphate, and 50 pounds of sulfate of potash doubled the yield on plots receiving this treatment the first season and two and one-half the yield the next season. He states that increase was due to larger size of berries and to the large amount of new growth on fertilized bushes. The fertilizers were applied in February, and the ensuing rain and cultivation worked the materials into the soil.

Consumption of Blueberries and Use of the Evergreen Species (mainly Vaccinium ovatum Pursh) as a Cut Greenery

In the east it is estimated that from 50 to 75 car loads are picked annually from the wild areas. Cultivated areas are mainly in New Jersey.

In the west the figures are merely estimates. "The Better Fruits of April, 1932" says of the blueberry: "A fruit with a tang and flavor that people remember. It is its best in pies. Over 600 tons of wild berries were canned in Washington last year."
F. W. Cleator, Recreation Examiner, U.S.F.S., R. 6
under the heading National Forest By-products says: "A half-
million dollars worth of huckleberries per year is probably a
very conservative estimate for the average pick of the North
Pacific region. It is my personal guess, in face of very poor
statistics, that it is nearer a million."

There are no records as to the amount of cut material
(mainly Vaccinium ovatum Pursh), Evergreen Coast Blueberry, used
for decorative purposes. A. J. Clarke of the Clarke Bros. Florists
in Portland, Oregon, says: "It grows in many parts of the Pacific
coast states and the cut branches are brought into all the larger
cities for decorative purposes." J. D. Crowley says: "The ever-
green blueberry is used for decorative purposes probably more
than any other native plant in this section (referring to western
Washington). As I understand it considerable quantities of the
evergreen are shipped to the east side of this state and to
points farther east for greenery. The plant is also used to a
limited extent in landscaping."
Summary

The blueberry as grown today shows marked improvements when compared to the ones growing in their original wild habitat. The Blueberry Industry is fairly well established in the eastern United States and in a few years as much can probably be said of the west. Much of our western land, especially on the Pacific Coast, is suitable for blueberry farms. This delicious berry finds a ready market as well as the Evergreen Blueberry (Vaccinium ovatum Pursh.) branches which are one of the principle sources of cut greenery used in inside decoration. The Evergreen Blueberry (Vaccinium ovatum Pursh.) has great possibilities in landscape compositions.

Bibliography

American Fruit Grower Sept. 1928

Directions of Blueberry Culture, by F. V. Coville

U. S. D. A. Bulg. 974

Blueberry Culture in Florida- Florida Agr. Exper. Sta. Bul 194

Blueberry Culture- C. S. Baeth with and S. Coville


Horticultural Status of the Genus Vaccinium

Maine Agr. Exper. Sta. Bul. 76

Experiments in Blueberry Culture- F. V. Coville

U. S. D. A. Bulg. 193
Bibliography (continued)

Propagation Studies With the Southern Blueberry

By L. M. Ware - Miss. Agr. Exp. Sta. Bul. 280

D. J. Crowley- Blueberry Growing a New Industry
in Washington. Popular Bul. 144; '28; W. S. C.

D. J. Crowley- Observations and Experiments with
Blueberries in Western Washington. W. S. C.

H. C. Williamson, Jr. - The Propagation of Blueberries
by Hardwood Cuttings -- Oregon State College

March 31, 1932.