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# *Essentials of* **BLUEBERRY CULTURE**

By Stanley Johnston



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**Agricultural Experiment Station**  
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**EAST LANSING**

## CONTENTS

	Page
Distribution of the Blueberry .....	3
Choosing the Location for Blueberry Growing .....	4
Selecting the Plantation Site .....	5
Soil Requirements .....	5
Avoid Frost Injury .....	8
Varieties .....	9
Propagation .....	10
Building the Propagating Frame .....	10
Use of Plastic Covers on Propagating Frames .....	11
Location of Propagating Frames .....	12
Making and Storing the Cuttings .....	12
Material in Which to Root Cuttings and Plantings .....	13
Watering, Sanitation, and Ventilation .....	15
Use of Fertilizer in Propagating Frames, Storing Cuttings over Winter, Planting and Caring for the Nursery .....	16
Field Planting .....	17
Replanting in Old Fields .....	17
Provisions for Pollination, Cultivation for Cover Crops .....	18
Irrigation, Sod Culture, and Mulching .....	19
Adding Organic Matter to the Soil .....	20
Use of Fertilizers .....	20
Pruning .....	21
Growing Blueberries in the Home Garden .....	22
Insects .....	25
Diseases .....	26
Production .....	27
Harvesting .....	28
Grading, Packing and Marketing .....	29
Conclusion .....	30

# Essentials of Blueberry Culture

By STANLEY JOHNSTON

THE BLUEBERRY IS EVEN MORE AMERICAN than turkey for Thanksgiving, for it was in this country in great abundance and was highly prized by the Indians before the white settlers arrived.

Because of the abundant supply of wild blueberries, little was done to cultivate or improve this fruit for nearly 300 years after the Pilgrims landed. In 1906 investigations were started by the United States Department of Agriculture, under the direction of the late Dr. F. V. Coville, whose work in determining the soil requirements of the blueberry and in breeding and selecting varieties of unusually large size was of first importance in developing the cultivated blueberry industry.

Much credit for improving the highbush blueberry must also be given to Miss Elizabeth White of Whitesbog, New Jersey, who made selections of outstanding wild bushes and who, in cooperation with Dr. Coville, established the first commercial plantings of hybrid blueberries. A few of Miss White's selections served as parent stock in blueberry breeding work, and one, Rubel, has been an outstanding commercial variety.

## DISTRIBUTION OF THE BLUEBERRY

Many species of the blueberry are native to different parts of the United States. These can be divided into two general groups or types, highbush and lowbush.

The lowbush species are generally found in the more northern states or highlands farther south. Large quantities of wild lowbush blueberries are harvested for market in many places. However, the supply is decreasing each year.

Most of the experimental and improvement work with the blueberry has been done with the highbush type, especially the northern species, *Vaccinium australe*. This species is found growing native in Michigan about as far north as the lower end of Saginaw Bay, although apparently it can be grown in suitable soil as far north as Ludington or Traverse City on the western side of the state adjacent to



Lake Michigan. It is also established in central and southern New York; in the New England states, particularly in southern New Hampshire, Vermont and Maine; in the vicinity of Puget Sound in Washington; extensively in New Jersey, and as far south as North Carolina.

The cultivated blueberry industry has been founded on the northern highbush blueberry and the largest producing states are New Jersey, Michigan and North Carolina, with smaller acreages in the New England states, New York, Pennsylvania, Maryland, Delaware, Ohio, Indiana, Oregon and Washington.

The total acreage of cultivated blueberries in the United States is probably between 18,000 and 20,000. Michigan's acreage is estimated between 5,000 and 6,000. Production in Michigan in 1958 was over 16 million pints having a gross value of about \$4 million. Only about 60 percent of Michigan's acreage is in full production. The industry in the state is growing steadily.

There is no cultivated industry with the lowbush species of the blueberry, although areas of wild plants, such as in parts of Maine, have been improved in production to some degree by systematic burning to remove competing vegetation and by dusting with insecticides for insect control.

While the blueberry is found in many different parts of the country, it is very exacting in its soil and climatic requirements, and the prospective grower should be certain that these conditions are suitable before engaging in blueberry culture.

## CHOOSING THE LOCATION FOR BLUEBERRY GROWING

In selecting a location, careful consideration should be given to:

1. **Climate**—The northern highbush blueberry forms the basis for the cultivated blueberry industry. This species does not succeed in northern regions, such as northern Michigan because of too short a growing season and too low winter temperatures. Neither does it do well in the far South.

The Michigan Agricultural Experiment Station has been hybridizing the cultivated highbush blueberry with the native lowbush blueberry of northern Michigan and apparently has found varieties suitable for growing under cultivation in northern areas. These varieties will probably be introduced within a few years.

2. **Markets**—Nearness to markets, both for fresh use and commercial processing, is a distinct advantage in growing a perishable fruit.

3. **Availability of Pickers**—A mature blueberry plantation requires a large number of pickers. Their availability should always be kept in mind when choosing a location.

## SELECTING THE PLANTATION SITE

A good site for a blueberry plantation should have 1) a suitable soil, and 2) be as free from frost as possible.

### Soil Requirements

**Reaction**—The blueberry plant requires a soil that is very acid, preferably one within the pH range of 4.0 to 5.1 (Fig. 1). The prospective grower should have his soil tested by his county agricultural agent or the Michigan Agricultural Experiment Station.

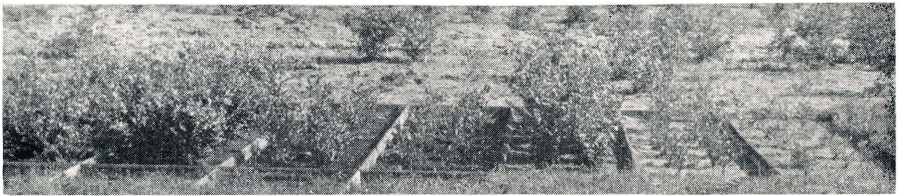


Fig. 1. Blueberry plants set in muck and sand soils of various degrees of acidity after 3 years' growth. From left to right: Extremely acid, very acid, moderately acid, and slightly acid muck soils (pH 3.4, 4.4, 5.5, and 6.8, respectively). The plants in the slightly and moderately acid sand and muck soils are making poor growth, the leaves are abnormally colored, and they drop prematurely. The plants in the extremely acid muck (pH 3.4) are growing fairly well but not as well as those where the pH is 4.4. Soils testing below pH 4.0 should receive sufficient lime to raise the pH to about 4.4 for best results.

Merrill<sup>1</sup> has shown that it is practicable to make soils testing below pH 4.0 suitable for blueberry production by applying limestone at the rate of one to four tons per acre, depending upon the degree of soil acidity to be corrected (Fig. 2). If possible, the limestone should be worked into the soil before planting.

Several materials may be used to increase soil acidity, including sulfur, sulfate of aluminum, crude tannic acid, and acid peat. Of these, sulfur is most commonly used. Acidifying soil for commercial blueberry culture is not recommended, unless the necessary change

<sup>1</sup>Merrill, T. A. 1939. Acid tolerance of the highbush blueberry. Mich. Agr. Expt. Sta. Quart. Bul. 12 (2):112-116.





Fig. 2. Left: A blueberry plant after growing for 6 years where the soil was too acid (pH 3.2). Right: A 2-year-old plant growing in the same area after the soil had been treated with limestone at the rate of 2 tons per acre, raising the pH from 3.2 to 3.8.

in soil reaction is slight. Prospective growers confronted with this problem are advised to write to their experiment station for assistance.

**Moisture Content**—The highbush blueberry grows best where the water table can be maintained from 14 to 22 inches below the surface. It is not always possible to provide this ideal condition, but for practical purposes the water level in the soil at least should not be lower than 10 to 12 inches from the surface during the spring months. Insufficient soil moisture results in lack of fruit bud formation, and, if the deficiency is great, in the injury or death of the plants. Too much water, especially during the growing season, can be as injurious or even more so than an insufficient amount (Fig. 3).

**Organic Matter**—An ideal blueberry soil consists of sand having a high organic matter content (Fig. 4). Plants growing in muck soil, which consists mostly of organic matter, have a tendency to grow too late in the fall because of the gradual release of nitrogen from the decomposing organic matter during the warm summer and early fall months. Late fall growth is immature and susceptible to winter injury. Care should be used not to apply too much nitrogen fertilizer on muck soil and cultivation of such soils should cease by July 1. A cover crop should be sown if there is insufficient weed growth to serve as a cover





Fig. 3. Rubel plants with water table constantly maintained at different depths. Above: Plants soon after setting. Below: The same plants after 4 years' growth. From left to right: Water table maintained at 30, 22, 14, and 6 inches. The 30-inch water table did not furnish sufficient moisture, while the 6-inch water table was too near the surface.



Fig. 4. Blueberry plants in their fourth growing season, growing in (left) a white sandy soil having very little organic matter, and (right) in a soil well supplied with organic matter. The pH of both soils is about the same.



crop. Competition of the cover crop for nutrients and soil moisture will help prevent late fall growth of the blueberry plant.

**Texture**—Blueberry plants are usually found growing in the wild state on soils ranging from sand to peat. For some time it was thought that they would not grow on a clay soil. However, recent experiments have shown that blueberry plants will grow well on such a soil provided it is sufficiently acid and well supplied with organic matter. Apparently, though, most areas of naturally suitable blueberry soils are of a sandy or peaty nature (Fig. 5).



Fig. 5. Blueberry plants (left) growing vigorously in a soil having a high clay content (31.8 percent) and with a pH of 4.87; and failing (right) in a soil having a slightly smaller clay content (28.8 percent) but with a considerably higher pH reading of 6.08. This indicates that the proper degree of soil acidity is more important in the successful growth of the highbush blueberry than the clay content of the soil.

### Avoid Frost Injury

To obtain proper soil moisture requirements, it is usually necessary to establish the plantation on comparatively low land that is more subject to frost than higher land. Wide, open areas permitting as much movement of air as possible should be chosen. Avoid valleys or depressions with hills close by. Nearness to large bodies of water is added insurance against frost.

## Varieties

Several varieties of large-fruited blueberries are available. They ripen in succession from about July 1 in southwestern Michigan to the middle of September, and sometimes later.

*Recommended varieties for Michigan are as follows:*

**Earliblue**—Begins to ripen early in July. A new variety of promise for the very early season. The bush is moderately vigorous and productive. The berry is medium-large, firm, and has excellent flavor. It ships and processes well. The picking scar is rather large.

**Bluecrop**—Begins to ripen a week later than Earliblue. The bush has very small leaves but produces large crops of medium-large berries. If allowed to overbear, the fruit will be rather small. Berries are light blue, firm, and have a perfect picking scar. Ships and processes well.

**Rubel**—Begins to ripen about two weeks after Bluecrop. It is one of the first cultivated varieties introduced. Bush vigorous and productive. Berries excellent in every way, except a little small. Ships and processes unusually well. This variety is still planted to some extent but has largely been replaced by Jersey which ripens at about the same time and produces a larger berry. Rubel requires a good soil for best success.

**Jersey**—Ripens about the same time as Rubel. The leading variety in Michigan at present. Large, productive bush. Berries are excellent in every way.

### *Varieties for trial*

**Blueray**—Begins to ripen about with Bluecrop. Vigorous, productive bush. Berries large but not as attractive as Bluecrop. Clusters are rather tight, making picking more difficult. Picking scar is quite large.

**Berkeley**—Begins to ripen two weeks after Earliblue. Vigorous, productive bush. Berries large, light blue, attractive and of mild flavor. Good points are productiveness, beautiful color and large size. Questionable points are a tendency for the fruit to drop when ripe, and possible susceptibility to frost.

**Coville**—Begins to ripen about a week after Jersey. Vigorous, productive bush. Berries large, firm and have good flavor. An excellent va-



riety, but should be planted in only a limited way in Michigan because of its late season of maturity.

## PROPAGATION

The blueberry is not easy to propagate by ordinary methods and requires special treatment as well as careful attention. Until recent years plants were so high in price that there was considerable incentive for users of even comparatively small numbers of plants to attempt to propagate their own. Unless one intends to grow large acreages, it will no doubt be found cheaper and more convenient, as well as time-saving, to purchase plants from growers or nurserymen.

The following outline of propagation methods is given for those who like to propagate their own plants:

### Building the Propagating Frame

A so-called box propagating frame is used, measuring 6 feet long, 27 inches wide and 12-16 inches high. Dimensions for length and width may be changed to accommodate glass sash of various sizes that may be on hand. The cutting tray is made of 4-inch lumber with  $\frac{1}{8}$ - or  $\frac{1}{4}$ -inch mesh hardware cloth stapled on the underside. This tray rests on braces nailed on the inside of the frame 8 inches from the top. It can be removed without disturbing the cuttings, which facilitates handling. After the cuttings are planted the glass sash and shade are placed on top of the frame. (See Figs. 6 and 7 for construction details.)

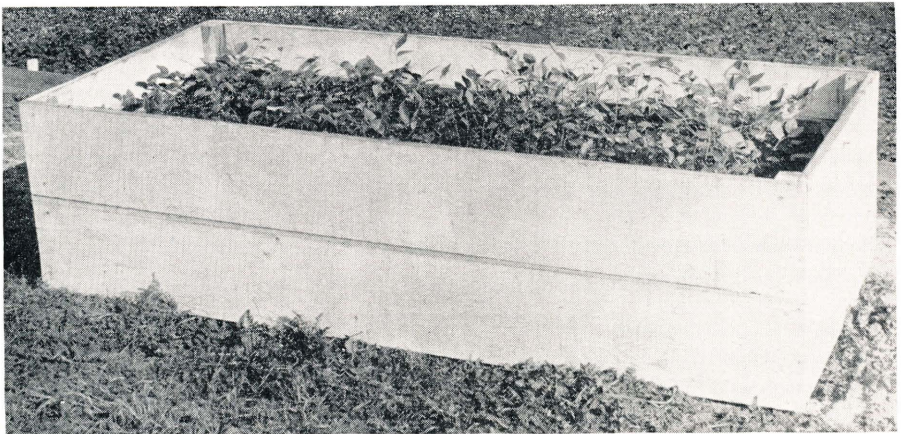


Fig. 6. A low box propagating frame, 16 inches high. See Fig. 7 for more details of construction.

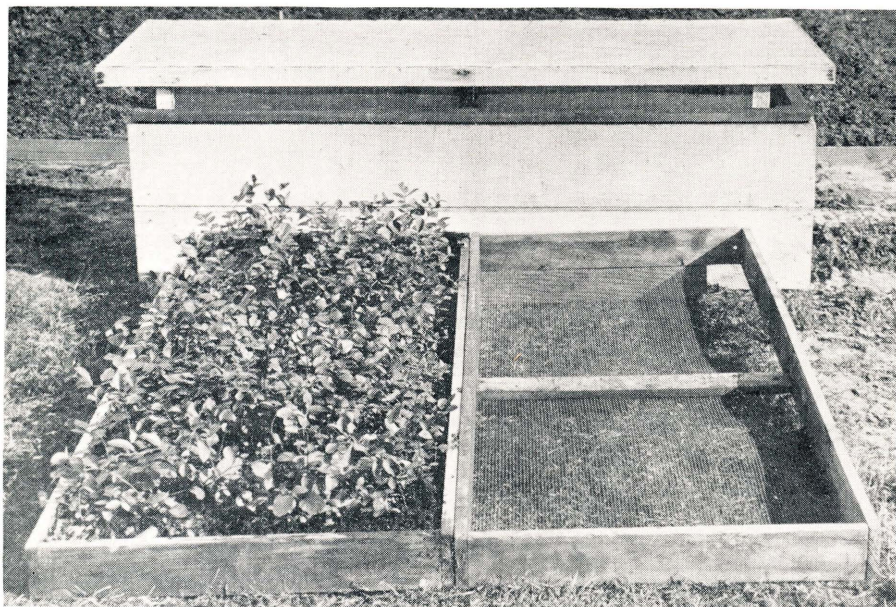


Fig. 7. Low propagating frame with glass sash and burlap shade in place. In front is an empty cutting tray and one filled with rooted cuttings. These trays set in the top of the propagating frame (see Fig. 6), and, being movable, provide a very convenient way of handling cuttings prior to planting in the nursery.

Burlap similar to that used for bran sacks makes the best shading material as it provides just about the right amount of light. Closer or looser woven materials should not be used.

### Use of Plastic Covers on Propagating Frames

Trials have been made with various plastic covers on propagating frames as a substitute for glass.<sup>2</sup> It was found that temperatures in the frames covered with clear plastic were higher during hot days in June than under glass. Temperatures in frames covered with clear plastic, reinforced with a fine wire mesh, were nearly the same as under glass sash. Extremely high temperature in late spring before the cuttings have become well rooted can be fatal.

It is suggested that only the wire mesh plastic be used in a limited experimental way in comparison with glass until more is known about this material. The plastic mesh does have certain advantages over glass in being less expensive, lighter in weight, easier to handle and more resistant to breakage.

<sup>2</sup>Johnston, Stanley. Feb. 1958. Investigations with plastic covers for blueberry propagating frames. Mich. Agr. Expt. Sta. Quart. Bul. 40-58.



### Location of Propagating Frames

It is important that the propagating frames be located in the open sunlight, well removed from buildings and trees.

### Making and Storing the Cuttings

1. Blueberries are commonly propagated by means of cuttings made in late winter or early spring from shoots produced the previous season.

2. Use sound shoots of medium to medium-large size for cuttings. Avoid winter-injured wood or wood with fruit buds (Fig. 8).

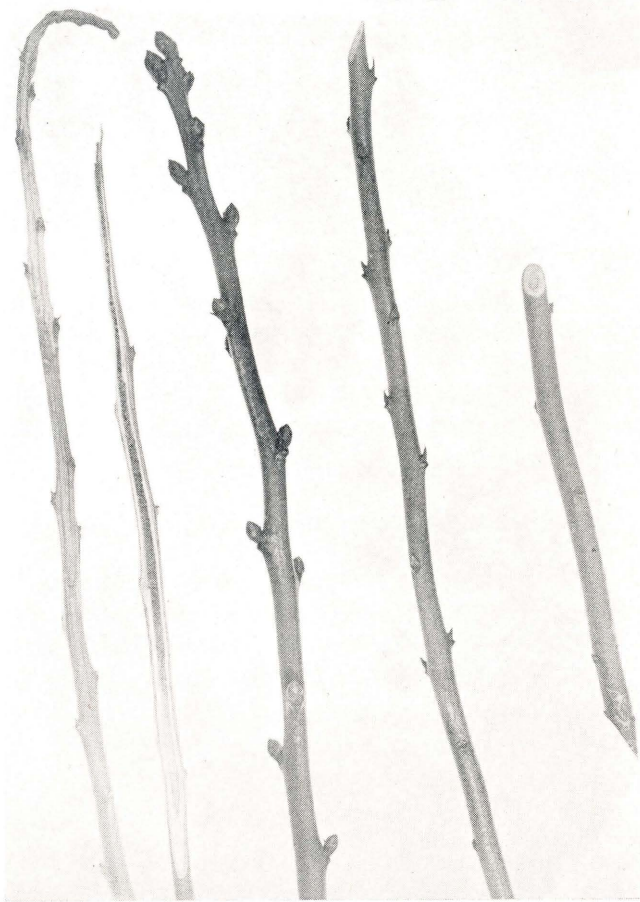


Fig. 8. Shoot at left shows winter injury; beside it is another shoot showing the extent of the injury. Shoot in center is undesirable for cuttings because of the prevalence of fruit buds. Shoot at right illustrates best type of wood for hardwood cuttings. At the extreme right is a hardwood cutting ready for planting.

3. Make the cuttings about 4 inches in length, the lower cut being made at a slant just behind the lowest bud, and the upper cut just above the top bud on the cutting.

4. Cuttings can be made with a sharp knife or pruning shears adjusted for this work. The use of ordinary pruning shears in making blueberry cuttings is likely to result in injury to the cuttings. However, the blade can be removed from a pair of Snap-Cut shears and ground much thinner. The metal bumpers should be replaced with wooden ones. Cuttings can be made with these adjusted shears without injury and with greater comfort and speed. The wooden bumpers will need to be replaced with new ones occasionally.

5. To make planting easier, cuttings should be bunched in groups of 50 with all the butts pointing the same way.

6. If stored before planting, the bundles of cuttings should be placed in shallow flats or propagating trays in clean peat moss which has been soaked in water and then pressed until just damp, but not too wet. Keep in this condition and store in a cool place until ready to plant. Many cuttings have been ruined by storing in too wet peat moss. Usually better results will be obtained if the storage period can be eliminated or reduced to a very short time.

### **Material in Which to Root Cuttings**

Ground sphagnum peat moss has given the best results as a material in which to root cuttings. Tests to date indicate the best sources of peat moss for propagation are northern and western Europe, and British Columbia, Canada. Peat moss from local peat beds should not be used unless it has been carefully tested and found to be satisfactory.

Do not add soil, fertilizers or other materials to the ground sphagnum peat moss (Fig. 9).

### **Planting Cuttings**

1. Cuttings are usually planted about the middle of April in Michigan, or as soon as danger from severe freezing has passed.

2. The peat should be soaked before placing in the propagating frames by being submerged in water. The soaking period will range from 2 or 3 to several hours. Some peats become saturated with water

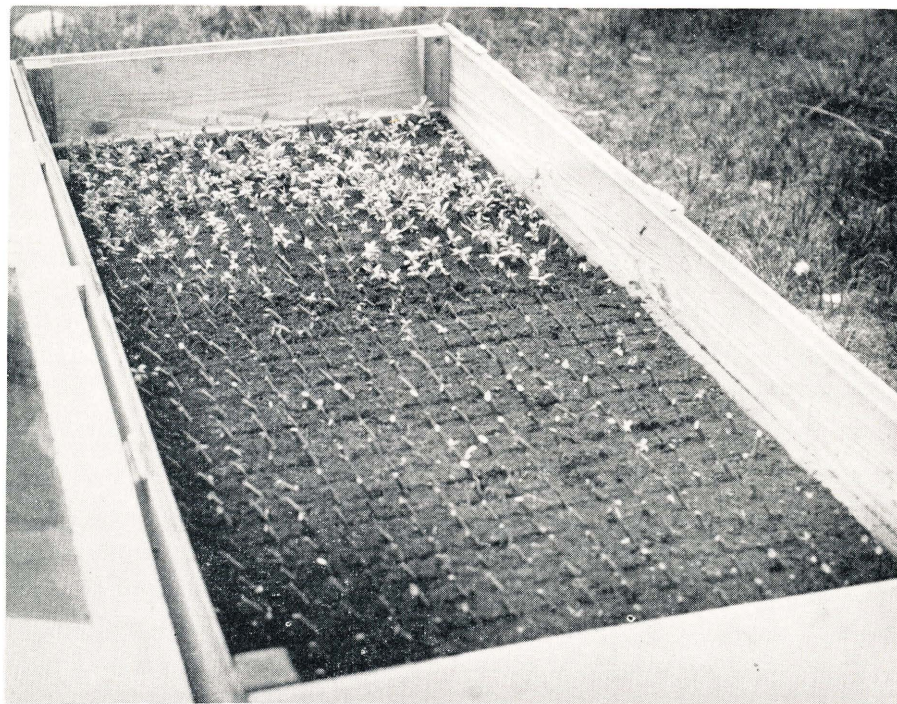


Fig. 9. Cuttings in the foreground of the propagating frame that have failed to start new growth were killed by fertilizer having been mixed with the peat. In the background, where no fertilizer was added, the cuttings are alive and growing.

quickly. Too long a soaking period for such peats gives poorer results. A long soaking period does not seem to injure the peat from northern Europe or British Columbia. After soaking, fill the trays to the top to allow for settling.

3. To plant, push the cutting into the peat at a slant about two-thirds of its length. Plant in rows 2 inches apart and space the cuttings slightly more than an inch apart in the row.

4. Sprinkle thoroughly after the cuttings are in place.

5. The glass sash and burlap shade should be placed over the cuttings and kept there, except for watering periods, until the cuttings are well rooted, which is usually about the middle of July in Michigan. Sufficient ventilation may be obtained by permanently blocking up the sash about  $\frac{3}{16}$  of an inch on one side.



## Watering

The peat should be examined daily to determine if it is sufficiently moist. If water can be squeezed readily from the peat between the thumb and finger, it is moist enough.

If water is needed it should be applied with a sprinkler in the morning before the cuttings become warmed very much by the sun. Only water from which the chill has been removed should be used. Never water the cuttings during the heat of the day or in the evening.

## Sanitation

Loss from fungus infection after planting is sometimes serious if the cuttings are not properly handled.

The cuttings should be examined every morning preferably, or at least every other morning, and all those showing signs of dying should be removed at once. Weak cuttings will not form roots and are a source of infection.

Foreign matter of all kinds and also leaves showing signs of fungus infection should be removed as soon as observed.

If fungus infection becomes established in the cutting bed, increased ventilation will assist in checking it. Care will have to be used not to increase ventilation to the point where severe wilting takes place.

Poor results have been obtained from spraying cuttings in the frames with various fungicides. Severe spray injury has invariably resulted from this practice because of the warm, humid atmosphere inside the frame. Tests are now in progress with chemicals used to drench the soil and cuttings when planted and at intervals thereafter. These tests show some promise. Growers having trouble with fungus infection in propagating frames should write to the South Haven Experiment Station, South Haven, Michigan, for the latest results of these tests.

## Ventilation

When it is certain that virtually all cuttings are rooted, the sash should be gradually blocked up a little higher each day for about a week or 10 days until the cuttings are fully ventilated. Then remove the glass sash but leave the burlap shade over the cuttings until about the middle of September when it can be removed to permit the cuttings to harden properly for winter. Water the cuttings when necessary, which may be frequently after the glass sash has been removed.



## Use of Fertilizer in Propagating Frames

Serious injury has resulted from mixing fertilizer with the peat in propagating frames just before planting (Fig. 9). Likewise, watering cuttings with fertilizer in solution before they are rooted is hazardous. However, the use of fertilizer dissolved in water immediately after the cuttings are rooted will result in larger plants at the end of the season. Directions are as follows:

Make a stock solution of fertilizer in water at the rate of 1 pound of 11-11-11 blueberry fertilizer to 4 gallons of water. The fertilizer dissolves slowly. Therefore, the stock solution should be made a few hours in advance of using. Stir occasionally. Some material in the fertilizer will not dissolve and will clog the sprinkler head when used. Screen this material out before using the solution.

Use 1 quart of stock solution in 1 gallon of water to sprinkle about 25 square feet of propagating bed. This area is equal to about one and one-half standard propagating trays 6 x 3 ft. Rinse the leaves thoroughly with clear water after applying the fertilizer solution. **This is important to prevent possible foliage injury.**

Start applications after cuttings are rooted, usually about the middle of July, and make two applications at 10-day intervals. Do not apply after the third week in August as the plants should not grow too late in the fall.

## Storing Cuttings Over Winter

In October or early November, a trench 4 inches deep and wide enough to accommodate the trays of cuttings should be prepared. After the trays are placed in the trench, all open spaces should be filled in around them with soil. A closely woven wire fence is an added protection to keep dogs, cats and rabbits out of the trays during the winter.

## Planting and Caring for the Nursery

The following spring the rooted cuttings should be removed from the trays and planted in the best available piece of suitable soil in rows 18 inches or more apart, depending on the method of cultivation, and about 6-10 inches apart in the row.

Cultivate and hoe the soil in the nursery thoroughly, until September, and then sow a cover crop if weed growth is not dense.

Better plants will be grown if the nursery is fertilized about a

month after planting, or early in June in Michigan. (See discussion on the use of fertilizers.)

### FIELD PLANTING

1. Plants 2 or 3 years old are considered best for field planting. Large plants do well but require more labor in digging, handling and planting. Small plants can be used but generally do not result in as good a stand, especially if a poor growing season is encountered after planting.

2. A planting distance of 10 x 4 feet has been used in Michigan since the beginning of the cultivated blueberry industry. Some growers think wider distances should be used, such as 11 or 12 feet between rows and 5 feet between plants in the row. Wider distances decrease the number of plants per acre, which usually decreases yields per acre. With proper pruning, 10 x 4 feet should be a satisfactory planting distance.

3. Wet spots in the field should be ridged before planting and the plants set on the ridges. Tile draining may be needed to remove excess water from some exceptionally wet places.

4. Leave as many roots and as much earth on the plants as possible in transplanting from the nursery row to the field.

5. Set plants an inch or two deeper than they grew in the nursery.

6. Do not put fertilizer or other chemicals in the plant holes. If the soil lacks organic matter, mixing a shovel full of peat with the soil in each planting hole will be helpful.

7. Either before or soon after planting, prune off all fruit buds on the plants. This will probably be sufficient pruning at this time unless the tops are very large in proportion to the roots left after digging.

### Replanting in Old Fields

When old plants have been removed and new plants set in the same row, poor growth results unless the land has been rested for two or three years. New plants will grow quite well if they can be set in the old row middles. If this is impossible because of interference with remaining rows of old plants, the new plants should not be set until the resting period has been completed.

If entire fields of old plants are removed, they can be replanted

immediately, if the new rows are planted in the row middles of the previous planting.

### Provisions for Pollination

Experiments in Michigan by Merrill<sup>3</sup> indicated that Rubel and Jersey are self-fertile. Later tests showed that other varieties now recommended for planting are also self-fertile. It is possible, therefore, in Michigan at least, to plant varieties in larger blocks than was considered advisable in the early years of the cultivated blueberry industry. Larger blocks of a single variety simplify cultural operations somewhat, especially harvesting. However, more than one variety — probably three or four — should be planted to extend the harvesting season and to distribute any risks that might be involved in planting only one variety.

### Cultivation and Cover Crops

The blueberry plant is shallow-rooted and accordingly, cultivation should be shallow. It should be frequent enough to keep down heavy weed growth. If the season is dry, cultivation should continue through the harvesting season. Bushes heavily loaded with ripe berries cannot be cultivated without knocking-off a considerable quantity of fruit, unless the cultivation is done immediately following a picking when all ripe fruit has been removed. Green berries are not easily shaken from the bushes.

Hoeing is necessary for best growth, especially while the plants are young. Hand hoeing has been mostly replaced, especially in the larger plantations, by the mechanical hoe. This machine has been very efficient in blueberry plantings.

Young plantings should be sown to a cover crop about the first of August, and bearing plantations immediately after harvest. Often a heavy growth of weeds or crabgrass appears as soon as cultivation ceases. These plants often provide a very good cover crop. If they are not present in abundance, a cover crop should be sown. Few cover crops do well in such highly acid soil. Oats, or a mixture of one-half oats and one-half buckwheat, have been the best cover crops found for use in blueberry plantations where a seeded crop is necessary.

<sup>3</sup>Merrill, T. A. 1936. Pollination of the highbush blueberry. Mich. Agr. Expt. Sta. Tech. Bul. 151.



## **Irrigation**

While the highbush blueberry is grown on rather moist soils, inadequate soil moisture frequently reduces growth and production. Many plantation owners have found irrigation profitable to increase the soil moisture supply at critical times, and for protection against frost at blossoming time. Whether irrigation can be installed to advantage will depend largely on the cost of obtaining an adequate supply of water. The grower should seek expert advice on this question before investing in an irrigation system for his blueberry plantation.

## **Sod Culture**

Growing blueberries in a natural sod cover, or with a permanent cover of fescue, has not given satisfactory results unless supplementary soil moisture can be provided by means of irrigation. Even with irrigation, the permanent cover must be mowed occasionally to reduce competition from grass and weeds with the blueberry plants for nutrients, and to make conditions more favorable for pickers during the harvesting season. The mummy berry disease is much more serious in uncultivated fields and if sod culture is used, extra care will be needed in controlling this disease.

## **Mulching**

Blueberry plants grow well if mulched heavily with straw or sawdust, provided the soil is suitable for blueberry growing. Mulching is recommended for small home plantings. Straw mulches are not advised for commercial plantations because of the great fire hazard. Heavy sawdust mulches have been used in some small commercial plantings in Michigan, but without success. Several inches of mulching material are required. This amount of sawdust is almost impossible to find in southern Michigan for mulching many acres and it is quite expensive to transport and apply. More sawdust needs to be applied every two or three years. Weeds become established in the decaying mulch, requiring their removal. If sawdust is used in home plantings, avoid applying fresh sawdust. Injury has been observed from its use. Also, double the amount of nitrogen fertilizer until the sawdust becomes well decomposed.



## **Adding Organic Matter to the Soil**

The application of 2 or 3 inches of sawdust or acid peat to increase the organic matter of the soil, working it in by cultivation, has given favorable results. This practice is recommended wherever these materials can be obtained at a reasonable price. Brush cutting machines are now coming into rather general use in blueberry plantations to chop prunings into small pieces, which are cultivated into the soil. Formerly, these prunings were pushed from the fields and burned, which was a waste of good organic matter.

## **USE OF FERTILIZERS**

1. Excellent results have been obtained from the use of a complete fertilizer. An 11-11-11 formula is recommended for sand soils, and a 5-10-15 formula for muck soils.

2. The potash in the above mixtures should be derived from sulfate of potash. Instances are known of injury to young blueberry plants from the use of muriate of potash, but no cases of injury on older plants have been reported.

3. It is recommended that 1 ounce of the approved mixed fertilizer be applied on the surface around each plant soon after planting. Never place fertilizer in the plant holes. Increase the amount of fertilizer each year by 1 ounce until a total of 8 ounces per plant is being used. Moderate variations can be made in the amount of fertilizer used depending upon the fertility of the soil. The area fertilized should be widened each year about a foot beyond the spread of the bushes until the fertilizer is being distributed over the entire space between the rows.

4. Fertilizer should be applied in established plantations in early spring before the young leaves have emerged. Injury is likely to result from getting fertilizer on the opening buds or young leaves, especially if they are wet from rain or dew. If applications are required after the buds are open, keep fertilizer off the plants and apply only when they are perfectly dry.

5. Nursery beds may be fertilized about a month after the rooted cuttings have been planted, using the recommended complete fertilizer (11-11-11) at the rate of  $\frac{1}{2}$  pound per 100 square feet and exercising care not to get any of the fertilizer on the plants.

6. Never use fertilizer in propagating frames before cuttings have rooted. Careful use of fertilizer in solution after cuttings have rooted will result in larger plants. (See discussion on the use of fertilizers in propagating frames in the section on propagation.)

## PRUNING

1. Blueberry plants need not be pruned until the end of the third year in the field. Then only the small bushy growth near the base of the plant should be removed.

2. Experiments at the South Haven Experiment Station<sup>4</sup> showed that the heavier the pruning given mature blueberry plants the 1) smaller the crop; 2) larger the berries; and 3) higher the percentage of berries maturing early.

3. Keeping in mind these basic principles, each grower can determine what type of pruning will best meet his needs. If he wants larger, earlier-maturing berries, his pruning should be rather heavy. If he wants larger crops of somewhat smaller and later-maturing berries, his pruning should be light. Modifications of the two extremes can be adopted.

4. A moderate pruning each year is recommended for Michigan blueberry plantations for the following reasons:

- (a) To remove dead and broken branches and the large clusters of very thin, bushy wood that accumulate in mature bushes. These clusters of bushy wood can be removed with only a few pruning cuts. Do not remove small, thin shoots individually because of the high labor cost.
- (b) To remove bearing branches close to the ground. Berries on these branches usually get very dirty and pickers dislike to handle them.
- (c) To reduce the number of old stems (sometimes called canes) to three or four. These old stems can be easily identified as the bark becomes grayish-black with age. Remove those that have the fewest fruit buds. Remove them to the crown rather than heading them back to a side branch. It is very important to prevent bushes from having too many old stems.

<sup>4</sup>Brightwell, W. T., and Stanley Johnston. 1944. Pruning the highbush blueberry. Mich. Agr. Expt. Sta. Tech. Bul. 192.

(d) To serve as insurance against dry years when berries on unpruned bushes are small and poor in quality.

5. Plantations on light soils deficient in organic matter must be pruned more than those on better soils because of the inability of the lighter soils to furnish sufficient moisture to properly mature large crops of fruit.

6. The type of pruning recommended can almost always be given mature bushes with lopping shears much faster and easier than with hand shears, thereby cutting the cost of pruning which is a time-consuming and expensive operation.

7. Pruning may be started as soon as the leaves drop in the fall and be continued as late as through blossoming time or slightly after if necessary.



Fig. 10. Left: A mature Rubus bush before pruning. Right: The same bush after receiving the type of pruning recommended for the average Michigan plantation. Low branches and one old stem have been removed together with a few of the largest clusters of fine, bushy wood. Plants growing on light soils poorly supplied with organic matter will probably have to be given somewhat heavier pruning than shown above.

### Growing Blueberries in the Home Garden

Blueberries can be grown in the home garden quite successfully if the soil is naturally sufficiently acid in reaction. In such gardens, it is probably best to use the mulch system rather than to cultivate.



Straw, aged sawdust and oak leaves make good mulching materials. Water can be applied as needed, and fertilizer used according to directions given below.

Many methods have been tried in attempts to grow blueberries in the home garden where the soil is not sufficiently acid for the blueberry plant. Most of these have not been satisfactory. Of those tried at South Haven, the metal tub method has given the best results.

Old metal drums of about 50-gallon capacity can usually be obtained at low cost. Have a metal worker cut each drum into two tubs and drill about four 2-inch drainage holes in the bottom of each tub. Burn out any residue of oil, paint, tar, or similar materials that might be injurious to plants. Set the tubs in holes in sunny, open areas in the garden (Fig. 11). Leave an inch of the top rim extending

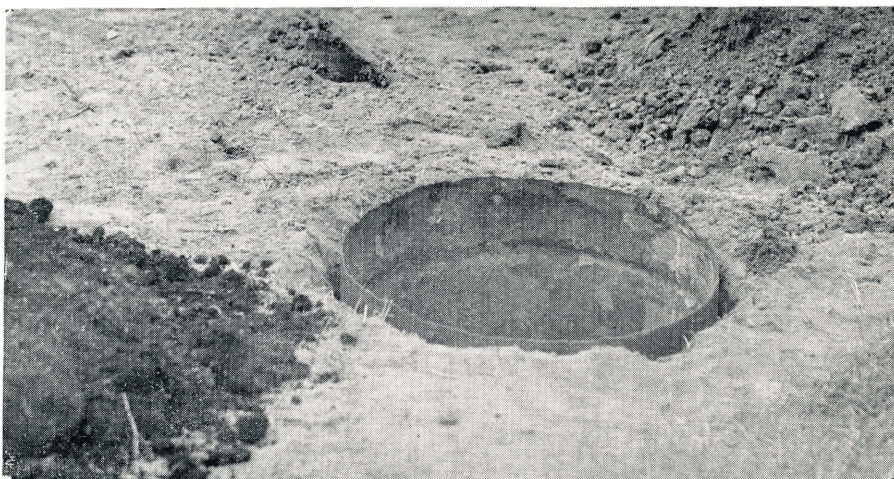


Fig. 11. Half of a 50-gallon metal drum in place, with a pile of acid peat at the left and garden soil at the right. The tub should be filled with a mixture of 2 parts of acid peat to 1 part of garden soil. If soil well supplied with organic matter having a pH test of 4.0 to 5.1 can be found nearby it can be used instead of the peat-and-soil mixture.

above the ground level. Fill the tubs with soil having a high level of organic matter and a pH of 4.0 to 5.1. It may be more convenient to obtain acid peat and mix two parts of this material with 1 part of the garden soil present. Set one plant in each tub. (Fig. 12).

Sprinkle an ounce (2 tablespoons) of a complete garden fertilizer on the soil surface of each tub about two weeks after planting. Do not put fertilizer in the plant holes. Apply fertilizer each spring and





Fig. 12. A blueberry plant in the tub near the end of the first season's growth.

if needed, a second application can be made not later than the middle of June. Increase fertilizer gradually each year but do not exceed a total of  $\frac{1}{4}$ -pound in one season. Apply water when necessary. Keep soil moderately moist, but not saturated. It is beneficial to place a mulch of oak leaves, peat moss or old sawdust around the plants and beyond the edges of the tubs. These materials will also help keep the soil acid. Do not use fresh sawdust.

Plants in tubs receiving good care will attain a height of 4 to 5 feet and will produce a considerable quantity of fruit. Birds are very fond of blueberries and will pick them, even before they are fully ripe, unless the plants are covered with mosquito netting or wire screen as the ripening season approaches.

In addition to the fruit produced, the blueberry plant is a very beautiful ornamental shrub at any time of year. In spring it is covered with small, white, bell-shaped flowers; in summer the glossy green foliage and large, bright blue berries combine to make a pleasing sight; in autumn the foliage turns various shades of red; and in winter the green, olive and red wood of the various varieties is attractive.

### Insects

A number of insects attack the blueberry plant and fruit. The most important of these are:

**Insects Attacking the Plant**—White grubs, larvae of the June beetle, sometimes seriously injure newly set blueberry plants by chewing the roots and tender bark around the crown. Larvae of the strawberry root weevil will cause similar injury.

Several kinds of caterpillars attack the leaves of blueberry plants, especially during July and August, and can quickly devour the leaves on a large plant. They have not been prevalent enough in Michigan to require spraying for their control. Pickers should be asked to report them. The caterpillars can then be brushed from the plants and crushed, or heavily infested twigs can be removed and burned.

Lecanium scale has been serious in a few Michigan plantations. This is a large, brown-shelled scale attached to stems and shoots which can be easily seen during the dormant season.

**Insects Attacking the Fruit**—Three insects attack the green berries in June; cranberry fruitworm, plum curculio and cherry fruitworm. Losses from these insects are often great if not controlled. Fortunately, all three can be controlled with about the same program.

The blueberry fruit fly has been the most troublesome blueberry insect in North America. It has been commonly found in wild blueberries for a long time. A light infestation was found in a few Michigan cultivated blueberry fields for the first time in 1943. The female fly lays eggs in soft, overripe berries. The eggs hatch into small, light-colored maggots which work inside the berries. A thorough dusting program has kept this insect under control in cultivated fields.



**Control Measures for Insects**—Because so many useful new insecticides have been discovered in recent years, recommendations for insect control are changing rapidly. Therefore, it seems inadvisable to give control recommendations in this publication. Write to the Cooperative Agricultural Extension Service in your county or to the Bulletin Office, Michigan State University, East Lansing, Michigan, for Extension Bulletin E-363, Tree and Small Fruit Insects in Michigan.

### Diseases

There are numerous minor diseases of blueberries but only three of major importance in Michigan at present. They are:

**Stunt**—Plants having this disease become dwarfed in size, the foliage is smaller, somewhat mottled and cupped, and the berries are small, later in maturing and worthless. This disease has been prevalent in fields of cultivated blueberries for many years but has become serious only in a few instances. However, like all virus diseases, it is potentially very hazardous and growers should remove all infected plants as quickly as observed. Plantations should be examined once or twice during the growing season to search for diseased plants. These should be removed and burned.

Annual inspection of blueberry fields for stunt and other virus diseases is necessary in Michigan if plants are grown for sale. However, growers are urged to have their fields inspected annually by state inspectors as an insurance against the spread of virus diseases, even though they are not growing plants for sale. Write to the Bureau of Plant Industry, State Department of Agriculture, Lansing, Michigan, for information on this service.

**Shoestring**—A virus disease of the blueberry that has been known for some time but which has recently become more prevalent in Michigan. Most noticeable symptoms are red streaks of varying length in the new shoots in the spring which become less evident as the season progresses. Severely affected leaves are narrow and pointed. Affected twigs often sharply change their normal direction of growth. Diseased plants should be promptly removed and burned. State Department of Agriculture inspectors will tag diseased bushes for removal while inspecting for stunt disease. See comments in the discussion of stunt for information about obtaining inspection service.

## Mummy Berry

In some seasons, growers are greatly concerned to see many berries turn pale in color before ripening and finally turn gray and shrivel. Losses are occasionally severe, especially following wet springs and in plantations growing on peat soils or moist, sand soils containing large amounts of organic matter. The disease is caused by a fungus, *Sclerotinia vaccinii* Wor. It is not present in serious proportions every year, and is less serious if the weather is dry during the blossoming period when infection takes place.

Considerable experimental work has been done in recent years on the control of mummy berry, and it is suggested that growers who are having trouble with this disease write to the Department of Botany and Plant Pathology, Michigan State University, East Lansing, Michigan, for added help for its control.

**Control Measures for Blueberry Diseases**—Complete information on disease of blueberries is given in Extension Bulletin E-362, Small Fruit Diseases in Michigan, which may be obtained from the Cooperative Agricultural Extension Agent in your County, or by writing to the Bulletin Office, Michigan State University, East Lansing.

## Production

Production begins in a small way the year after planting, although it is best to remove the blossoms to prevent bearing. The second-year crop is too small to be of importance and all of the strength of the bush might better go into growth.

Yields vary greatly with soil conditions and care. On the average, 400 to 800 pints may be harvested the third season and 1,400 to 2,000 pints the fourth summer. Plants reach full production in about eight years. Average yields in full bearing, under good conditions, should range from 4,000 to 7,000 pints per acre, although occasionally much higher yields are obtained.

Blueberry bushes, growing under the right conditions, are long-lived, some wild plants being known that are considerably over 100 years of age. The oldest cultivated plants in Michigan are 30 years old. At 12 years of age these plants had become too tall for economical harvesting and were rather severely pruned-back. They developed vigorous new tops and produced well for several years when it was again necessary to prune back the tops. It has been observed that bushes 25 to 30 years of age have declined somewhat in production.



Experiments are in progress to determine the cause of this decline. It is believed that the problem can be solved and that blueberry bushes can be maintained in profitable production until 50 years of age or older.

### Harvesting

Harvesting begins in southern Michigan early in July, in a normal season, and extends until about the middle of September, or sometimes later. Peak production is usually reached during the first few days of August.

Blueberries hang on the bushes exceptionally well after reaching maturity. Picking is done about every 10 days. Most varieties require 3 to 5 pickings to harvest practically all of the berries.

The blueberry harvest now provides work for thousands of pickers



Fig. 13. Picking cultivated highbush blueberries. The harvesting season extends through most of July, August and the first part of September in Michigan and provides a pleasant and profitable vacation for many pickers.



over a period of several weeks. It requires about 5 or 6 pickers to harvest an acre of berries in full production. Large plantations provide housing and camp grounds for many of their pickers who come from southern states to help with the harvest.

Harvesting blueberries is expensive, amounting to nearly half of the total cost of production. There is a possibility that mechanical picking may soon be perfected to the point where it will harvest at least a fairly large portion of the crop.

### Grading, Packing and Marketing

About 45 percent of the average Michigan cultivated blueberry



Fig. 14. A packed pint box of cultivated blueberries ready for market. Note the cellophane cover and grade designation. This pack has met with general approval on the fresh markets. Berries for processing are shipped in lug boxes and 30-pound cans.

crop is sold on the fresh market and the balance is used by processors.

Berries for the fresh market are packed in pint cups (Fig. 14). These are filled rounding full and covered with a sheet of cellophane on which has been printed the proper grade name. The cellophane sheet is fitted tightly around the pint cup and held in place by means of a rubber band. This makes a clean and attractive package. Berries for processors are put in lug boxes and 30-pound cans.

The Michigan Blueberry Growers' Association, a cooperative organization, sells about 95 percent of the cultivated blueberry crop produced in the state. It has established grades and standards which all members must meet. This has proved to be an orderly and efficient method of marketing.

The large cultivated blueberry has met with a favorable reception on the markets for fresh fruit, canning and quick-freezing. The fresh berries may be used in many ways including serving with sugar and cream, as an attractive addition to fruit salads, and on ice cream. The canned or quick-frozen berries are famous for pies and various kinds of muffins and puddings.

## CONCLUSION

There is always a fascination about growing something new, and no doubt many persons will be tempted to grow cultivated blueberries who do not have the proper conditions available. It is important to note that blueberry culture, owing to exacting soil and climatic requirements, is a highly specialized type of fruit growing. Prospective growers should consult their experiment stations or successful blueberry growers for advice before proceeding.

