

# Blueberry Culture

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A CLUSTER OF RUBELS—NATURAL SIZE  
(Photo by Jos. J. White, Inc.)

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# Blueberry Culture

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Blueberry culture as developed in New Jersey since 1915 has aroused national interest. The first commercial shipment was made in 1916 and now New Jersey berries may be found in all of the principal markets of northeastern United States. Other states, principally North Carolina and Michigan, have recently established plantings of commercial importance. The excellent quality of the cultivated fruit assures it a prominent and permanent place in all the markets.

### Soil

Only those types of soil known to produce uniformly good results should be used for blueberry plantings because of the present high cost of the plants. The actual cost of the land probably will be low but care must be taken to find the correct location. It may be necessary to acquire a large block of useless land to get just the piece needed for blueberries. It is time and money well spent if a suitable field can be obtained. It would be folly to plant a field just because one owned it unless it was known to be of the right type.

The land in New Jersey used successfully for cultivated blueberries is all of the same general type. The topsoil is peat mixed with coarse sand; the subsoil is sand underlaid with hardpan usually within 3 or 4 feet of the surface. Such land is not adapted to any type of agriculture except cranberry growing, and therefore only a small portion of it has been cleared. The wild growth present is a good indication of the type of soil. Probably the best type for our purpose grows a mixture of pine, white cedar, and red maple, such land containing about 3 inches of peat. A common type grows naturally a mixture of wild blueberry, leatherleaf, and possibly some wild cranberries. Higher and thinner soils can be used if care is

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taken to irrigate them in dry weather, but a grower can expect better growth on the two types above described.

Old savannah cranberry bogs have been plowed up and used to advantage for blueberry fields. Other cleared land is usually drained so deeply and plowed so thoroughly that the peat originally in the soil is all used up. Such land could not be used with any certainty of success. Ordinary forest land, especially the pine and oak for-



FIG. 1. BREAKING NEW LAND FOR BLUEBERRY CULTURE  
(Photo by Jos. J. White, Inc.)

ests of southern New Jersey, is usually too dry. Locations having a thin pine growth with a solid ground covering of sheep laurel can be used if there is a constant water supply, but it is doubtful whether they should be used when there is so much of the better land available. Swamps of solid cedar indicate deep peat, usually too deep for use as a blueberry field.

Probably other soils will be found that will be satisfactory for blueberry culture but at the present time only those that have proved so are recommended.

### Preparation of the Land and Planting

The site is prepared by clearing off the vegetation by the ordinary methods, draining and plowing. The heavy forest growth on the best of the soil is very expensive to clear, because of the large stumps that must be removed, but sometimes the lumber from the trees partially repays the cost. The leatherleaf, wild blueberry swamp is much easier to clear but it contains no revenue-producing material to be removed. An old cranberry bog is the easiest of all, as the vine growth can be removed by burning and the land can be plowed almost immediately.

The ground is plowed deeply enough to turn over at least two inches of the sand that is under the peat. As the site is kept fallow for a year before it is planted to blueberries, the peat is well broken up and mixed with the sand by the time the plants need it. Of course, the first plowing is accomplished with considerable difficulty because of the logs and old stumps in these soils but the workings following are much like upland work.

For the best results, the water is held from 18 to 24 inches below the surface. Usually open ditches make the most practical drainage system although, in some cases, tile drainage to supplement open ditches has been installed with success. It is highly important to prevent the water from standing on the surface during the growing season, as the bushes are seriously damaged thereby. The land used is generally somewhat irregular. Special drains should be connected with the low spots which otherwise are apt to produce weak plants subject to winter killing. Very sandy areas are not likely to be profitable unless considerable peat is added. A well planned drainage system can be used for irrigation during drought periods if water is available to be turned into the system.

At present, the custom is to set the plants in rows 8 feet apart and the plants 4 feet apart in rows (1,360 plants per acre). In the best parts of many fields, such good growth has been obtained that crowding has resulted. It is considered better to thin out such areas by removing alternate plants after crowding has become serious, rather than to greatly reduce the production capacity of a whole field by using a wider planting distance.

Blueberries must be thoroughly cross-pollinated for best results. Rows of different varieties, or at least of two varieties, alternating in the field allow better pollination by bumblebees and other insects than do solid blocks of a single variety. The blooming periods of all New Jersey varieties come close enough together to permit the planting of any one variety with any other.

### Tillage

For good results, the field must be kept free of weed growth throughout the growing season. Uncontrolled growth of weeds can, in a short time, very seriously check the growth of blueberry bushes and prevent the development of good fruiting wood. Clean cultivation has been the only successful method of weed control in general use. Most of the common cultivating tools have been used in the blueberry fields in combination with hoeing and hand pulling of weeds between and under the bushes. A shallow-working harrow was designed at the Blueberry Substation especially for blueberries (see fig. 2). This tool greatly reduces hand hoeing since it can be run close to the crowns of the bushes and does not cut deeply enough to seriously damage the roots. It is low and can be drawn by a single horse or garden tractor, so that it is possible to cultivate at all times with a minimum of damage to overhanging branches, bloom, or fruit.

Prof. J. Harold Clark of this station has shown that a hay mulch will improve the growth of blueberries on a soil naturally unsuited to this plant. The mulch, of course, removes the need of all cultivation. Mulching experiments are being conducted in commercial fields as it would be a distinct advantage if cultivation and attendant oxidation of the soil organic matter could be avoided entirely.

### Varieties

The blueberry industry owes a debt of gratitude to Miss Elizabeth C. White and Dr. Frederick V. Coville for their work in select-

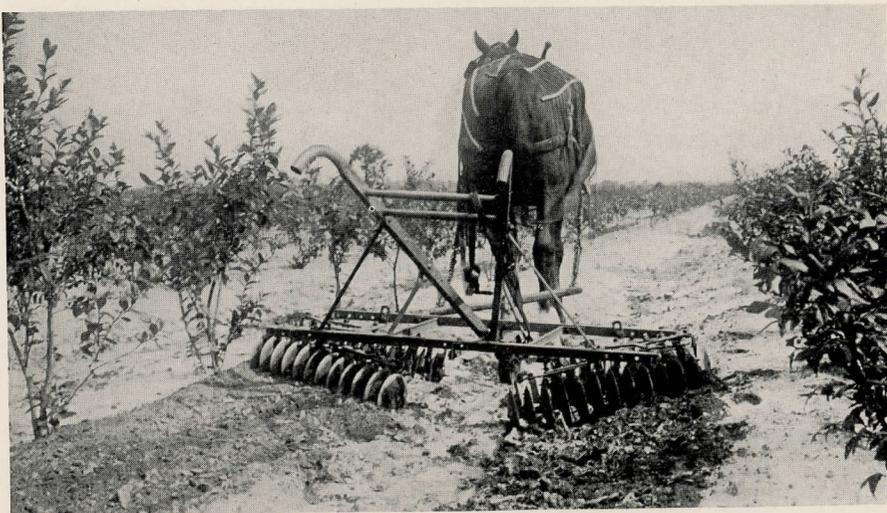


FIG. 2. CULTIVATING CLOSE TO YOUNG BLUEBERRY BUSHES WITH THE NEW JERSEY BLUEBERRY HARROW  
Observe how the machine has adjusted itself to the slope of the land

ing and breeding varieties. The results gained could be accomplished only by great labor and infinite care. Miss White's selections of wild plants are undoubtedly the best among many hundred thousand growing naturally in the vicinity of Pemberton and Chatsworth. Dr. Coville's hybrids are selected from nearly 90,000 crosses which he made of selected plants. The following named varieties are all excellent and all have large fruit and good flavor. The terms used in describing them are chosen for the purpose of comparing them with one another and not with any other blueberries. The more common varieties are as follows:

#### *June*

(Coville Hybrid). This is a new bush that starts to ripen shortly before Cabot. The entire crop ripens promptly and is gone a week before the last picking of Cabot. Mediumly high bush, hard to propagate, and slow to come into foliage in the spring. Leaf is small.

#### *Cabot*

(Coville Hybrid). Standard early high bush berry, first picking late in June, good producer, excellent flavor, good shipper; bush inclined to be low and spreading, difficult to propagate, an excellent commercial variety.

#### *Pioneer*

(Coville Hybrid). Ripens 10 to 14 days after Cabot, excellent flavor, mediumly high bush, good producer, an excellent commercial variety.

#### *Concord*

(Coville Hybrid). Ripens 10 to 14 days after Cabot; high bush; relatively few fruit buds to a stem and does not need the customary thinning. The berries do not fall off readily after ripening. Fruit large with excellent flavor and good color.

#### *Rancocas*

(Coville Hybrid). Ripens 14 to 18 days after Cabot, good flavor; a rather tall bush, excellent producer, an excellent commercial variety.

#### *Rubel*

(White Selection). Ripens 14 to 18 days after Cabot, fair flavor, excellent shipper; tall, well-shaped bush that is vigorous and rela-

tively easy to propagate, excellent producer, an excellent variety at present.

*Sam*

(White Selection). Ripens 14 to 18 days after Cabot, fair quality; good producer, inclined to grow tall and irregular.

*Stanley*

(Coville Hybrid). Ripens 14 to 18 days after Cabot; high bush with equally long sprouts; berries large and with excellent flavor. Leaves large, thick, and shiny.

*Katharine*

(Coville Hybrid). Ripens 14 to 18 days after Cabot, excellent flavor, rather hard to pick, and skin inclined to tear at stem end; mediumly high bush, good producer.

*Jersey*

(Coville Hybrid). Ripens 14 to 18 days after Cabot; high bush; berries large, well flavored, good shipper, appearance attractive. This variety is new but has great promise.

*Scammell*

(Coville Hybrid). Ripens 16 to 20 days after Cabot, excellent flavor, attractive color; medium high bush with thin branches; good producer.

*Weymouth*

(Coville Hybrid). A cross between Cabot and June, ripens about the time of June. Large berry, attractive color. This variety has not been planted commercially yet so that little is known about its possibilities.

*Dixi*

(Coville Hybrid). This is a newly named plant of which only the original seedling has been in bearing. It is thought to be of especially high quality, good color, and large size. It ripens in mid-season.

Note. The varieties Adams, Dunfee, Greenfield, Grover, and Harding are not being planted in the newer fields and, therefore, have not been included in this table.

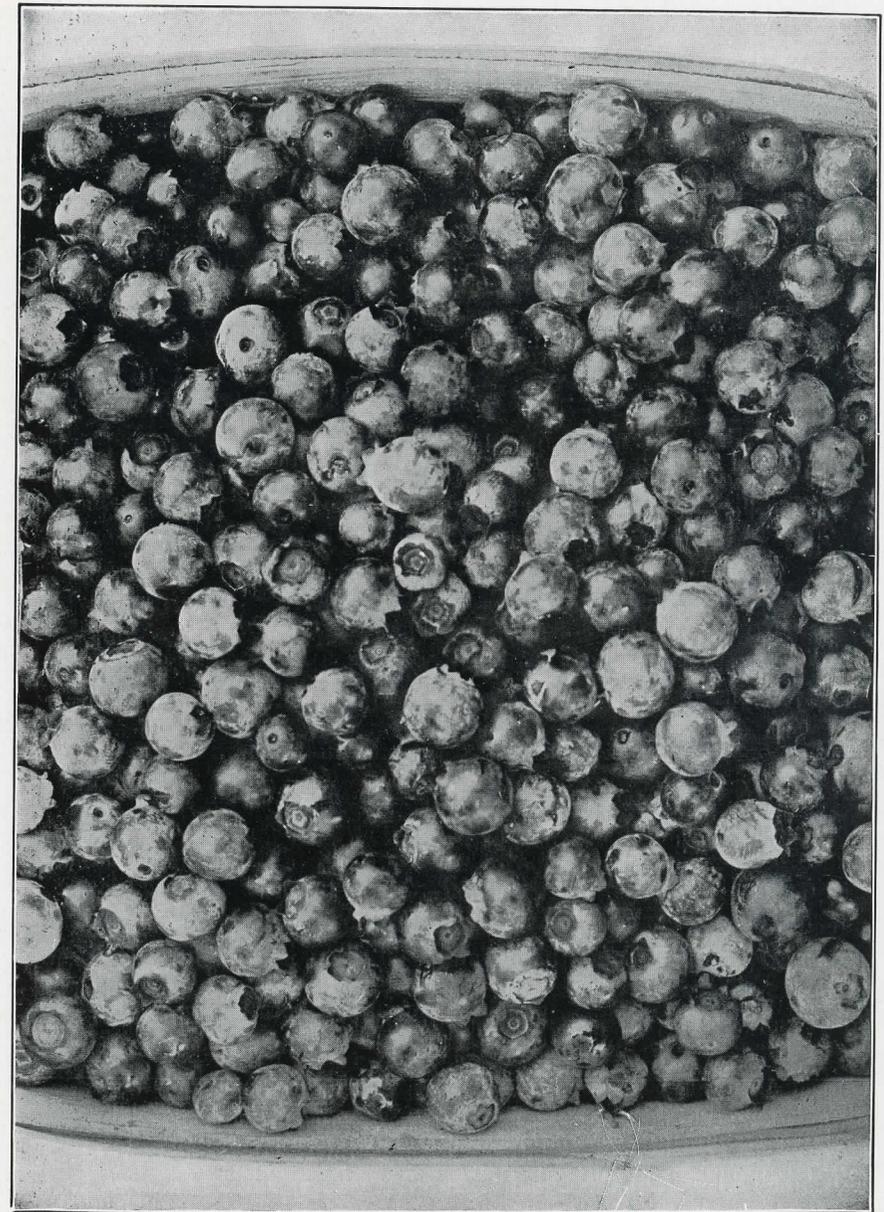


FIG. 3. THE ORDINARY WILD BLUEBERRY OF NEW JERSEY  
(From U. S. Dept. Agr., Bul. 974)

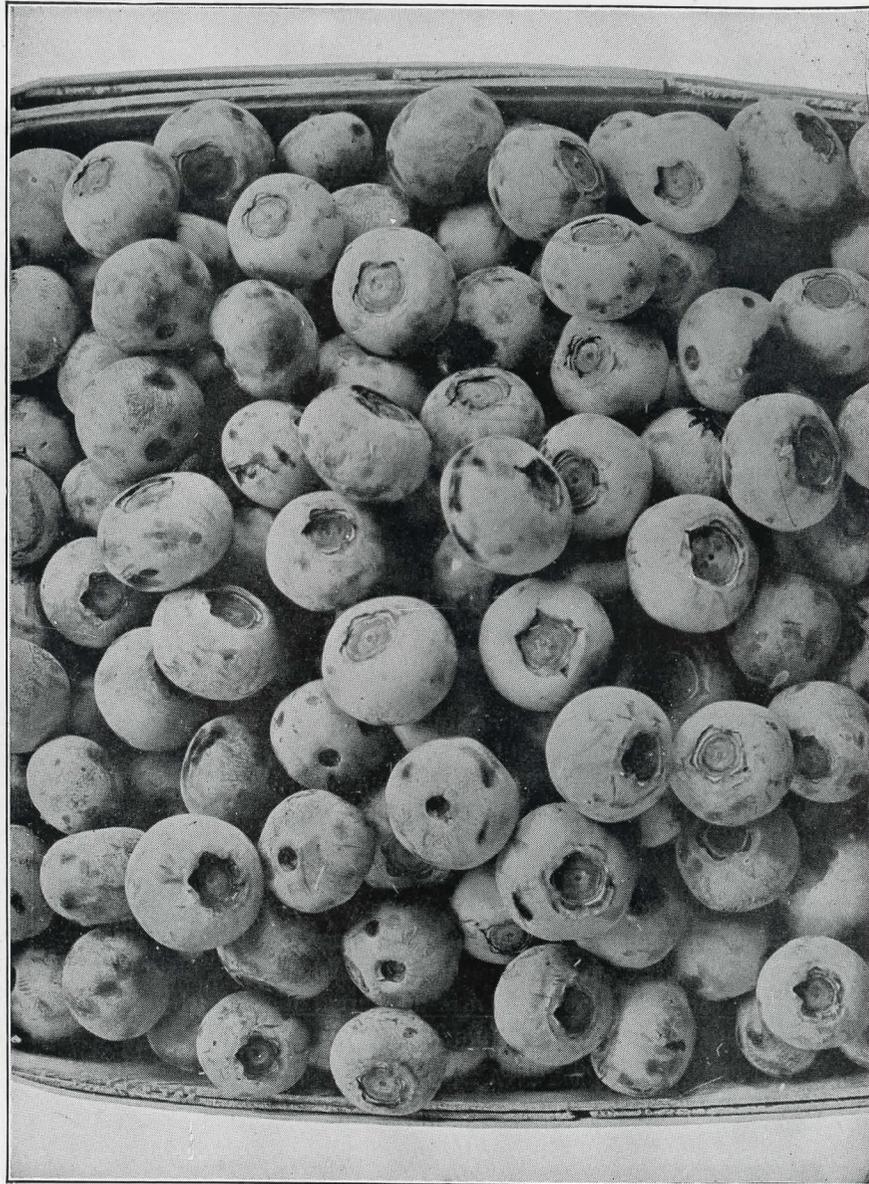


FIG. 4. FRUIT OF THE KATHARINE BLUEBERRY, A SELECTED HYBRID  
(From U. S. Dept. Agr., Bul. 974)

### Fertilizer

With other conditions equal, it is relatively easy to double the yield of blueberries by the use of fertilizer. The mixture recommended as a result of nine years of investigation is high in nitrogen and is made up as follows:

450 lb. Nitrate of Soda  
450 lb. Calcium Nitrate  
800 lb. Rock Phosphate  
300 lb. Sulfate of Potash

Ammonium salts, dried blood, and acid phosphate have not given good results.

When plants are producing two quarts or more to the bush, this mixture may be used at the rate of 300 pounds to the acre early in May and again at the same rate three weeks to a month later. Small bushes should receive proportionately reduced amounts.

The fertilizer should be carefully applied. It is broadcast by hand as evenly as possible covering the area under the branches except within six inches of the crown. Ordinarily, this will include all of the soil containing roots. Unless a rain follows the treatment, the fertilizer should be mixed with the soil by hand raking or by cultivating with the New Jersey blueberry harrow.

Newly planted fields should be fertilized with great caution. The amount used should be not more than 100 pounds to the acre, and it should be applied only after the plants have made some new growth.

### Propagation

Hardwood cuttings are the chief sources of new plants. They may be made any time during the dormant season of the plant, but they are usually taken in late winter so that the wood obtained in pruning may be used for cuttings. Great care should be taken to keep the wood from drying out, with the attending loss of vitality of the cutting. Twenty-five or fifty may be made at a time and immediately tied in a bundle and packed in damp moss, sawdust, or sand, and stored in a cellar. Frequent inspection should be made to prevent the packing from drying out.

Cuttings are made from the mature wood of the previous season's growth. Ordinarily they are from 3 to 4 inches long with several leaf buds on each cutting. The more successful propagators insist on having buds at the extreme ends of the cutting, as in figure 5. Large suckers with few leaf buds make poor material for cuttings, best results being obtained from thin wood with leaf buds close together. Twigs with fruit buds should not be used for cuttings.

The cutting bed is made of the ordinary coldframe type, 6 feet wide and as long as convenient. As coldframe sash is made 6 feet by 3 feet, the length of the bed should be some multiple of three.

The bed should be placed on porous soil and high enough to permit good drainage. The soil inside the bed is a mixture of sand and well-rotted peat, about half and half by volume. It should not be so compact as to hold a great quantity of water nor should it be loose enough to dry out quickly. The mixture as given may be placed evenly in the bed and packed sufficiently by a thorough watering. When thorough drainage is not insured, it is advisable to use wire-bottom cutting boxes. These boxes may be made about 4 inches deep, 3 feet long, and 12 to 15 inches wide. Galvanized hardware cloth, 7 or 8 meshes to the inch, is stapled and cleated across the bottom. The cleats run the long way, one on each edge. These boxes are elevated 3 or 4 inches from the surface of the ground. This permits more rapid warming of the soil. It is also possible that the additional aeration is beneficial.

Cuttings may be set out 1 inch apart in rows about 2 inches apart and watered enough to pack them in place. The frames should be covered immediately with glass, and successive waterings should be frequent enough to keep the soil damp at all times especially at the edges of the boxes or frames. Excessive watering is to be avoided. It is well to examine the beds every day to determine when watering is necessary. The beds should not be watered in the middle of the day. All operations should be conducted with the least possible removal of the sash.

The cutting beds must be shaded during the middle of the day. It is possible to grow a few plants by leaving the shades on all the time, but much better growth will result if the cuttings are given all the light they will stand. This plan necessitates putting the shades on about 9 o'clock in the morning and taking them off about 4 in the afternoon of every clear day. They may be left off all day on cloudy days but must be put on quickly if the sun



FIG. 5.  
BLUE-  
BERRY  
CUTTING

comes out. The shades are made of plastering lath set about three-eighths of an inch apart on a frame, the outside measurements of the frame and the glass sash being the same. The glass is kept tight on the beds until about the last of June, when the cuttings have rooted and the second growth is starting. Then some ventilation is allowed, being gradually increased until the last of August, when the glass may be taken off entirely.

In order to eliminate the necessity of moving the shades on and off daily, one grower built a permanent shade about 7 feet above the glass. The small amount of sunlight coming through the shade was well diffused before it came to the glass. He reports fair success with this method.

The cuttings send out a short shoot at the top soon after they are set out. During June this growth stops and root growth starts. If the root growth is successful, additional top growth is made during July and August. Further root growth is made in the fall. The rooted cuttings may be taken out of the beds in late August or in spring before growth starts. If left in the frames over winter, they should be mulched to prevent heaving by frost. On being taken from the beds they are set out in nursery rows for a year before being set in the field.

Softwood cuttings are made at the close of the first growth period, some time in the second half of June or the first half of July. They are made from the current year's growth, about the same length as winter cuttings and the two terminal leaves are halved. The rest of the leaves are, of course, stripped from the cutting. These cuttings are set out in June in the same manner as winter cuttings, as to beds, sash, and shade, and with the additional precaution that they must be handled promptly and not allowed to wilt. They root in two or three weeks and top growth starts in September.

This method is somewhat surer of producing results, especially with Cabot, but it has the decided disadvantage of stunting the parent plant severely. It is possible that this disadvantage may be overcome by not fruiting the bushes from which the cutting wood is taken. The method would be used more extensively were it not for the fact that the summer cuttings must be taken during the harvest time when labor is busily engaged elsewhere.

A more recent development in propagation has been the use of shade without any glass whatsoever. For this purpose an enclosure about seven feet high is built of widely spaced lath which shuts out about half the light overhead and one-third on the sides. A well drained location is necessary. The beds are formed on top of the ground, using a mixture of coarse sand and Holland peat

moss in even proportions. The beds are about five feet across and enclosed by four-inch boards on edge. The cuttings are six inches long and are laid down at an angle of less than 30° with the top of the bed. Only the two top buds are left exposed. They may be about one inch apart in rows about four inches apart. This method requires more frequent watering than with the glass sash method. The risk of fungous infection is largely eliminated. The equipment is cheaper, the plants can be observed more quickly and easily, and there is no danger of sudden burning.

### Insects

Considerable care has been taken by blueberry growers to prevent the building up of serious insect pests in their fields. Unusual pests are watched closely and their importance estimated. In a few cases, definite control measures have been established.

#### *Blueberry Fruit Fly*

The most serious insect pest of blueberries is the blueberry fruit fly (*Rhagoletis pomonella* Walsh), the larva of which is active inside the ripe fruit. Infested fruit is, of course, unmarketable.

In New Jersey, the flies emerge from overwintering puparia from June 15 to July 15, mostly between June 20 and July 5. After flying about for 10 to 12 days, they start to lay eggs in the ripe or ripening fruit. The eggs hatch in two to five days, and the larvae are mature in about 20 days when they enter the ground, pupate, and remain dormant until the next year.

The adult flies can be killed before they lay eggs by dusting the field with ground derris (5% rotenone) 10-15 pounds to the acre, once on June 30 and again 10 days later. Usually the treatment is made by airplane or autogiro. If a hand machine is used, a diluent should be added in order to get sufficient distribution.

#### *Stem Borer*

The young stems of the blueberry plant are often girdled during late June or July three or six inches from the tip. Two parallel girdles or rings of punctures are cut around the stem about a half inch apart between which an egg is laid under the bark. The grub hatching from the egg is the stem borer (*Oberea myops* Wald). It tunnels the stem and if undisturbed will work for three years before emerging as an adult. The first year it tunnels but a few inches. The second year it may reach the base of the plant, and the third year it will appear in another stem.

Cutting off the wilted tips well below the girdled area during

July will keep this pest under control. Any missed at this time may be found while pruning. No tunneled shoot should be left on the bush. The cut pieces may be thrown between the rows as the borer cannot get back to the bush.

#### *Stem Gall*

The common insect gall on blueberries is caused by *Hemadas nubilipennis* Ashm. They become numerous enough to reduce the fruitfulness of the bush if allowed to reproduce undisturbed. However, the control is simple. The galls should be cut from the bushes and removed from the field and destroyed during the winter pruning. The flies emerge and reinfest the plants if the galls are allowed to remain on the damp ground.

#### *Japanese Beetle*

Commercial plantations located adjacent to a general farming area have been particularly subject to attack by Japanese beetle (*Popillia japonica* Newm). Those situated in the pine belt, where the beetle does not reproduce in such large numbers, have been comparatively free of this pest. The beetles are attracted by the foliage and ripe fruit of the blueberry and often ruin one-third of the crop. They fly in from neighboring fields and woodland and under suitable conditions congregate in large numbers. The most satisfactory control yet obtained consists of simply knocking the beetles off the bushes early in the morning when they do not fly easily. At this time, a slight shaking of the bushes causes them to drop so that they may easily be caught in a tight basket or tub, carried from the field, and destroyed. The method is not completely satisfactory, but it does allow the harvesting of the crop.

### Pruning

The grower starts his blueberry plantation with selected or hybrid bushes which are capable of producing high-grade fruit when given proper care. After the young plants have made a thrifty start in a suitable location and with good field culture, the grower is interested in maintaining vigorous yearly new growth and at the same time producing large crops of high quality fruit.

The largest single factor in producing fancy fruit is pruning. This conclusion has been reached after several years of practical experimentation with a commercial planting. With otherwise perfect care, the unpruned bushes in a very few years will show no profit at all, the poorly pruned bushes will be making a small return,

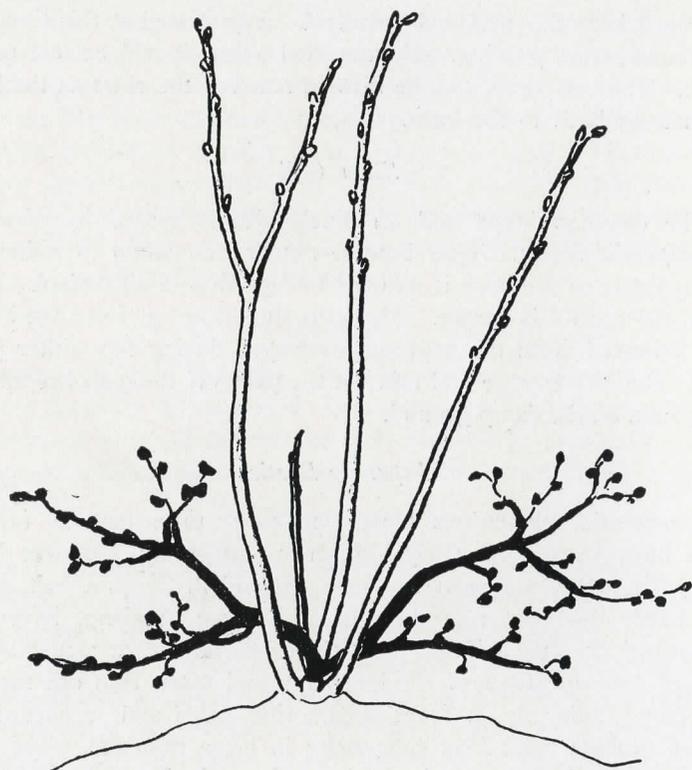


FIG. 6. BLUEBERRY PLANT AFTER ONE YEAR IN THE FIELD  
Branches Shown Full Black to Be Removed in Pruning

but well-pruned bushes will more than repay the additional expense of a thorough pruning.

In starting experiments on blueberry growing, the general theory of pruning and its object, which is to obtain the proper balance between leaf area and fruit, were first considered. Wild bushes were found to bear their best fruit on young shoots 1 to 2 years old. It was noted, also, that the old plants when killed by fire sprouted from the stump and bore heavy crops of large fruit several years and then lapsed into poorer fruiting as they grew older. It was evident from these observations that the plants tried to produce too much fruit as they advanced in age and they did not have sufficient leaf area to bring the fruit to full size at maturity and at the same time push new sprouts to replace the old wood.

Many different pruning methods were tried in an endeavor to reach a practical system for commercial application. The work at

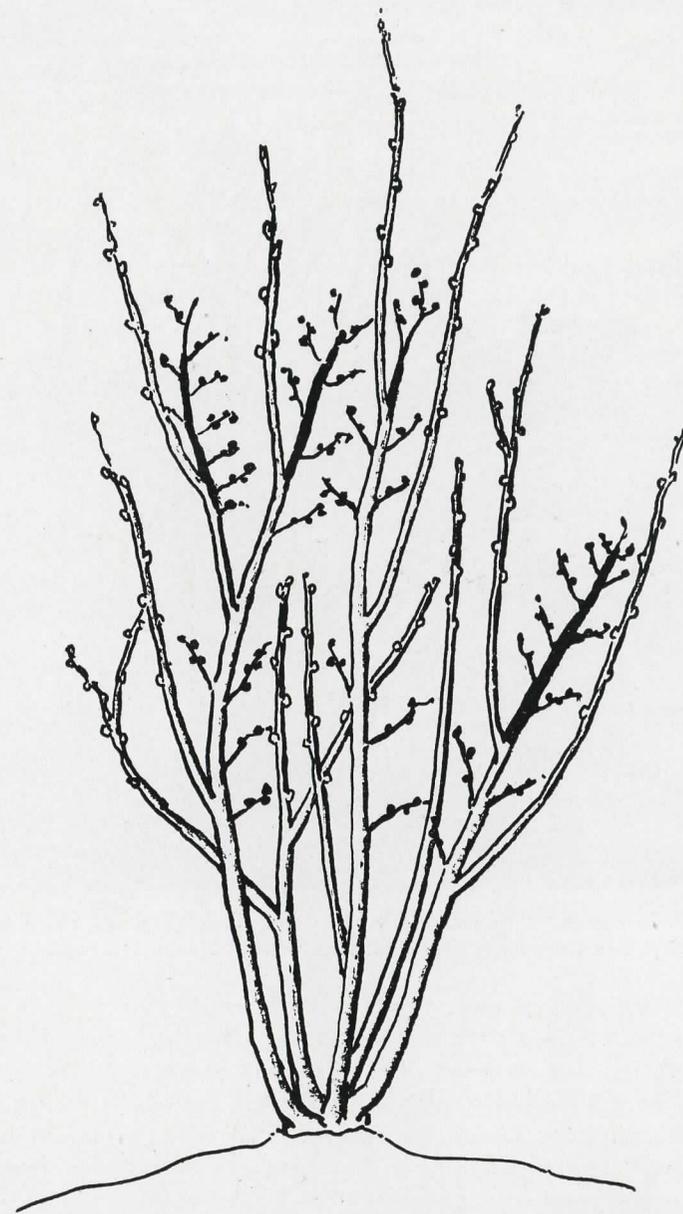


FIG. 7. BLUEBERRY PLANT AFTER TWO YEARS IN THE FIELD  
Branches Shown Full Black to Be Removed in Pruning



FIG. 8. RANCOCAS BEFORE PRUNING. AFTER TWO YEARS IN THE FIELD THE GROWTH IS LUXURIANT AND NEEDS HEAVY PRUNING

best is tedious and slow. Only methods which to date have given the necessary results without unnecessary labor are given here.

Fruit is borne on wood of the previous season's growth. It has been found by experiment that the largest fruit is borne on those shoots that grew luxuriantly and matured well the season before fruiting. This vigorous growth appears as new shoots from the base of the plant or stout laterals from older wood. That which is not desirable for fruiting has grown more slowly from the older wood and has a bushy appearance. The bark does not show as bright color as that which has grown faster and the proportion of fruit buds to leaf buds is greater. The bushy growth is pruned out

every year from the first year after planting. For the first year or two this is all that is necessary, except that all flower buds should be removed when planting is made. Figure 6 shows a plant one year in the field. The bushy growth low on the sides should be cut away at the base, allowing the four 1-year shoots to form the basis for the next year's growth. The following year the plant appears as in figure 7. Here again the bushy twigs are trimmed out, leaving only strong laterals which should fruit abundantly that summer. If growing conditions are favorable, this plant is healthy and making new vigorous growth, but probably not renewing itself from the base with new shoots. Now is the time to start the heavy pruning to form those renewal shoots. One or two of the oldest-



FIG. 9. RANCOCAS AFTER PRUNING. CUT BACK TO SPROUT WOOD