Growing Blueberries

in Oregon

C. A. Boller

Agricultural Experiment Station
Oregon State College
Corvallis

Station Bulletin 499 Revised November 1956

Cover photo—The blueberry planting at the Experiment Station farm near Corvallis looked like this 3 years after planting. The soil is Chehalis silty clay loam, and the mulch is 6 inches of fir sawdust. The stunted plants at the center right are in a plot which had received no fertilizer.

Growing Blueberries *in Oregon*

By C. A. Boller
Assistant Horticulturist

Blueberry cultivation began about 40 years ago in New Jersey, where the species is native, but the greatest growth of the industry has occurred in the last 25 years. Today, it is a multimillion dollar crop in New Jersey, and an increasingly important small-fruit crop in Michigan and several other eastern states.

First plantings in the Northwest were made about 35 years ago on the coast. For one reason or another these early plantings were not sufficiently successful to cause a rapid acreage expansion. Eventually, a satisfactory combination of climate, soil, and cultural practices was attained in the Puget Sound region of Washington. High yields and high prices reported from this region received wide publicity with the result that hundreds of small plantings were made in Washington and Oregon west of the Cascades.

Time will tell how widely adapted this crop is to the Northwest. Some young plantings in Oregon are starting out well, but this does not necessarily mean they will be as productive at maturity as the better plantings on organic soils in Washington, New Jersey, or

Pickers have to reach above their heads for some of the berries in this 25-year-old planting in Massachusetts. The 6 foot by 6 foot spacing has resulted in a crowded condition which interferes with efficient harvesting and tends to shade out lower growth.

Michigan. Most promising young plantings in Oregon are on soils far different from those well adapted to blueberry growing. Possibly, by careful attention to irrigation and fertilization, blueberries can be grown economically on soils to which they are not naturally adapted, but this has not yet been proved.

In addition to the cultural problems, we have much to learn about the suitability of climate in various parts of western Oregon, and we will have the problem of developing satisfactory markets after local markets are saturated. Blueberry growing in Oregon is still in the experimental stage and will remain there until the industry can accumulate records and observations from many mature plantings having a wide variety of locations, soils, and cultural practices. The following discussion is an attempt to apply to Oregon conditions the findings of other states, and includes some tentative conclusions drawn from local observations and experimental data gathered during the past 10 years.

Climatic Requirements

Successful blueberry plantings are found in climates ranging from the warm, moist summers of New Jersey to the cool, dry summers of the Puget Sound region. The climate of western Oregon, with exception of the Rogue River Valley, is similar to that of the Puget Sound region, though somewhat warmer and dryer. Summer temperatures may be too low in some coast areas where there is little protection from the sea breeze. Fruit maturity is very late and yields have not been high in these areas.

Eastern observers have reported severe damage resulting from minimum temperatures of around —20° F. In Michigan the highbush blueberry is excluded from the northern half of the State by the severe winters. Severe winter damage to blueberries is not likely to occur in any part of western Oregon.

The blueberry, like many other berry crops, is moderately susceptible to spring frost injury. Severe damage from spring frosts is not anticipated in any part of western Oregon except in "frost pockets," small areas at a lower elevation than the surrounding land. Such areas should be avoided unless known to be safe for berry production.

Soil Requirements

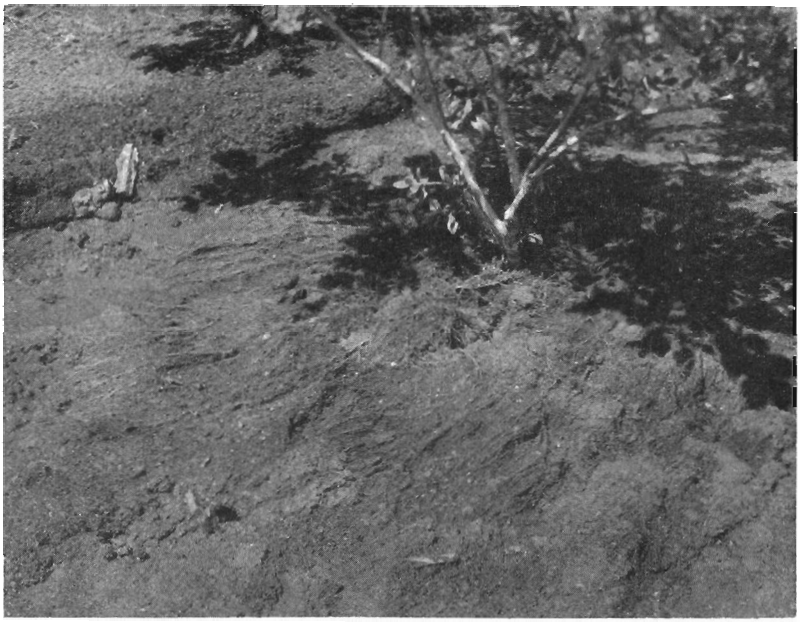
Typical soil used for blueberry production in the East is a mixture of sand and peat with a water table ranging from 1 to 3 feet below the surface. High acidity of this kind of soil was long thought to be the essential feature that made it suitable for blueberry growing,

but it now appears that other factors may be more important. In these soils nature has produced the ideal combination of aeration, moisture supply, and fertility for the highbush blueberry. It is possible to duplicate these conditions by artificial means, such as sprinkler irrigation, use of sawdust, and liberal application of ammonium sulphate. Fortunately, these methods offer certain advantages which at least partially offset higher costs.

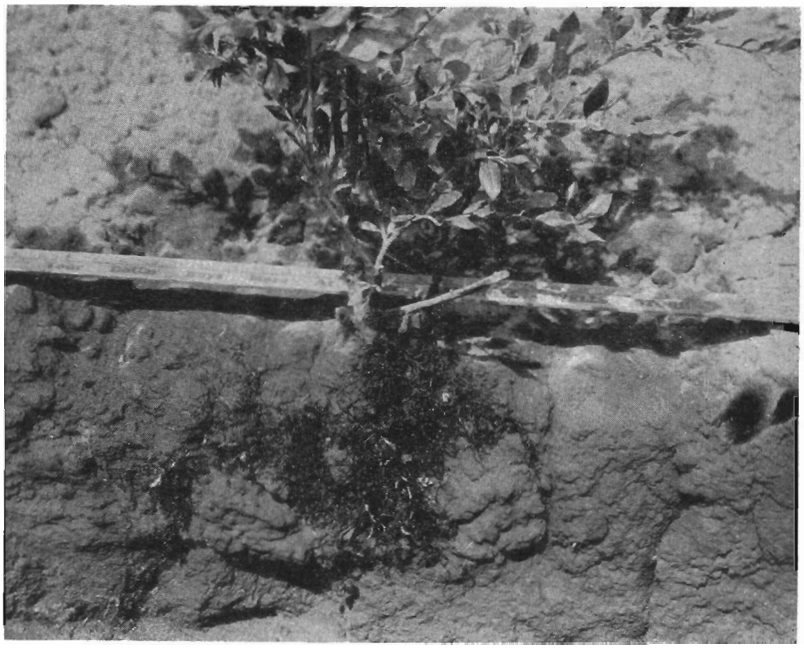
Soils of western Oregon are naturally acid. Some bottom lands are close to neutral but will increase in acidity with the application of ammonium sulphate. Soil which has been limed may cause some difficulty. Calcareous soils in the Rogue River Valley are not recommended for blueberry growing.

Soil suitable for blueberry growing is loose and well aerated in the upper foot at least. This condition may be a result of light texture or of good structure in a heavier soil.

Light-textured soils comprise a relatively small part of the land area of western Oregon and often are subject to flooding. These low locations, however, usually have the advantage of an abundance of cheap water for irrigation.



The sawdust mulch was washed away from this blueberry plant exposing a mat of fibrous roots on the soil surface. This plant also had a larger clump of roots below soil surface than the unmulched plant shown on opposite page (same age and variety).



This unmulched plant, after growing for 3 years on a silty clay loam, had only this small clump of roots extending 6 to 18 inches below the surface. Note small volume of the root system and its tendency to follow cracks in the soil.

Good soil structure in medium- and heavy-textured soils results from a high content of organic matter and good soil management. Some red hills soils have a well-developed "shot structure" which seems to be enjoyed by the few blueberry plants found in home gardens in these areas. This type of land might be considered for a commercial blueberry planting *provided an adequate supply of irrigation water is available.* Excellent structure is often found under old sod. If this land is mulched, its structure might be maintained for many years if not permanently. The effects of poor structure can be offset to a considerable extent by the use of a mulch; nevertheless, using a soil of poor structure for a blueberry planting increases the risk of failure.

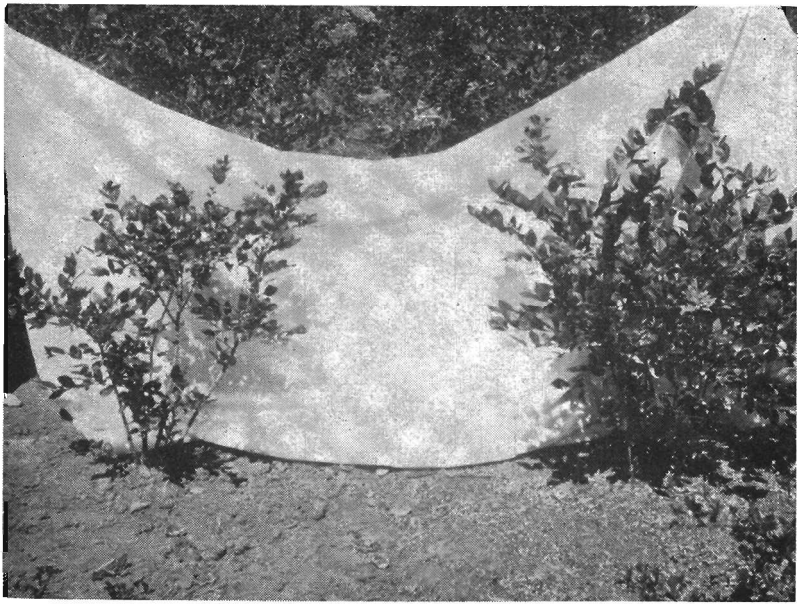
Soil aeration is restricted by poor drainage. Soils of the Dayton series, commonly called "white land," have poor drainage because of level topography and impervious subsoil. Soils of the Wapato series may have good structure but are apt to be too wet early in the growing season. Excessive wetness may occur on slopes where seepage from nearby hills comes to the surface.

Artificial drainage may be used, but unless the project is approved by a drainage engineer, results may be disappointing. There are, however, a few locations where artificial drainage has provided such excellent control of the water table that subirrigation became practical. An example of this is Lake Labish in Marion County.

Looseness and aeration of the upper foot of soil is probably the most important characteristic to consider in choosing a soil in western Oregon. This condition depends on texture, structure, and drainage. Structure, in turn, depends on organic matter content and management practices over a long period. Other soil factors are of less importance. For example, a good blueberry soil may have a tight subsoil if adequate drainage is not prevented. Initial soil fertility is not important since cost of additional fertilizer is a small item in total production costs.

Mulching

Mulching has proved to be highly beneficial on soils not ideal for blueberry growing. The poorer the soil, the greater the benefit. Fir sawdust, an excellent mulching material, is plentiful and cheap in



Mulching versus cultivating is demonstrated by these 2 plants grown for 3 years on a silty clay loam. Plant on the left was cultivated. Plant on the right had a 6-inch sawdust mulch. Fertilizer and water applications were the same for both.

many parts of western Oregon. The expense of hauling and spreading sawdust, however, may be very high unless efficient methods are used. After mulch is established, annual cost of maintenance depends on its rate of decomposition. A fir sawdust mulch at the Oregon Agricultural Experiment Station has been settling at the rate of about $\frac{3}{4}$ inch per year.

Mulching eliminates most of the cost of cultivation. A sawdust mulch 6 to 8 inches deep can be expected to improve growth of plants on many soils, and smother out all but a few perennial weeds, such as Canada thistle and morning-glory. These can be eliminated in time by hoeing or spraying. Ordinarily, very few weeds will become established on the surface of the sawdust, and these are easily pulled.

Irrigation

Though blueberries can be grown in the Willamette Valley without irrigation, it is doubtful that nonirrigated plantings can ever attain high yields. A low-yielding planting may be profitable at the present time but may become unprofitable when competition increases.

Subirrigation, widely used in the East, is seldom practical in western Oregon, and where practical there is often danger of frost damage late in the spring. Blueberries thrive under the same soil conditions that exist in a good cranberry field on the coast (the cranberry belongs to the same genus), but these fields are developed at high cost per acre and often require expensive methods of frost control.

Sprinkler irrigation has given good results with blueberries. Amount of water to use and frequency of application depend on soil and atmospheric conditions and on amount of leaf surface in relation to volume of root system. Until more information is available, a rate of 2 inches of water every 2 weeks during the dry season may be taken as a guide for the novice.

Choosing a Location

In choosing a location the following items should be considered: (1) climate, (2) soil, (3) cost and reliability of irrigation, (4) cost of mulching, if mulching is to be used, (5) labor supply, and (6) market for the crop. Some have already been discussed.

Labor for picking usually can be recruited from local women and children. The work is easy and pleasant, and most of it is done in July and August.

Present and future markets should be considered in choosing a location. When local markets are saturated, the grower must turn to processing or ship fresh fruit to distant markets. It is not enough to locate a blueberry planting near a processing plant. The processor usually will not add a product to his line until a large tonnage of the raw material is offered for sale. The grower, therefore, must also consider probable growth of the blueberry industry in his area. The same might apply for distant shipment because a large acreage permits use of a central packing plant and carload shipments.

Varieties

The cultivated blueberry industry in the United States is founded on varieties introduced by the U. S. Department of Agriculture. These varieties are the result of a breeding program begun in New Jersey about 1910. Varieties introduced before 1925 are becoming obsolete, largely due to their small berry size.

It will be many years before we know which varieties are best adapted to growing and marketing conditions of the Northwest and to different parts of the region. In the meantime, it will be helpful to consider which varieties have been planted in the East in recent years. The table below lists 20 USDA varieties, the year of introduction, relative size of berry of each variety, and relative season of maturity.

Rancocas was planted extensively in the East because of its resistance to stunt. It was planted in the cooler sections of the Northwest because of its earliness, but is being replaced by varieties easier to pick and prune.

Jersey is now the most widely planted of all varieties. Its long, loose clusters make it productive and easy to pick. It has been grown in the Northwest for many years and seems to be well liked by growers in all but the coolest areas, where part of the crop may be lost due to cold wet weather or a shortage of pickers before the end of its harvest season.

Concord is earlier than Jersey, but more difficult to pick and often less productive.

Stanley was unrivaled for flavor until the introduction of Dixi. In 1949 it was still the second most popular variety in New Jersey. In some areas of the Northwest it is favored over Jersey because of its earliness and high quality, but in many plantings it is less productive than Jersey and has more tendency for berry size to decrease after the first picking.

USDA Varieties Introduced After 1925

Variety	Year introduced	Berry size	Season
Rancocas	1926	Small	Midseason
Jersey	1928	Small	Late
Concord	1928	Small	Midseason
Stanley	1930	Small	Midseason
June	1930	Small	Early
Weymouth	1936	Medium	Early
Dixi	1936	Large	Late
Atlantic	1939	Medium	Midseason
Burlington	1939	Small	Late
Pemberton	1939	Medium	Midseason
Berkeley	1949	Large	Midseason
Coville	1949	Large	Late
Murphy	1950	Medium	Early
Wolcott	1950	Medium	Early
Angola	1951	Medium	Early
Ivanhoe	1951	Large	Midseason
Earliblue	1952	Medium	Early
Bluecrop	1952	Medium	Midseason
Herbert	1952	Large	Late
Croatan	1954	Medium	Early
Blueray	1955	Large	Midseason

June was superseded by Weymouth which has larger berries.

Weymouth was popular in New Jersey because of its earliness. It is difficult to prune, and its fruit is rather low in quality.

Dixi was the first variety to combine large berry size with high flavor. The fruit is more perishable than most other varieties, both on the bush and after harvest. Where it can be grown and handled successfully, it is a good variety for home use and, on a limited scale, for local markets. Because of its late season and susceptibility to rain damage, it is not recommended for coastal plantings in the Northwest.

Atlantic has good fruit but requires heavy pruning to overcome its spreading growth habit.

Burlington was introduced as a late variety with good shipping quality. It has not been popular in the Northwest, where shipping quality has been less important than in the East.

Pemberton is similar to Jersey in vigor and productivity, superior in berry size, inferior in shipping quality. It seems to be less widely adapted than Jersey. In Northwest plantings it has been subject to many ills, some of which have not been fully explained.

Berkeley is the first of the "new series." The fruit is said to have good shipping quality in spite of its large size. It has not yet been tested adequately in the Northwest. So far it appears very promising, though its growth habit will bear watching.

Coville was introduced as a very late variety, but in a test planting at Corvallis it has been ripening about with Jersey. It has more size and flavor than Jersey. Its productivity has not yet been tested adequately.

Murphy, Wolcott, Angola, and **Croatan** were introduced as canker-resistant varieties for North Carolina, where they are reported to ripen with or ahead of Weymouth.

Ivanhoe was also introduced as a canker-resistant variety for North Carolina but, because of its excellent flavor and other good characteristics and in spite of its dark berries, it has found a place in northern areas also.

Bluecrop is reported to ripen with Ivanhoe, and was introduced for northern areas. Several more years will be required to determine which of these two varieties is better adapted to the Northwest as a replacement for Rancocas, Concord, and Stanley.

Earliblue is reported to ripen with or slightly after Weymouth, and to be much superior in both fruit and bush characteristics.

Herbert is reported to be similar to Dixi in season, size, and flavor, but less perishable.

Blueray is one of the latest USDA introductions. This variety produces a large, fine-flavored berry which ripens from 5 to 20 days after Earliblue, depending on how it is pruned. Light pruning delays maturity. Heavy pruning hastens maturity. The bush seems as hardy as Bluecrop or Herbert, and may be hardier than Jersey.

In addition to the USDA varieties, several varieties have been introduced by Mr. Joseph Eberhardt of Washington and by Mr. E. W. Johnston of British Columbia. These were selected in coastal areas. All ripen ahead of Jersey. Some may still have a place in parts

These pickers are using carriers holding 8 hallocks. From 2 to 5 pickings at weekly intervals are required for a single variety.

of the Northwest, but are faced with serious competition from the newer USDA varieties.

Every planting should have at least two varieties in order to provide for cross-pollination. Growers who start on a small scale with the intention of future expansion should plant several varieties to test under their particular conditions. Another reason for having several varieties is to spread out the picking season.

In evaluating varieties, it is necessary to consider both marketability and cost of production. Marketability is influenced by appearance and flavor. The fruit grower may think of flavor as the most important factor in fruit quality, but the general public is attracted by the largest and bluest blueberries on the market. Of course, when two varieties are equal in other respects, the one with the best flavor should be used. In the long run, good flavor will strengthen demand for blueberries and produce preference for some varieties over others.

Factors affecting appearance are (1) size and uniformity, (2) color, and (3) freedom from defects such as mold, withering, adherence of stems and flower parts, blemishes from insect and disease injury, etc. For judging color, fruit should be seen in the box rather than on the bush because handling tends to darken the color. Susceptibility to mold and withering is influenced by the scar left where fruit is separated from stem. The scar may be large or small, may have clean or torn edges. The importance of a good scar has been emphasized in the East, yet, of the 3 varieties recently most popular in New Jersey, only 1 has a good scar. There have been few, if any, complaints about moldy berries in the Northwest. This may be due to the closeness of markets or possibly to dry summer atmosphere. Growers contemplating distant shipping should perhaps give more attention to the scar when choosing varieties.

Varietal characteristics affecting cost of production are: (1) productivity (largely dependent on vigor), (2) resistance to pests and adverse environmental conditions, (3) growth and fruiting habits in relation to ease of pruning, (4) berry size, (5) uniformity of ripening, and (6) number, size, position, and compactness of fruit clusters. The last three affect the cost of picking.

The problem of choosing the best varieties is complex. Considering our limited knowledge of the characteristics of the newer varieties and our uncertainty about future markets, the best the grower can do today is to avoid varieties with outstanding faults such as small berry size, sprawling growth habit, etc.

Obtaining Plants

There are several blueberry propagators in Oregon and Washington. Their advertisements may be found in farm and garden journals, including Sunday supplements of the metropolitan newspapers. Eastern propagators sometimes offer plants at prices lower than those in the Northwest. It should be remembered that shipping costs must be added to these prices, and that there is always some danger of importing insect and disease pests not yet found in the West.

The value of a plant is dependent on: (1) correct labeling of variety, (2) freedom from disease and insect pests, (3) size, and (4) condition. The latter refers to freedom from desiccation, freezing, or mechanical injury. Plants are priced according to size of top or age of plant. Size of top is important mainly as an indication of size of the root system, which is difficult to measure. Age is a good criterion only when the plants are grown under uniform conditions. A weak 3-year-old plant may be less desirable for planting than a vigorous 2-year-old.

Under good growing conditions a plant is large enough for field planting after 2 or 3 years in the nursery. A plant more than 3 years old is likely to lose a large part of its root system when moved, perhaps enough to set it back a year or more. Planting 3-year-old rather than 2-year-old stock may result in production of the first commercial crop 1 year earlier, and the net return from this crop may far exceed the extra cost. On the other hand, a grower can reduce his initial investment by planting 2-year-old stock. He can reduce it still more, by buying rooted cuttings and growing them in a nursery row for 1 or 2 years before field planting.

Growing plants from cuttings is not recommended except to those willing to give them the careful attention required and realizing that the first attempt may fail. For information on propagation see list of references at the end of this bulletin.

Planting

A distance of 8 feet between rows is a minimum for convenience in cultural and harvesting operations, even in a mulched planting. If a standard-sized tractor is to be used in the rows, a spacing of at least 10 feet is necessary. Plants are sometimes set as close as 4 feet apart in the row, giving a solid row in a few years. The 4-foot spacing may produce a higher tonnage the first few crop years, but will require a higher initial investment and will eventually result in a crowded condition that is likely to increase production costs. A popular planting scheme in New Jersey is 8 foot by 8 foot which permits cross-cultivation with a narrow tractor. Under good growing conditions the 8-foot by 8-foot spacing will give maximum production per acre after about 8 years. An 8-foot by 6-foot spacing is a compromise which may be advisable for conditions not expected to produce large plants. In Michigan 10-foot by 4-foot and 10-foot by 5-foot spacings are popular, but some of the more recent plantings have rows 11 feet apart.

In laying out the planting, roadways should be provided at convenient intervals for hauling out fruit, hauling in mulch material,

spraying, etc. To provide for cross-pollination varieties should be mixed, but too much dispersal can complicate cultural and harvesting operations. A good arrangement is 2 rows of 1 variety followed by 2 rows of another variety. Where a grower wishes to use 1 variety with a minimum number of pollinators, he may plant a single row of the pollinating variety every third or fourth row, or he may plant a pollinator in every third space in every third row.

Fall planting, as early as the plants can be obtained (usually November), is recommended for western Oregon. Planting may be done, however, any time during the winter or early spring. Late spring planting, especially if followed by warm dry weather, may weaken the plants so that they make little growth the first year. Weeds should be under control before planting. Cultivating an open field is much easier than cultivating around blueberry plants. Even when mulch is used, previous weed control is recommended unless the grower knows he can depend on the mulch to smother out all weeds. Fall planting also has the advantage of allowing more root growth before buds open in the spring.

Because of its very fibrous root system, the blueberry should be planted in a well-pulverized medium. If soil is not easily pulverized, use of peat moss, leaf mold, or sawdust in the hole is recommended. Top of the root clump should be close to the soil surface if mulch is to be applied immediately after planting. Otherwise, it should be about 4 inches deep.

Fertilizing

Organic soils, ideal for blueberry growing, are high in nitrogen. To duplicate this condition on mineral soils it is necessary to use larger amounts of a nitrogen fertilizer than ordinarily used for other fruit crops. The tendency is to use too little nitrogen, with the result that leaf color is poor and growth is weak.

Ammonium sulphate is the recommended source of nitrogen for blueberries on mineral soils because it increases soil acidity and supplies nitrogen in the ammonium form. For medium- and fine-textured mineral soils, application of ½ pound of ammonium sulphate per plant per year is suggested. It should be applied in early spring on the surface in a broad ring around the plant and not in contact with stems. Fertilizer is supplied slowly to the root system as it is leached in by rain or irrigation. For coarse-textured soils (sandy or gravelly), it is safer to reduce application rate and apply two or more times during the growing season.

The fertilizer program outlined above may be begun the first year after field planting and followed each year, unless observation of the plants indicates that the rate is either excessive or insufficient.

Symptoms of nitrogen deficiency have been mentioned. Excessive amounts of nitrogen may make plants less fruitful, causing them to produce a type of growth difficult to manage and more susceptible to disease and winter injury.

Nitrogen is the only element known to be deficient in blueberry plantings on mineral soils in Oregon. Some growers wish to use a "complete fertilizer"; that is, a mixture containing nitrogen, phosphorus, and potassium. Those wishing to try a phosphorus fertilizer may mix superphosphate into the soil before planting, or apply it to soil surface just before mulching. Since potassium fertilizers are soluble, their effects may be determined easily by application on the surface around a few plants.

On organic soils, addition of phosphorus or potassium, or both, may be more important than addition of nitrogen. Complete fertilizers, such as 7-7-7 or 5-10-10, are usually recommended. The most satisfactory formulation for an area can be determined only from years of experience.

When blueberry plants show indications of mineral deficiency, one or more of the following conditions may be responsible: (1) inadequate or poor distribution of water, (2) small or weak root system due to poor drainage, insect or disease injury, fertilizer burn, or excessive compactness of soil, (3) inadequate supply of ammonium nitrogen (nitrates seem to be toxic under some conditions), and (4) inadequate supply of some other element, such as phosphorus or iron.

Pruning

Principal purpose of pruning is to regulate crop size in order to maintain plant vigor and fruit quality. Most blueberry varieties tend to overbear. An excessive fruit crop can check growth almost completely, thus seriously reducing capacity of plant to bear large crops in succeeding years. An excessive crop reduces berry size and retards their ripening.

In the nursery, and for the first 1 to 3 years in the field (depending on their growth), bushes should not be allowed to bear at all. For small plants probably the best procedure is to strip off the blossom clusters as they appear. By this method, bearing is prevented without loss of leaf surface. On older plants fruit buds can be pruned off during the dormant season. These buds are found on the weakest growth and near the tips of more vigorous growth. They are easily recognized by their size and plumpness in contrast to the small, pointed leaf buds.

When the bush is large and vigorous enough to bear a crop, only part of the fruiting wood is removed. The amount to leave depends

on variety and growing conditions, and must be learned from experience. On older bushes, cutting off or cutting back individual fruiting laterals becomes laborious. Common procedure is to remove entire stems full of weak laterals or to cut stems back to strong laterals. By this method a single cut removes hundreds of fruit buds, along with some old wood and a few leaf buds.

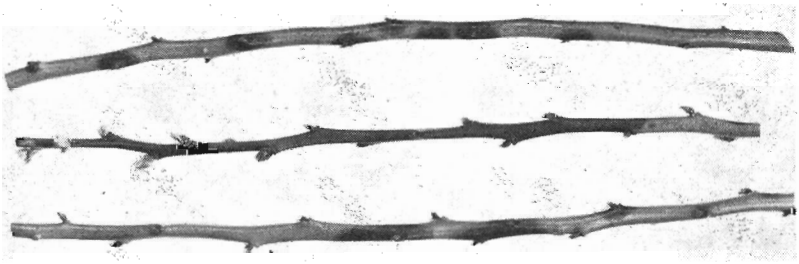
In addition to fruit buds it may be necessary to remove some vegetative wood to prevent the bush from becoming too sprawling or too high. In transplanting, if a large portion of the root system is lost, the top of the bush should be reduced so that the leaf area will not overtax the root system's capacity to supply water and nutrients.

Pruning should not be thought of as a substitute for good growing conditions. It can be used only to produce growth at the expense of fruit production or to invigorate part of the plant at the expense of total growth.

Diseases*

Common blueberry diseases of eastern United States have not been found in Oregon. Probably the virus disease, stunt, has been introduced in planting stock, but symptoms do not appear in this climate and the insect that transmits the disease does not occur in Oregon.

Bacterial canker appears first as water-soaking of 1-year-old canes, usually in January or early February, but rapidly changes to definite reddish-brown or black cankers covering only a fraction of an inch or entire length of the stem. All buds in the cankered area are killed. Sometimes, the stems are girdled and killed. In other cases



Bacterial canker.

the stem above the canker continues to grow, but may be weakened and unproductive.

Plants in the field and cuttings in propagation beds are attacked. Vigorous plants are likely to be most severely diseased. The varieties

* This section was prepared by Dr. E. K. Vaughan, Plant Pathologist, Oregon Agricultural Experiment Station.

Jersey, Atlantic, Scammel, Coville, Evelyn, and N51G are severely affected. Weymouth, June, Rancocas, Rubel, Pioneer, and Burlington are highly resistant.

All infected wood should be pruned out and destroyed as soon as practicable. In addition, susceptible varieties should be sprayed with bordeaux mixture, 8-8-100, or with Copper "A," 6 pounds per 100 gallons, about the middle of October and again in early November. A good spreader-sticker should be added to the sprays.

Botrytis blight affects growing tips, flowers, and newly formed berries. On canes, infected areas are brown or gray in color and usually extend down the cane for only a few inches. Because succulent growth is most severely affected, growers should avoid using excessive amounts of nitrogen fertilizer.

In the flower cluster, the disease appears first when corollas of the earliest flowers begin to turn brown. The fungus covers the dying flower with a dense gray powdery mass and quickly spreads to adjacent flowers and fruits, often destroying an entire inflorescence. Varieties retaining the corolla for an extended period are most susceptible—those dropping the corolla rather promptly are less susceptible.

Blighted twigs should be pruned out and burned as promptly as practicable. Both twig and blossom blight phases of the disease can be controlled by spraying with Ferbam, 1½ pounds per 100 gallons, or bordeaux mixture 8-8-100. First spray should be applied in late March, and second just prior to flowering. During cold wet seasons, a third spray may be required 2 weeks later. A good spreader-sticker should be added to the sprays.

Cane gall appears as rough, irregular, warty outgrowths along the stems. Occasionally they are found on young canes, but are most pronounced on older growth. Infected canes should be pruned out and destroyed. They should not be worked into the soil around plants. Nursery stock should be obtained only from healthy yards. Best control is through use of disease-free plants.

Insect Pests*

Black vine weevil.

Black vine weevil is the most important insect pest of blueberries in Oregon. It is one of the strawberry root weevil group. Larvae feed on plant roots and may girdle them. The legless larvae are white and have brown heads. They do their damage during fall, winter, and spring. Adults are black beetles, ⅜ inch long. They begin to emerge

* This section was prepared by Dr. R. G. Rosenstiel, Associate Entomologist, Oregon Agricultural Experiment Station.

from the soil early in June, and continue to appear during the summer. They feed at night and chew "half-circle"-shaped notches on edges of the tender leaves. Eggs are laid in July and August under clods around plant bases.

Baits have been successful for control of the smaller strawberry root weevil, but they have not been effective for the larger black vine weevil. Adult black vine weevils may be controlled (to a considerable extent) by application of malathion to plant bases or to lower foliage. Use at least 3 times between approximately July 10 and August 15.

Malathion has a short residual toxicity, and this residue is toxic to humans. Because of this, all malathion applications must be made at least 3 days before fruits are picked.

Tent caterpillars.

These pests sometimes feed on blueberry plant foliage. They also annoy the pickers. Tent caterpillars may be controlled by using malathion dust or spray at least 3 days before picking, preferably when they are feeding. They generally injure fruit trees or alders near blueberries, and defoliate trees before they move to blueberries. A spray of 3 pounds of lead arsenate or 2 pounds actual DDT per 100 gallons of water may be applied to trees, when caterpillars are small. That stops them before they get to the blueberries.

Safety precautions.

Remember: Most insecticides are poisonous and should be treated with care. Avoid getting them on fruit at times when they may cause residue problems. Store in dry, safe places away from children and pets. Observe manufacturer's precautions on the package labels to prevent accidents.

Harvesting and Marketing

Harvest season extends from the first of July to the end of August in the Willamette Valley, and is 1 to 4 weeks later in cooler areas. From 2 to 4 pickings are required for a single variety. Pickings are often made at weekly intervals, but intervals can be extended to 2 weeks and more without serious loss of fruit. The Jersey variety, which has a long harvest period, has been successfully harvested in Corvallis with 3 pickings: 2 heavy pickings about 12 days apart, and a cleanup of the final 10 per cent of the crop 2 to 3 weeks after the second picking. The intervals between pickings depend on weather, labor supply, and extent of bird damage.

Picking is done by cupping both hands under a cluster and running fingers lightly over it to shell off the ripest berries. Fruit is

Many of the larger growers have their packing facilities in the field. In this shed, carriers are unloaded on the right end of the table, and packed crates are removed from the left. Girls in the center are using a special tool to apply cellophane covers and rubber bands to the hallocks.

placed in boxes or cans held at a convenient height. Fresh fruit may be sold in the boxes without further handling, or may be culled and graded at the packing shed. Boxes are filled heaping full, and covered with sheets of cellophane held in place with rubber bands.

Local markets in Oregon are still absorbing a large part of the fresh blueberry crop at prices above those paid for other berries. If plantings continue at the present rate, the time will come when growers must either reduce prices (relative to other prices), or divert part of the crop for shipping and processing.

Shipments of blueberries from Washington to California have been made, but returns have sometimes been disappointing. This huge potential market might be developed, however, if satisfactory transportation at reasonable cost can be arranged. Processing blueberries is now a well-established business in Michigan and Washington, and serves as a safety valve to prevent glutting the fresh fruit markets. The product must compete with wild blueberries from Maine and with other kinds of berries.

Oregon growers may experience some marketing difficulties when there is too much fruit for local markets but not enough for processing. During this transitional period, growers may find it advantageous to cooperate in pooling surplus fruit and in developing new markets. There are two grower organizations in the Northwest: The Oregon Blueberry Growers' Association, and the Pacific Northwest Blueberry Growers' Association, with headquarters in Washington.

Growing Blueberries at Home

The foregoing discussion applies to commercial blueberry production. The home gardener may be willing to spend more time and effort on soil preparation than could be justified for a business enterprise. He may also be less concerned about yield and other factors affecting cost of production.

Blueberries can be expected to survive and produce some fruit in any garden in western Oregon and in some of the fruit-growing districts of eastern Oregon. It may be necessary in some cases to mix sawdust or peat moss with the soil, and to use sulphur or aluminum sulphate in addition to ammonium sulphate. Soil conditions favorable to rhododendrons and azaleas also are favorable to blueberries. Your county agent is familiar with soils in your area and can advise on methods of growing acid-loving plants.

References

1. Darrow, G. M. and R. B. Wilcox. Blueberry Growing. U. S. Department of Agriculture Farmer's Bulletin No. 1951. 1951.
2. Rosenstiel, R. G. Strawberry Root Weevil Control. Oregon Agricultural Experiment Station Circular of Information No. 546. 1955.
3. Schwartze, C. D. and A. S. Myhre. Blueberry Propagation. Washington Station Circular No. 124. 1950.