



Commercial Blueberry Production in Oklahoma

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Blueberries (*Vaccinium* spp.) can be grown in most regions of Oklahoma. This crop provides many healthful dietary benefits, including vitamins, minerals, and components that may help prevent age-related diseases and cancer. There are three types of blueberries to consider depending on where you live in the state. The northern highbush is better adapted to the northern part of the state (Tulsa and north), requiring cooler nights during maturation to produce a flavorful fruit. Northern highbush blueberries require about 800 hours of chilling below 45°F for effective growth and development. This type of blueberry is not as tolerant of high daytime temperatures during the summer months as southern highbush and rabbiteye blueberries and the plants will decline and lose productivity in these conditions.

In southern Oklahoma (Oklahoma City and south), southern highbush or rabbiteye cultivars should be grown. Southern highbush blueberries are hybrids between northern highbush cultivars and blueberry species native to the southern U.S. They combine the high fruit quality of northern highbush with the heat and disease tolerance of the native species. Central Oklahoma (between Tulsa and Oklahoma City) is the transition zone where all types of blueberries can be cultivated depending on site selection and cultural practices, although southern highbush and rabbiteye are most recommended. Southern highbush blueberries require an intermediate amount of chilling between the northern highbush and rabbiteye. Rabbiteye cultivars vary in their chilling requirements, some as little as 150 hours and other up to 600 hours. Rabbiteye blueberries usually ripen their crop later than the northern highbush or southern highbush cultivars.

Cultivar Selection

Cultivar selection is very important for blueberries, particularly in relation to the intended fruit use. Due to the variable ripening habit, it is possible to harvest fresh fruit from the end of May until late July by using more than one cultivar. Each cultivar should be harvested at least every seven days and preferably more often. A minimum of four separate harvests to get all of the fruit will be necessary.

Northern Highbush (Northern and Central Oklahoma)

'Duke' – A very early ripening type that blooms relatively late. It has an upright and open growth habit. The fruit is medium-sized and firm with good flavor. It ripens mid to late May in central Oklahoma.

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'Collins' – A productive cultivar with medium-sized fruit that ripens after 'Duke'. The fruit has good flavor. Maintenance of plant vigor in older plantings has been a problem in some instances.

'Blueray' – The fruit is large, dark blue, and firm with good flavor, ripening in mid-season. Consistently productive, but may overproduce if not pruned regularly. It has an upright-spreading growth habit and is very hardy. Heavy bearing canes tend to droop into the row middles.

'Bluecrop' – The most widely grown cultivar in the world. This cultivar produces numerous medium to large, firm berries ripening in midseason. It tends to overproduce if not pruned regularly. The berries have good flavor.

'Elliot' – Plants are very productive. It is considered the latest of all cultivars. Its berries are not fully ripe when they first turn blue. Fruit is medium-sized and has a mild flavor, but is very firm and stores well. The plant is upright and somewhat bushy.

Southern Highbush (Southern and Central Oklahoma)

'Legacy' – Ripening time is early June in central Oklahoma. The fruit is medium in size with superior flavor. The plant is vigorous with upright growth. Yields are high. Budbreak and bloom are earlier than 'Summit' or 'Ozarkblue' so this cultivar should be grown on superior sites only.

'Summit' – Summit's area of adaptation is similar to 'Ozarkblue'. The fruit is large and ripens early to mid-June in central Oklahoma. The flavor is sweet and flavorful. Yields have been high in research trials; 8 to 10 pounds per plant on four- and five-year old plants. The plant has moderate vigor. Budbreak and bloom are earlier than 'Ozarkblue'. It has a consistent crop.

'Ozarkblue' – 'Ozarkblue' was released from the University of Arkansas in 1996. 'Ozarkblue' is adapted to the traditional rabbiteye production areas of Oklahoma. The fruit is large and ripens in mid-June in central Oklahoma. The flavor is sweet

and has low acid. Yields have been very high in research trials; 15 pounds per plant on four- and five-year-old plants. The plant has moderate vigor and is very erect. 'Ozarkblue' breaks bud and blooms later than other southern highbush and rabbiteye cultivars so it is less prone to spring frosts. It produces consistently.

Rabbiteye (Southern and Central Oklahoma)

'Climax' – Ripens early over a short period. Fruit size is medium and flavor is good. Growth is upright and spreading. Frost risk is rather high. Plant with 'Brightwell' or 'Premier'.

'Premier' – Ripens early. Growth is vigorous and upright. The fruit is large with excellent quality. The plant is very productive. Plant with 'Climax' or 'Brightwell'.

'Brightwell' – Ripening occurs mid-season and over a long period. The fruit is large with excellent quality. The plant is very productive with vigorous and upright growth. Plant with 'Climax' or 'Premier'.

'Tifblue' – It ripens from mid to late season. Berry size is small to medium and plants are very productive. An older, traditional cultivar that is still common in commercial production. Plant with 'Premier' or 'Brightwell'.

Site Selection

Blueberries require a site free of bermudagrass and Johnsongrass with good air drainage to prevent cold injury and frost damage. An acidic soil that is well-drained with medium to low fertility is also very important. Blueberries need a site in full sun. In addition, blueberries require irrigation for plant survival, optimum growth, and fruit production. Ultimately, non-irrigated highbush blueberries will die, the only question is when this will occur. Non-irrigated rabbiteye plants may survive, but will have less yield and poor fruit quality in most seasons.

Although blueberries are not as frost susceptible as some other crops, frost pockets should be avoided. Try to plant on a gentle slope or well-drained, level, high ground. A location on a slope may be subject to frost damage if surrounded by trees. A site on a slight, northward facing slope helps prevent spring frost injury and gives some protection from drying southwest winds during the summer.

Surface and internal soil drainage are essential since standing water may kill plants, and poorly drained soils are conducive to soilborne disease problems. Blueberries require almost continuous optimum soil moisture conditions. This is more likely obtained from a loam or sandy loam top soil and a loam or clay loam subsoil. Gray and mottled subsoil indicates poor drainage. Poor drainage is often a severe problem even on a slope. Blueberries should be planted on a raised bed on most soils types to improved water drainage. This can be accomplished by mounding up the planting row from several inches to a foot high and several feet wide depending on the potential for poor drainage. Plants should be set no deeper than what they were grown at in the pot or in the nursery.

The desired pH of soils artificially acidified for cultivated blueberries is in the range of 5.0 to 5.2. A high pH soil to be planted to blueberries should be reduced to about pH 5.4 with the initial sulfur treatment. This should be done at least

six months prior to planting. To acidify sandy soils, sulfur is recommended at the rate of 1 to 1.5 pounds per 100 square feet for each full point the soil tests above the desired level. On heavier soils (those with high clay content), use two to four lbs/100 sq. ft. (Table 1). Once proper acidity has been established, it can usually be maintained through annual use of an acidifying fertilizer, such as ammonium sulfate. Chlorosis of the blueberry foliage often occurs when the pH is too low or too high. It appears on the younger leaves with yellowing between the veins and the veins remaining green.

Table 1. Pounds of sulfur per 100 square feet to lower soil pH one unit.

<i>Soil Texture</i>	<i>lbs/100 sq.ft.</i>
Sand	1.0 to 1.5
Loam	2.0 to 3.0
Clay	3.0 to 4.0

Irrigation

Irrigation is essential for blueberry growth. A large amount of irrigation water that contains little salt or lime must be available for a successful planting. It is helpful if the pH of the irrigation water is close to 5.0 as this prevents the pH of the soil from rising to a higher pH. The root system of the blueberry is very small, shallow, and has no root hairs to facilitate water uptake. The highbush type can easily be killed by dry weather. During hot weather, mature blueberry plants need a total of 1.5 to 3 inches of water every 10 days from rainfall or irrigation. Daily irrigation beginning about noon may be effective for helping the shallow root system cool and improve penetration into the soil. Current recommendations are for each plant to receive 6 to 10 gallons of water per day during hot summer days. Keep in mind that these requirements will vary according to the weather. Young plants require sufficient irrigation to keep the soil moist in the root zone under the plants. Mulching helps conserve moisture but does not take the place of irrigation. Make arrangements and plans for irrigation before planting the crop. Rabbiteye cultivars are much more drought tolerant than northern and southern highbush cultivars. However, healthy bushes and maximum yields can only be accomplished with adequate irrigation. Water stress (too much or too little) reduces fruit size and yield. It may also reduce flower bud formation and delay ripening. Leaves of flooded or drought-stressed plants become dark red with brownish margins and often die.

Site Preparation

Take representative soil samples before planting, and add the necessary soil amendments during land preparation. Apply wettable sulfur before planting. Other forms of elemental sulfur such as "flowers" of sulfur require many months to react and acidify the soil. Although a quick soil acidifier, aluminum sulfate is only about one-fourth as effective as wettable sulfur and several light applications are needed to avoid salt damage. Ferrous sulfate also reacts quickly to lower the soil pH but is less effective than aluminum sulfate. Severe manganese (Mn) toxicity problems may occur at some sites if the pH is lowered too much.

Complete any smoothing, terracing, or soil moving

procedures as far in advance before planting blueberries as possible. Where substantial cuts are considered, the remaining soil must be of sufficient depth and condition to support the plants. Green manure crops and moderate amounts of manure or litter may benefit these spots. Leguminous crops such as clover can add nitrogen and organic matter to the soil, whereas other cover crops can be used to improve soil tilth (e.g. buckwheat, sorghum-sudangrass, or millet). Chicken litter must be applied well in advance of planting to prevent plant injury due to excessive soil salt concentration.

New Plants and Planting

The plants in a new planting represent a large investment in time and money and they should be well cared for before being put into the ground. If planting bare root plants, store in the refrigerator at 33 to 36°F when they arrive, and then plant the following day if possible. Another option is to open a trench in the soil, space the plants along the side of the trench, and cover the roots with soil with the tops exposed until planting time. Potted plants should also be protected from freezing or drying. Do not allow the plant roots to dry out on planting day. Keep the bare root plants (a few at a time) in water or a shaded plastic bag (be careful of heating on sunny days) until planted to prevent drying.

Blueberries can be planted in the fall or spring; however, spring is the preferred time with 2-year-old container grown plants. They should be from 12 to 16 inches tall for best survivability. Ideally, two or more cultivars should be planted to improve pollination because blueberries are only partially self-fruitful. So, the inclusion of two or more cultivars that bloom about the same time will dramatically improve fruit set and, ultimately, yield. Cultivate the area before planting. Use a shovel or open a furrow with a turning plow for a convenient size hole. Dig the holes and open the planting furrows as needed to prevent drying the soil. Place plants 5 feet apart within the row and have a spacing between rows of 8 to 10 feet. Place one-half gallon of moist peat moss in the bottom of the furrow or hole for bare root plants. Spread the blueberry roots out laterally on the peat moss to give the same depth as grown in the nursery. Cover the roots with a mixture of the remaining one-half gallon of peat moss and soil, almost filling the hole. Firm the soil around the roots and finish filling the hole with the peat moss mixture. The newly planted blueberries should be watered immediately. Prune bare root plants back one-half at planting. For container plants, remove from the container, and if root bound, make at least four vertical slices through the root mass. Plant so the top of the potting mix is at the soil surface. Surround the plant ball (under and on the sides) with a generous amount (approximately one gallon) of a peat moss and soil mixture. Remove flower buds to promote vegetative growth and plant development.

Maintaining the Planting

Fertilizing and Mulching

To prevent damage to the root system, blueberries should not receive fertilizer at planting or after planting until growth has started. Unless soil tests indicate a different fertilizer requirement, apply 10-10-10 at two tablespoons per plant as a band in a 12-inch radius circle; after six weeks apply one

tablespoon ammonium sulfate in the 12-inch radius circle. Do not apply the fertilizer directly to the base of the plant, but rather uniformly within the dripline around the plant.

Research indicates that excessive phosphate fertilization may be undesirable for blueberries. Continue the use of mixed fertilizers only if the soil test indicates a need. Otherwise use nitrogen fertilizer only, three applications at six-week intervals in the second and subsequent years. Apply the fertilizer in a uniform application over the mulch. Adjust fertilizer rates according to plant response. Ammonium sulfate is recommended if soil pH is above 5.2. Use ammonium nitrate or urea in the 5.0 to 5.2 range. Urea is preferred if the pH falls below this range, but the use of calcium nitrate fertilizer may be preferable to the urea application when the pH is below 4.8.

Experience and research show that mulching to 5 or 6 inches is essential for new blueberry plantings. The plant roots are so shallow and restricted that any cultivation can damage them. The blueberry is also seriously affected by wide fluctuations in moisture and high soil temperatures. Mulch reduces summer soil temperature, conserves moisture, suppresses weeds and unwanted suckers, promotes growth of the root system, and helps prevent winter injury. An inch or more of mulch must be replaced each year. For small plantings almost any mulching material can be used except leguminous materials such as alfalfa hay. Fresh (green) mulching material should not be used due to the possibility of plant injury. However, hard and softwood sawdust or chips are generally the most abundant materials. Pine needles or bark are also suitable mulching materials. Material aged for at least one year should be used. Mulch should be applied as soon as possible after planting to prevent heaving of fall-planted, or drying of spring-planted, plants.

Pruning

Pruning of blueberries is essential to produce large, early berries and vigorous plants. Remove the large flower buds at the tips of the shoots the first and second seasons, especially on small plants, to allow a larger, heavier-producing plant to develop (Figure 1). After the second growing season, remove a portion of the canes and fruiting twigs to shape the plant and reduce the excess flower buds. Remove any low, sprawling, or weak branches and cut back any excessively tall canes. Thin out the centers and encourage spreading of the upright cultivars and make cuts to encourage more upright growth of sprawling cultivars. Tipping can be done to maintain a convenient plant height. It is also important to maintain clean pruning equipment, as diseases can be spread from one plant to another in the pruning process. Therefore, follow pruning of diseased stems with sanitation of the pruning equipment before moving on to non-diseased plants with a 10 percent chlorine bleach solution. Do not prune if heavy dews or any rain is predicted because the damp conditions are favorable for disease development.

Blossoms and fruit occur on shoots and buds produced the previous season. Thus, moderate annual growth is encouraged. Regulate the crop size to allow for growth needed to produce the next crop. Too many blossoms and fruit weaken the plant and result in a large crop of small berries maturing late over a long period of time. Young plants especially may be stunted by overproduction. Remove weak fruiting, twiggy growth as it develops. Old canes or shoots lose fruitfulness over time. Therefore, starting about the fifth year, remove one

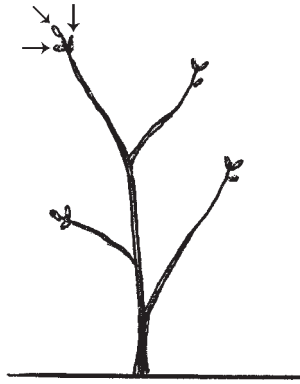


Figure 1. Flower buds form at the ends of the shoots (arrows). A few will be present on the newly established plants and more will be present next spring. All should be removed the first two years to encourage plant growth.

of the largest, oldest canes in the middle of the plant for every six canes present on the plant, in addition to the other required pruning. This type of plant thinning will promote vigor, allow sunlight penetration into the plant, and also improve airflow which aids in disease prevention. Older blueberry plantings should contain about equal numbers of one-, two-, three-, four-, and five-year-old canes.

Harvest

Blueberries should not be allowed to bear fruit until the third year of growth. Although blueberries will flower early in their development, allowing them to bear fruit is detrimental to the long-term health of the plant. Plants allowed to bear fruit too early may set many fruit, but grow few leaves to support them. If the developing fruit is not removed, the plants may die from stress.

Maturing blueberry fruit enlarge, develop a deep blue-black color and soften slightly. When the berries appear ripe, a "taste test" is the best indicator of when to pick. Some cultivars will retain the stem on the fruit, while others do not. If the stem does not come off with the fruit, the stem scar on the fruit may be dry or wet (torn open). Dry stem scars are less susceptible to infection by fruit rots after picking than wet stem scars.

Harvesting of fruit should be done during the coolest part of the day, preferably morning. The berries should be refrigerated soon after harvest. Refrigerated berries will usually remain in good condition for several days if they are handled properly.

Bird Damage to Blueberries

Birds can be a serious pest of blueberries. Blackbirds and songbirds can do extensive damage without some form of control. Noise making devices that produce loud, variable noises have been tried, but the results are erratic and often disappointing. In addition, noise making devices may not be allowed in urban or suburban areas. Therefore, some form of netting that excludes birds is preferred. A permanent, quonset-type, bird-excluding cage can be constructed of 1.25 inch, thin-walled galvanized pipe covered with 1-inch poultry wire. Allow at least 6 feet from the edge of the cage to the nearest row and at least 8 feet between rows. Another type of cage might be made from 10-foot treated posts buried 3 feet in the ground that support cross-wires and bird netting. Bird netting can be stored when not in use and can last several years.

Rodent Damage and Control

Although mulch is essential to blueberry establishment, mice (voles) are a serious problem in many plantings. A continual control program should be initiated at the first sign of infestation. Mice feed on grass and weeds in the summer, but on blueberry roots during the winter. Treat in late fall before the grass and weeds have died from frost. Check with your local county extension educator for the latest recommendation for rodent control.

Diseases and Insect Pests

Blueberries can be grown on a small scale with little or no use of fungicides and insecticides. Major blueberry insect pests and diseases found in other blueberry production areas of the U.S. have not yet become established in Oklahoma. However, some common diseases such as phytophthora root rot or stem cankers can occur. Also, aphids, plum curculio, blueberry maggot, and Japanese beetle are potential insect problems. Contact your local county extension educator for the latest information on blueberry diseases, insect pests, and control measures.

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