

# Commercial Blueberry Production Guide for Alabama

Three types of blueberries appear to be adapted to cultivation in Alabama. The most prominent of these is the rabbiteye (*Vaccinium ashei*). The northern highbush types (*Vaccinium corymbosum*) may be adapted to certain cool sites in northern Alabama. Additionally, a new type of blueberry known as the southern highbush has been recently developed from the interspecific hybridization of the native southern species *Vaccinium darrowi* (Darrow's evergreen) with rabbiteye and highbush species.

The low-chill requirement of certain of these new southern highbush cultivars of only 200 to 300 hours at temperatures of 45°F and lower has made it possible to extend the blueberry industry as far south as central Florida. Most highbush cultivars (varieties) require more chilling hours than rabbiteye plants require for regular leaf and bloom development (650 to 900 hours for highbush versus 350 to 650 for rabbiteye).

The low-chilling southern highbush cultivars require 300 to 600 chilling hours for proper development. Figure 1 shows the approximate chilling hours that accumulate in Alabama from about October 1 through February 28. Northern highbush types are more winter-hardy than rabbiteye, and their flower buds can survive temperatures of -22° to -31°F while in a dormant condition. Most dormant rabbiteye flower buds are injured by temperatures lower than -12° to -15°F.

Potential yields vary among the different types of blueberries, although climatic and cultural variations often are more important than genetic differences. Mature rabbiteye plantings have the potential to produce more than 10,000 pounds of fruit per acre, but commercial production levels are significantly lower. A properly managed farm where frost protection is practiced should average 8,000 to 9,000 pounds per acre. In northern states highbush plantings can achieve yields of more than 15,000 pounds per acre, but the commercial norm is closer to 4,000 to 5,000 pounds per acre. The yield potential of a mature southern highbush planting has not been established at this time.

Fruit size varies among blueberry types and is strongly influenced by environmental conditions. Highbush cultivars have the largest fruit (1.5 to 2.5 grams), while rabbiteye fruit average 1.2 to 1.5 grams

per fruit. Rabbiteye fruit generally have a tougher skin and are seedier than highbush. The fresh fruit quality of rabbiteye cultivars is generally comparable to that of southern or northern highbush cultivars, and they tend to have superior shelf life. Additionally, the flavor of rabbiteye fruit holds after peak ripeness and does not go flat.

Other differences include the natural stature of the plant, with cultivated highbush types naturally reaching 6 to 12 feet, while the more vigorous rabbiteyes may grow to be nearly 20 feet tall. Cultivated highbush plantings are typically maintained between 6 and 8 feet by pruning and rabbiteye plantings below 10 feet (preferably about 6 feet for hand harvest). Other significant differences are that rabbiteye plants appear to be more tolerant of drought and heat than highbush, as well as being more resistant to diseases and insects. Rabbiteye plants are quite adaptable to upland mineral soils with low organic matter content, while southern highbush are somewhat adaptable, and northern highbush are poorly adapted.

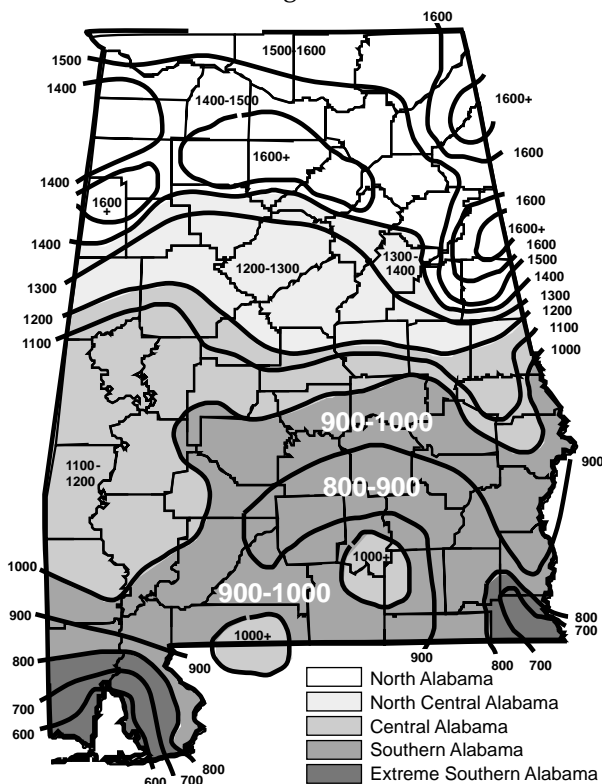
Southern highbush cultivars do offer several important advantages such as the fact that they ripen 1 to 3 weeks earlier than the earliest ripening rabbiteye cultivars. The fruit is as large and often larger than rabbiteye fruit and may have other attractive characteristics such as being thinner-skinned, which makes it more desirable for fresh and processing markets. The plants are less vigorous and do not become as large as rabbiteyes. They are lower yielding and are probably more susceptible to diseases and insects. The low chilling requirement of the southern highbush promotes very early flowering and much greater danger of damage from late spring frosts. Currently the greatest motivation for growing southern highbush cultivars is the higher price for early fruit.

In general, the rabbiteye is by far the best type of blueberry adapted to Alabama. The northern highbush type may be grown in the northern third of the state and on higher elevations of the Piedmont area. There is currently very limited experience with southern highbush types in the state, and it is recommended that growers make small test plantings before considering larger acreages.

## CULTIVAR SELECTION

Proper cultivar selection is essential to the successful and profitable operation of any blueberry growing enterprise. Cultivars should be selected with regard to their suitability for the intended marketing outlet and method of harvest. Some cultivars are not as adaptable to machine harvesting because fruits are harder to remove from the bush, are too soft (resulting in excessive bruising), or do not have a concentrated ripening period. In other cases, certain cultivars may not be suitable for fresh market sales because fruits are too soft or may have a wet stem scar, which makes them susceptible to rapid postharvest decay. In some instances, cultivars that do not ship well may be a good choice for pick-your-own operations because they have excellent flavor or extend the picking season, while others may possess superior qualities for use as frozen fruit.

Blueberry cultivars differ in characteristics such as harvest season, yield, annual cropping consistency, fruit quality (including shelf life), amount of pruning required, disease resistance, winter hardiness, attractiveness to bees, regional adaptation (chilling requirement), and tolerance to drought, heat, and flooding. When such differences are known (Tables 1 and 2), they should be considered in selecting cultivars. Not all of these characteristics have been cataloged for existing cultivars, so it is often wise to test preliminary choices in small plantings before committing larger areas for commercial production in a given region or locality. Figure 1 shows the typical winter chilling hour accumulation for various regions of the state.



**Figure 1.** Ten-year average for winter chilling (hours at or below 45°F from October 1 through February 15 for the period 1984-85 through 1993-94).

Cultivars may be selected based on time to harvest. However, traditionally recommended early flowering cultivars such as 'Climax' may suffer crop losses from late spring frosts. Other cultivars that have gained good acceptance are 'Tifblue,' 'Premier,' and 'Brightwell.' 'Powderblue' and the late season cultivar 'Centurion' have also performed well in the South.

All southern highbush cultivars are currently under evaluation and should be planted on a trial basis only. Northern highbush cultivars are also only experimental in Alabama, but cultivars with stem canker resistance such as 'Bluechip,' 'Harrison,' or 'Bounty' are suggested for consideration. Late blooming, early ripening cultivars like 'Duke' and 'Spartan' are being evaluated. A complete list of Northern Highbush cultivars and their characteristics is available from the Department of Horticulture, Auburn University.

## POLLINATION AND RIPENING

Most rabbiteye cultivars are either partially or completely self-unfruitful and therefore require the transfer of pollen to one cultivar from a different cultivar for adequate fruit set. The cross-pollination results not only in increased fruit set, but, for some cultivars, also in an increase in berry size, seed content, and earlier ripening of berries. Some early flowering rabbiteye cultivars can also be interplanted with certain southern highbush cultivars for cross-pollination. In designing a planting it is important to interplant pollen-compatible cultivars that bloom together. Rows should consist of single cultivars for ease of harvesting, but a different cultivar should be planted in at least one of the adjacent rows (no more than two adjacent rows of the same cultivar). Blueberry flowers remain receptive to pollination for about 1 week after opening. Each rabbiteye flower bud contains six to ten flowers. From 40 to 60 percent of the flowers typically set and produce harvestable berries. In rabbiteye blueberries in Alabama, cross-pollination is accomplished mostly by solitary bees that nest in the ground. Honeybees are not particularly effective in cross-pollinating rabbiteye cultivars. Because of the structure of the flower, the honeybee's short tongue can't get to the nectar, so it tends to rob nectar through holes in the flower petals made by carpenter bees. Pollen that would have rubbed off inside the flower stays on the bee. Fruit set can be chemically induced in large planting blocks that have insufficient native bee populations by spraying the hormone gibberellic acid when most of the flowers are elongated but not yet open. Make a second application 10 to 14 days later. Spray in late evening to maximize the drying time and absorption of the chemical.

Most solid block highbush plantings will produce satisfactory crops when only one cultivar is included, but pollination by other cultivars will generally result in increased yields, larger fruit, and earlier ripening. A planting design in which a row of one cultivar is alternated with a row of another cultivar should encourage cross-pollination; place-

**Table 1. Rabbiteye Blueberry Cultivar Characteristics**

Cultivar	Season	Size	Color	Scar	Firmness	Flavor	Plant vigor	Yield	Chill hour requirement	Origin
Aliceblue	4	8	8	7	8	8	9	6	350-400	Florida 1977
	Comments:	Needs annual pruning, has fruit set and blossom rot disease problems, not recommended for shipping, plant with Beckyblue. Suggested for trial use in South Alabama								
Bonita	4	8	9	9	9	9	9	9	350-400	Florida 1985
	Comments:	Suggested for PYO and fresh fruit shipping suitable for South Alabama, plant with Beckyblue, fruit are tart for several days after turning blue. Excellent fruit quality. Suggested for trial use in South Alabama								
Beckyblue	4	8	8	9	9	8	8	8	300-400	Florida 1977
	Comments:	Blooms early, can be mechanically harvested, plant with Climax or similar early flowering cultivars. South Alabama only. Excellent fruit quality.								
Climax	4	8	8	9	10	8	8	8	450-500	Georgia 1974
	Comments:	Has concentrated ripening, may be harvested in two pickings. Excellent for mechanical harvesting for fresh market.								
Premier	5	10	9	10	8	10	9	9	600-650	N. Carolina 1978
	Comments:	Limber young canes may not support fruit load, good disease resistance, can be mechanically harvested for fresh market. Very good fruit quality.								
Brightwell	6	9	10	9	9	9	9	9	550-600	Georgia 1983
	Comments:	Ripens over a short period, suggested replacement for Woodard, disease resistant.								
Woodard	6	8	9	8	6	7	7	8	350-400	Georgia 1960
	Comments:	Tart until fully ripe, soft fruit. Fair quality fruit.								
Chaucer	5	8	8	7	6	8	9	9	350-400	Florida 1985
	Comments:	Suggest for PYO only, has wet picking scar. Fair quality fruit. Trial only.								
Bluegem	6	8	10	9	9	6	9	6	350-400	Florida 1970
	Comments:	Good fruit retention, 90% of fruit can be taken in a single picking, ideal for mechanical harvesting, may not be well-adapted to Alabama. Susceptible to Phytophthora root rot in locations that are not well-drained. Trial only.								
Briteblue	6	8	9	9	9	8	9	8	450-600	Georgia 1969
	Comments:	Berries easily handpicked because berries are produced in clusters, can be mechanically harvested. Fruit quality fair. Harvested fruit has many attached stems. Poor plant growth. Not recommended.								
Tifblue	6	9	9	10	9	9	10	10	550-650	Georgia 1955
	Comments:	Berries are very tart until fully ripe, berries cling to plant until fully ripe facilitating both hand and mechanical harvesting. Leading cultivar in the South. High yielding and dependable.								
Southland	6	8	8	9	8	8	8	8	500-600	Georgia 1969
	Comments:	Must be fully ripe before harvesting, skin may toughen late in the season, may come into full production later than other cultivars. Fair fruit quality.								
Bluebelle	6	7	9	9	7	8	8	8	450-500	Georgia 1974
	Comments:	Good PYO choice due to extended harvest, not recommended for shipping or processing, berries do not separate easily resulting in torn or wet stem scars.								
Delite	7	9	7	9	8	10	8	8	500	Georgia 1969
	Comments:	Berries accumulate adequate sugar content (not tart) before reaching optimum color maturity, may have blueberry rust disease problems. Fair to good quality fruit. Very cold tender, not recommended.								
Baldwin	7	10	7	9	9	9	9	8	450-500	Georgia 1985
	Comments:	Suggested for PYO where late season fruit is desired, not recommended for fresh market harvest, ripens over a long period. Home use.								
Choice	7	8	9	8	8	9	9	8	550	Florida 1985
	Comments:	Suggested for PYO and shipping, resistant to leaf diseases. Good quality berry. Trial only.								
Powderblue	7	8	10	10	9	9	9	9	600-650	N. Carolina 1978
	Comments:	Resistant to foliage diseases, suitable for mechanical harvest for fresh market, may crack less in wet weather than Tifblue, holds well on plant. Attractive good quality fruit.								
Centurion	8	9	8	9	8	9	8	8	600-650	N. Carolina 1978
	Comments:	Late bloom period helpful in avoiding spring frost damage. Mainly PYO or home use because of late ripening.								

Season: 1 (earliest) to 10 (latest); color 1 (dark) to 10 (light); other characteristics: 1 (poorest) to 10 (best)

**Table 2. Southern Highbush Blueberry Cultivar Characteristics**

Cultivar	Season	Size	Color	Scar	Firmness	Flavor	Plant vigor	Yield	Chill hour requirement	Origin
Sharpblue	1	8	7	6	8	8	5	7	300	Florida 1976
	Comments:	Resistant to stem canker, leaf disease may be a problem, suitable for PYO and local markets, interplant with Floridablue. Fair to good fruit quality. Not recommended.								
O'Neal	1	10	8	10	10	10	6	8	400-500	North Carolina 1987
	Comments:	Blooms over an extended period. Excellent fruit quality. Not adapted to machine harvest. Trial only.								
Avonblue	1	10	9	9	9	9	5	7	400	Florida 1977
	Comments:	Has good overall berry quality, produces many flower buds and must receive annual pruning to ensure large fruit size. Adapted to mechanical harvest. Not recommended.								
Georgiagem	2	8	8	9	9	9	6	8	400-500	Georgia 1986
	Comments:	Stem canker and blight may be a problem, requires well-drained site, small dry picking scars make fruit good for fresh market. Trial only.								
Gulfcoast	2	8	8	9	9	9	7	8	400-500	Mississippi 1987
	Comments:	Good fruit quality. Stems may adhere to fruit. Stem scar tearing may be a problem. Trial only.								
Cooper	2	9	8	9	9	9	6	8	400-500	Mississippi 1987
	Comments:	Stem canker may be a problem. Good fruit quality. Trial only.								
Cape Fear	3	10	9	9	9	8	6	10	500-600	North Carolina 1987
	Comments:	Fair fruit quality. Tolerant to stem blight. Trial only.								
Floridablue	2	9	8	8	8	8	5	6	300	Florida 1976
	Comments:	Difficult to propagate and grow, suitable for PYO and local markets, interplant with Sharpblue. Very good fruit quality. Not recommended.								
Blue Ridge	3	9	9	6	9	8	6	8	500-600	North Carolina 1987
	Comments:	Susceptible to stem canker, tolerant to stem blight, fruit may be tart, suggested for PYO only. Excellent fruit quality.								
Misty	1	8	8	9	8	8	8	8	300-400	Florida 1989
	Comments:	Also called 'Challenger.'								
Reveille	2	7	9	9	9	8	7	7	500-600	North Carolina 1990
	Comments:	Trial only.								
Bladen	2	7	9	9	8	8	8	7	500-600	North Carolina 1993
	Comments:	Trial only.								
Magnolia	2	8	8	9	9	8	6	8	500-600	Mississippi-USDA 1995
	Comments:	Compact growth habit. Blooms about 10 days later than Climax.								
Jubilee	2	8	8	9	9	8	7	8	500-600	Mississippi-USDA 1995
	Comments:	Firm fruit provides excellent shelf life.								
Pearl River	3	9	6	9	9	8	7	9	500-600	Mississippi-USDA 1995
	Comments:	Highbush x Rabbiteye hybrid and may require cross-pollination with SHB cultivars. Fruit quite dark. Blooms about 2 weeks later than Climax. Escapes spring frost well.								

ment of one strong bee colony per acre is recommended to further ensure it. Honeybees have definite preferences among blueberry cultivars, and more hives will be needed if bees appear to be neglecting flowers of certain unattractive cultivars. Timing the placement of hives is important; honeybee colonies should be placed in the field when 15 to 20 percent of the flowers have opened. A good commercial highbush blueberry crop is possible when at least 80 percent of the blossoms set fruit.

Cultivars may be selected with regard to the ripening season. Southern highbush cultivars are in full bloom about the same time as early rabbiteye cultivars, but, because of their ability to more quickly mature and ripen their fruit, they can be harvested 2 to 3 weeks earlier than the earliest ripening rabbiteye cultivars.

In general, the fruit of rabbiteye cultivars is mature 82 to 90 days after corolla drop (petal fall). The length of the harvest season of a single cultivar is typically 3 to 6

weeks. The length of the total harvest season may be extended by 3 weeks or more by choosing both very early and very late ripening cultivars. The earliest highbush cultivars start to ripen about 60 days after blossoms appear, while late-ripening cultivars may take 100 days or more. Harvest season length ranges from 2 to 5 weeks among individual highbush cultivars, and it may total 9 weeks from earliest to latest cultivar. Early ripening cultivars are economically attractive because earlier fruit receives higher prices in the marketplace. An important disadvantage associated with these cultivars is a corresponding early bloom period, which greatly increases the chance of crop loss from late spring frosts. When early ripening or flowering cultivars such as 'Climax' or southern highbush types are planted, an overhead sprinkler irrigation system for spring frost protection may be essential to prevent crop losses. Figure 2 shows the average date for the last 32°F freeze in the spring.

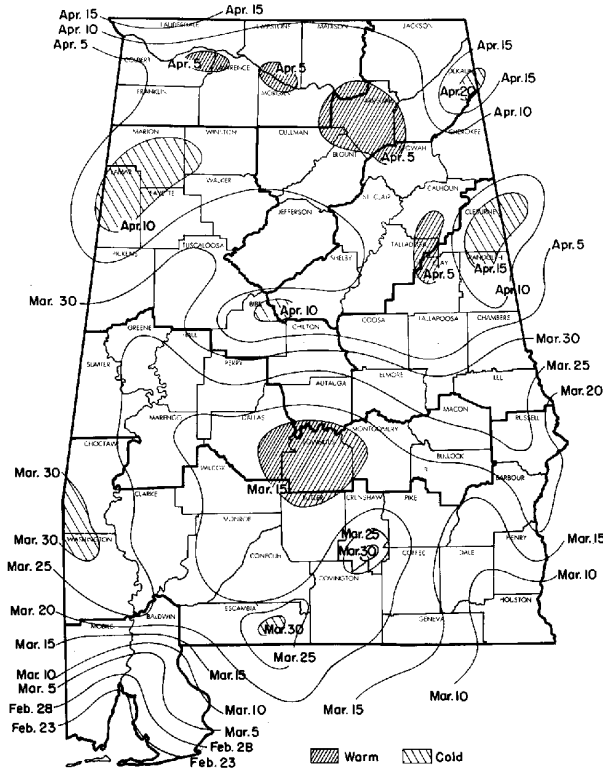


Figure 2. Mean date of last 32°F freeze in the spring

## SITE LOCATION

Good location selection is critical in determining the success of a commercial blueberry planting. Soil and climatic, economic, and marketing factors must all be considered. A careful site evaluation prior to planting is critical for the successful commercial production of blueberries. A soil test and irrigation water analysis should be conducted well in advance of planting to confirm the suitability of the proposed planting location.

The more critical factors in site selection are

- Soil type, including texture, depth, surface, and internal drainage
- pH of native soil
- Elevation of the site with respect to surrounding topography and movement of cold air
  - Availability of water for irrigation
  - Full exposure to sunlight

Rabbiteye blueberries will grow well on various soil types but do best on light, well-drained soils with a soil pH between 4.2 and 5.5. In the absence of proper soil acidity, plants may become yellow and grow poorly. If soil pH values are higher than 5.5, elemental sulfur can be applied the year before planting to increase soil acidity (lower the pH). These plants possess a fibrous root system that penetrates more deeply into a well-drained soil than does the root system of the highbush, but penetration is still relatively shallow. The roots develop best in a moist, well-drained soil with good fertility. Because of their fine fibrous root system, blueberries do not

grow well in very heavy, compact soil. Well-aerated, loose-textured soils such as sands, peats, and loams that are high in organic matter are best. However, rabbiteye varieties have performed well when grown on friable clay and clay loam soils with good internal drainage.

Adequate soil drainage is necessary to prevent root injury from excessive moisture. The water table should be a minimum of 20 inches below the soil surface. This can be accomplished on some sites by using drainage ditches, tiling, or setting the plants on wide raised beds. Blueberry plants will not tolerate excessive moisture (wet feet) for long periods of time. The growth and yield of blueberries is generally considered proportional to the amount of organic matter in the soil. As most soils in Alabama are extremely low in organic matter, the addition of organic material such as peat moss before planting is essential.

Among the most ideal sites for blueberries in Alabama are virgin areas that have not been farmed or soils that have been in pasture grass for many years and have a pH below 5.5. Old farmland can be used if the pH is below 5.5, and phosphorus and other soil nutrients are not excessively high. However, growers seem to experience more problems in growing blueberries on old farmland. As a general rule, blueberries grow best on land that has been recently cleared or never planted in crops. Avoid areas in newly cleared fields where large amounts of wood or logs have been burned for planting blueberries, because the ash will likely raise the soil pH above the range that is best for plant growth.

Sites surrounded by hills or dense stands of trees have relatively poor air circulation, which may increase frost damage and the incidence of fungus disease. Blueberries should not be planted in low-lying areas that are likely to be frost pockets. Planting on elevated sites that allow for good cold air drainage helps in preventing late spring frosts.

Another important consideration in site selection is marketing. This is not quite so important if all fruit will be marketed wholesale for the fresh market. Evaluation of the availability of local labor for hand harvesting or the decision to use mechanical harvesting should be given special attention before a sizeable planting is established. If a significant portion of the fruit will be direct marketed, thoughtful attention to the area demand and potential pick-your-own (PYO) customers from a population base within a radius of 25 to 50 miles of the farm should be calculated. Alternative marketing outlets such as roadside markets or the potential for producing a frozen bulk product should also be examined.

Careful economic evaluations of the cost of establishment, time and rate of return, and annual production costs are necessary before any commercial venture should be undertaken.

## SOIL PREPARATION

Depending upon its condition and current use, the soil should be prepared at least a year in advance of the actual planting. Organic matter content of the soil may be increased by incorporating a cover crop with the soil and by adding rotted, aged, pine sawdust, peat moss, manure (except poultry), leaf mold, or ground pine bark. Soil acidity should also be modified by the addition of sulfur if the soil pH is above 5.5. Sulfur applications will usually not make very high pH (alkaline) or calcareous soils acceptable for commercial blueberry production. Where sulfur is required, it should be thoroughly worked into the soil to a depth of 6 to 10 inches the year prior to planting (Table 3). Use of sulfur in the planting hole at planting time can kill newly set plants. The cost and amounts of sulfur may be reduced by treatment of 6-foot-wide strips centered on future row sites, as opposed to broadcast applications to the whole field. Liming is recommended only in cases of extremely low soil pH (below 3.7). The desirable range for soil pH for the rabbiteye type is 4.3 to 5.2, with the range of 4.5 to 5.0 being ideal. For highbush, a range of 4.0 to 5.2 is best, with 4.5 being optimum.

A preplant soil test is valuable in measuring the levels of other important nutrients such as phosphorus, potassium, calcium, and magnesium. Some adjustments for these elements are done most effectively if they are incorporated before planting.

Use of raised beds may increase the acceptability of sites with marginal soil aeration or drainage. Raised beds may also compensate, in part, for the sinking of plants that occurs as organic matter decays in the planting hole. Such sinking may increase the risks of certain diseases.

Raised beds may be constructed by using a mold-board plow or other equipment to move topsoil from sites of the future row-middles to adjacent sites planned for use as the row-centers. An average bed height of 8

to 12 inches and a width of 4 feet is suggested if this system is to be used. It is especially important that irrigation be available when using raised beds, because they tend to dry out more quickly than level soil during periods of drought. It is also important that the beds be constructed so that surface water drains along the middles and out of the field.

Reputable nurseries specializing in blueberry propagation generally provide lower-cost, higher-quality, true-to-name cultivars. Although used exclusively several years ago, field grown (1- and 2-year-old), bare-rooted plants are currently used less frequently. It is generally a good idea to purchase certified disease-free, 1- or 2-year-old plants. Avoid older plants, which may have been culls earlier. They are more difficult and costly to establish and may perform poorly after transplanting. Figure 3 shows a typical bare root and containerized blueberry transplant.



Figure 3. Bare root and containerized blueberry plants

Table 3. Changing Soil pH With Sulfur

Present pH of soil	Desired pH Value														
	4.0			4.5 (Blueberry Range)			5.0			5.5			6.0		
	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay
Pounds of Sulfur per 100 Square Feet															
4.00.0	0.0	0.0													
4.50.4	1.2	1.4	0.0	0.0	0.0										
5.00.8	2.4	2.6	0.4	1.2	1.4	0.0	0.0	0.0							
5.51.2	3.5	3.7	0.8	2.4	2.6	0.4	1.2	1.4	0.0	0.0	0.0				
6.01.5	4.6	4.8	1.2	3.5	3.7	0.8	2.4	2.6	0.4	1.2	1.4	0.0	0.0	0.0	
6.51.9	5.8	6.0	1.5	4.6	4.8	1.2	3.5	3.7	0.8	2.4	2.6	0.4	1.2	1.4	
7.02.3	6.9	7.1	1.9	5.8	6.0	1.5	4.6	4.8	1.2	3.5	3.7	0.8	2.4	2.6	
7.52.7	8.0	8.2	2.3	6.9	7.1	1.9	5.8	6.0	1.5	4.6	4.8	1.2	3.5	3.7	

Note: To convert value to pounds of sulfur required per acre multiply by 436. Several months may be required for bacteria to oxidize sulfur and lower the soil pH to the desired level. Use no more than one pound of sulfur per 100 sq. ft. on established plantings in any one year.

Most plants used in establishing commercial plantings in Alabama are container grown stock and these are preferred over bare roots. Ideally 2-year-old plants in 1-gallon size (3 quart nursery gallons) pots are used. These plants may be 18 to 36 inches tall and should be pruned back by at least a quarter of their height at the time of planting or before growth resumes in the spring. This pruning is important in that it removes many of the flower buds from the plant so that strong, vigorous new shoots will be produced. Flower buds should be pruned or rubbed off for the first 2 years after planting to promote strong vegetative growth.

If you purchase bare root plants, open the shipping container immediately and check to see that the roots are still moist and that the plants are in good condition. If bare root plants cannot be set out immediately, store them in clean soil in a cool place (35° to 45°F), or heal them into the soil in a cool, protected site and keep the roots moist. Container plants should be maintained with good soil moisture and protected from excessively low temperatures until transplanted.

Add wetted peat moss or a 50-50 mixture of peat moss and soil directly to the planting hole. Up to 1/2 bushel of Canadian peat moss for each planting hole is recommended. Aged sawdust and crushed composted pine bark provide some benefit but are not as beneficial as peat moss. These may be mixed with the peat and soil before backfilling the planting hole. Dig planting holes 12 inches deep and at least 4 inches larger in diameter than the spread of the plant roots to allow addition of organic matter around and under the plant. Plants may also be set into furrows and back-filled with a peat moss-soil mixture. A rototiller is an effective tool for mixing the wet peat moss with the soil. No root pruning of bare root plants is required except for the removal of damaged roots. Plants should be set at the same depth or no more than 1 inch deeper than they were in the nursery. **It is very important to cut four notches down the sides and along the bottom of the rootball on all plants that are pot bound with roots circling the pot.** Soil should be firmed around the plants to avoid drying of roots in large air spaces. It is not necessary to break up the rootball, although some growers prefer to use this method. The tops of bare root older plants may be pruned back 50 to 60 percent to balance the tops with the remaining roots and to stimulate new growth. A surface-applied mulch will also benefit the plant, although this is not commonly done or necessary for rabbiteye plantings.

Commercial planting distances are often dictated by size of equipment to be used in the planting (Table 4). Rabbiteye blueberries produce the largest plants of all cultivated species, making correct spacing very important when establishing a planting. We recommend that rows be spaced 12 to 14 feet apart with plants 5 to 6 feet apart in the row. (A spacing of 6 x 12 feet is the tra-

**Table 4. Number of Blueberry Plants Needed to Set One Acre at Various Spacings**

In rows	Between rows					
	8'	9'	10'	11'	12'	13'
4'	1361	1210	1089	990	908	838
5'	1089	968	870	792	726	670
6'	908	807	726	660	605	559

Example: At a spacing of 6' x 12', a total of 605 plants are needed for each acre.

ditional industry standard.) If the planting is to be machine harvested with an over-the-row harvester, spacing the plants 5 feet apart may increase harvesting efficiency. A wider row spacing of 13 to 14 feet is preferred by some growers using mechanical harvesters. Also, at least 25 feet of head space at the ends of rows is needed for mechanical harvesting.

Highbush plants are usually set 4 to 6 feet apart in the row with 9 to 12 feet between rows. Table 5 shows the number of plants required per acre at various plant spacings.

Eliminate noxious perennial weeds such as bermudagrass, johnsongrass, morningglory, bindweed, honeysuckle, greenbriar, and brambles by cultivation and systemic herbicides before planting. Current herbicide recommendations may be obtained from your county Extension office.

## SOIL MANAGEMENT

### Weed Control

Weed control is especially important because blueberries are very poor competitors for moisture and nutrients. Clean cultivation can be used, but care must be taken to avoid injury to the very shallow root systems of these plants. Use of sod strips between rows, with maintenance of a weed-free strip 3 to 4 feet wide on row centers, is preferable.

A thick layer of organic mulch can help control weeds, conserve moisture, maintain proper soil acidity, reduce soil temperature variation, and supply organic matter to the soil. Apply 3 to 6 inches of well-rotted sawdust, woodchips, pine straw, or other organic materials during the fall of the year of planting; a 50-50 mixture of sawdust and woodchips works well, because the chips help prevent wind erosion and allow for better water movement through the sawdust. Other organic materials such as finely ground pine bark, peanut hulls, or pine straw may also be used.

The response of highbush cultivars to soil mulching is dramatic, with mulched plants typically giving two to three times the yield of unmulched plants. The response of rabbiteye cultivars is not as great, and mulches are commonly not used in commercial plantings. Add 2 inches of mulch each year to compensate for decompo-

sition of previously applied material. Chemical weed control practices are available, and details may be obtained from your county Extension office. Mulching may, as noted for sod culture, conflict with the use of cultivation for control of certain disease and insect pests.

It is essential that a weed-free strip be maintained in the rows to assure that weeds do not compete with the blueberry plants. This is best accomplished by appropriately timed applications of preemergence and postemergence herbicides. Hand hoeing and shallow mechanical cultivation may also be used in some instances. The proper time to apply preemergence herbicides to kill weed seedlings as they emerge in blueberry fields is September 1 to October 1 for winter weeds and February 15 to March 30 for summer weeds. Application of contact and systemic (translocated) postemergence herbicides may be required to control some difficult weed species.

## FERTILIZATION

Nutritional status of a planting may be affected by a number of plant, soil, and environmental factors. The following suggestions should give acceptable results under usual circumstances. They are presented as guidelines from which producers may make necessary changes to fit local conditions. Blueberry plants are very sensitive to readily soluble fertilizers, and excessive amounts can cause plant injury or death. Higher than recommended rates can be damaging, causing pale yellow chlorosis of leaves and low vigor, particularly where too little water is applied. **Do not** concentrate fertilizer in a small area around plants and **do not** use the nitrate forms of nitrogen.

A fertilizer plan has been developed for Alabama that uses a 12-4-8 complete fertilizer (Table 5). This fertilizer contains 34 percent of the nitrogen (N) as slow release, sulfur-coated urea (or formaldehyde) and 66 percent as ammonium sulfate. In addition to the specific 12-4-8 program, generalized fertilization guidelines are given below.

**Table 5. Suggested Fertilizer Rates for Blueberries**

Growing season (leaf)	Amount of fertilizer per plant	
	12-4-8 <sup>a</sup>	or ammonium sulfate
Newly set	1.5 ounces	.75 ounces
1st <sup>b</sup>	1.5 ounces	.75 ounces
2nd	3.0 ounces	1.5 ounces
3rd	4.0 ounces	2.0 ounces
4th	6.0 ounces	3.0 ounces
5th	8.0 ounces	3.5 ounces
6th and older	10.0 ounces	4.0 ounces

<sup>a</sup>A typical acid base fertilizer analysis available for azaleas and camellias.

<sup>b</sup>First growing season is referred to as 1st leaf, with subsequent seasons as 2nd leaf, etc.

**First year in the field.** Apply about 100 pounds of 12-4-8 or a similar nursery or turf fertilizer that contains a slow release nitrogen source as a split application. Apply 40 pounds of 12-4-8 per acre in a band or circle 6 to 12 inches wide, with no fertilizer closer than 6 inches to row centers, shortly after growth resumes in the spring. Repeat this application in late May or early June, using 60 pounds of 12-4-8 per acre. Apply a minimum of 4 inches of water (either rainfall or irrigation) between any two fertilizations. Ammonium sulfate may be substituted for the above mixed fertilizers, if soil pH is in the range of 4.6 to 5.2 and phosphorus and potassium are in the medium soil test range. Ammonium sulfate should not be used, however, if pH is lower than 4.5. See Table 5 for proper rates of ammonium sulfate. **Do not** apply nitrogen fertilizer after mid-August.

**Second year in the field.** Apply 15 pounds of actual nitrogen (120 pounds of 12-4-8 or equivalent) per acre in a uniform band 2.5 feet wide and centered over the row just before bud-break in the second growing season. This application may be followed by two applications of 12-4-8 or ammonium sulfate at 6- to 8-week intervals (see Table 5 for rates).

**Third and later years in the field.** Plants entering their third or subsequent growing seasons in the fruiting field should receive 15 to 20 pounds of actual nitrogen (120 to 160 pounds of 12-4-8) per acre just before bud-break. Apply an additional 10 to 15 pounds of N as 12-4-8 or ammonium sulfate in each of two applications at 6- to 8-week intervals. The last application should be applied postharvest (usually July 1 through mid August). All of these applications should be spread uniformly on the soil surface within bands that are as wide as the average spread between branches in the field. Nitrogen applications should be adjusted by the producer if plants appear to be deficient or if winter injury seems to be resulting from prolonged growth in the fall.

## Notes On Fertilization

Hand applications of fertilizers are often used by growers, especially during the first two growing seasons. At the recommended rates, fertilizers are more easily spread on a per plant basis when applied by hand. See Table 5 for rates.

Sites with high quantities of organic matter or nitrogen residues remaining from previous crops may require little or no fertilizer during the establishment year, but this is not possible to predict on a generalized basis, and at least light applications are recommended. Some growers indicate that chlorides, found in muriates of potash of commercial fertilizer mixes, may damage plants less than 3 years of age. But, other growers obtain acceptable results with such mixes. Growers may request fertilizer suppliers to substitute potassium sulfate for muriate of potash if that is desired. Both forms of potash have proven acceptable in studies in Alabama.

Ammonium sulfate is a convenient source of nitrogen in the ammonium form, which should be used if soil pH is near the top of the desirable range. Other sources may be used when pH is in the acceptable range. Urea (especially sulfur-coated) is another good source of nitrogen for blueberries. Natural organic materials such as cottonseed meal are desirable.

Supplemental foliar or soil applications of iron in a chelated form may be useful or necessary for temporary alleviation of iron deficiency symptoms but is not often used because of high cost. Long-term solution of such deficiencies generally involves adjustment of soil pH, addition of organic mulches, and irrigation practices that maintain soil moisture within a desirable range.

## IRRIGATION

Supplemental irrigation helps maintain adequate soil moisture throughout the growing season and is essential for best growth and production. Water is critical for survival of new plantings, even if it must be hauled and hand-distributed.

During the 2 years following planting, the root system of blueberry plants is shallow and requires between 1 and 1¾ inches of water per week (during the growing season) to keep the plants growing vigorously. Supplemental watering of these young plants during dry periods will increase plant growth and thus will bring them into commercial production at a younger age. Blueberry plants perform at their very best when soil moisture in the root zone is maintained continuously at adequate levels rather than allowing plants to dry excessively and then rewetting.

Irrigation of producing blueberry plantings during dry periods results in larger berries and higher yields. Also, irrigation during dry periods in August and September will increase growth and fruit bud formation, thus increasing potential yield for the next season's crop, if irrigation is properly designed and operated. The drip irrigation line is normally placed on the surface, and weed control is maintained by chemicals and in some cases with mulch. However, where cultivation equipment is used, drip irrigation lines may be buried (emitters should be above ground).

As a general guideline, in hot weather an application rate of about 3,600 to 4,000 gallons of water per acre per day or around 6 to 8 gallons per mature bush should be sufficient. Mature blueberry bushes have a peak water requirement of 8 to 12 gallons per plant per day when carrying a full crop load under severe heat. In most cases, blueberry irrigation systems should be designed to provide a peak need of a minimum of 8 gallons per plant per day. With 6- x 12-foot plant spacing and 605 bushes per acre, this translates to a system pumping capacity of 4,840 gallons per acre per day or the need for at least 2 inches per week, especially during fruiting. Younger plants need less water according to

size, with 3- to 4-foot plants having a peak requirement of about 3 to 4 gallons per plant per day, and new plantings from 1 to 2 gallons per day. Because of their shallow root systems, blueberries should be irrigated at least twice a week under dry conditions. More frequent applications of smaller amounts are needed on lighter soils. Typically, a single 1 gallon per hour emitter is used per plant; however, two emitters per mature bush will give a much better soil wetting pattern. Microsprinklers can also be used under the bushes to give a uniform wetting pattern over a somewhat larger area of soil. They are superior to drip irrigation on light sandy soils. Overhead sprinkler irrigation may also be used in blueberry plantings, but it is not nearly as efficient in water use as the two previous methods. Overhead sprinkler irrigation may be used when the fruit is ripening, but it should be applied in early morning and preferably immediately after each picking to prevent fruit splitting. This system may also be of particular benefit in protecting blossoms from late spring freezes by producing a coating of ice. Open blueberry blossoms and green fruit will freeze at 29°F. Since late spring frosts cause more crop loss than any other factor, growers should seriously consider frost protection techniques such as overhead sprinklers when establishing a blueberry planting.

## PRUNING

### Rabbiteye Blueberries

Traditionally, rabbiteye blueberries have been pruned very little compared to highbush blueberries. However, this is changing as the result of new research and observations. **Annual selective hand pruning** of rabbiteye blueberries is now recommended for several reasons. However, other methods of pruning are also described in this section because they may be useful in certain situations.

Rabbiteye blueberry bushes are pruned for several reasons:

- To improve sunlight penetration into the bush so the lower part of the plant and interior of the plant will continue to bear fruit. Rabbiteye blueberry twigs require about 20 percent of full sunlight to produce a good crop of flower buds.
- To promote efficient mechanical harvest so a minimum of berries will be lost. This involves narrowing the base of the plant.
- To produce better quality berries that are damaged less in the mechanical harvesting process because they have been selectively cane pruned. Fruit that are attached to old, stiff canes require more force to be detached during mechanical harvesting and are less likely to drop their fruit over the catch pans of the mechanical harvester.
- To reduce the height of the plant so that hand-pickers can reach the fruit or the mechanical harvester can straddle the plant without causing damage to the plant.

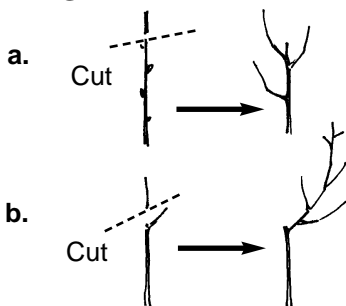
Selective hand pruning (thinning out) also results in more limber canes, which will bend over with a heavy crop load so the pickers can easily reach the fruit.

Harvester dimensions usually determine how large you can let your plants grow. As a general rule of thumb, plants can be allowed to grow 6 to 12 inches wider than the harvester and 6 to 12 inches taller than the harvester picking chamber without excessive berry loss, if the canes are fairly limber. If the canes are stiff, plants should not exceed the dimensions of the harvester. The throats of all harvesters are between 21 and 28 inches wide. If blueberries are growing on a raised bed, the width at the top of the bed should be less than the throat width of the harvester to allow for lower harvesting of the plant.

Two basic types of cuts are made in pruning:

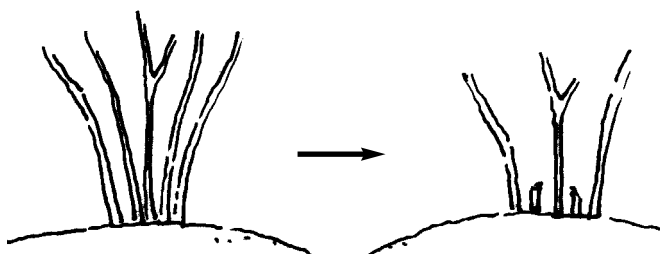
**1. Heading back cuts.** These consist of pruning the terminal growth of a shoot back to a bud or side branch. If pruned to a bud (Figure 4a), new shoots are produced from the bud(s) just below the cut. If a heading back cut is made to a side shoot (Figure 4b), new growth occurs on the side shoot that can be useful in increasing the width of the plant.

**2. Thinning cuts.** These are the complete removal of



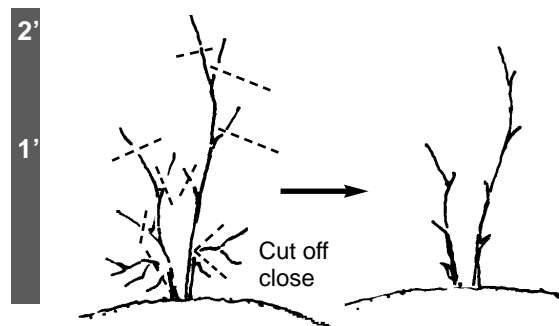
**Figure 4.** Two types of heading cuts: (a) Cutting back to the bud; (b) Cutting back to outward growing shoot

a cane near ground level (Figure 5) or the complete removal of side branches on upright canes.



**Figure 5.** Thinning cuts can be used to remove entire shoots near their source.

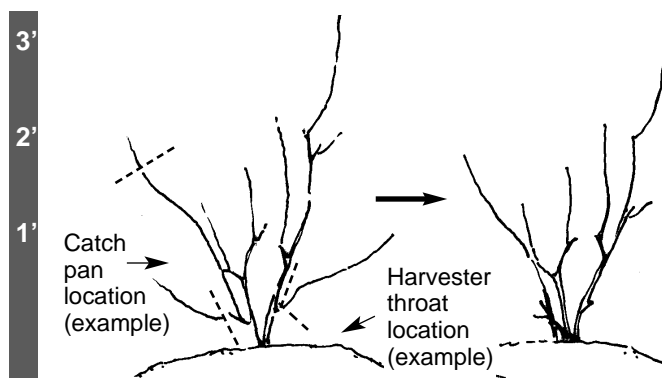
**First-year pruning.** At planting, bare root rabbiteye blueberry plants should be pruned to remove one-third to one-half the top in most cases. Remove all low, twiggy growth, leaving the one to three taller canes that have been headed back. This balances the root system and top, removes most of the flower buds, and results in rapid vigorous growth in the spring and summer months (Figure 6).



**Figure 6.** Pruning at planting

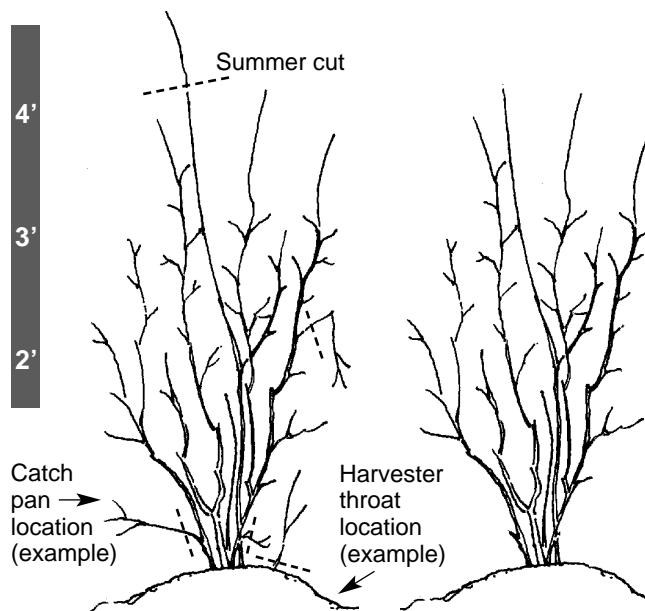
**Second-year pruning.** Before the start of the second growing season, prune off all low, twiggy growth below 12 inches, because it will not be harvested mechanically and is troublesome to pick by hand. Determine how low your mechanical harvester can pick fruit, taking into account that plants on beds may be harvested at a lower level if the top of the bed will fit into the throat of the harvester. Narrow the base of the plants in the area of the catch pans to 8 inches if mechanical or catch frame harvest is planned. If hand harvest is planned, plant width is less critical but should be maintained such that all fruit can be reached by hand.

It is also beneficial to top limber shoots that are heavily laden with flower buds. These will overcrop and be severely bent over by excessive fruit weight, distorting the plant shape. Extremely vigorous upright unbranched shoots should be tip pruned at 3½ to 4 feet to induce branching. Removing most of the flower buds by pruning and stripping is recommended on weak plants and non-vigorous cultivars such as 'Briteblue' (Figure 7).



**Figure 7.** Second-year pruning. The crown is narrowed to 8 inches, low twiggy growth is removed, and limber shoots with too many flower buds are headed back. To determine where the catch pans will meet the bush, measure the distance from the harvester wheel track, if the bushes are bedded.

**Third-, fourth-, and fifth-year pruning.** Before the start of the third, fourth, and fifth growing seasons, prune off all growth that is too low for the mechanical harvester you will use in your field; remove any broken limbs and narrow the base of the plants in the area of the catch pans to 8 inches if possible. Immediately after harvest, head back tall, vigorous “bull shoots” by one-third (Figure 8).



**Figure 8.** Third-, fourth-, and fifth-year pruning

**Sixth year—selective hand pruning for cane renewal.** At the end of the fifth growing season, the plants may be from 6 to 9 feet tall, depending on the cultivar, soil type, and growing conditions. With most rabbiteye cultivars, a fruiting canopy depth of only 6 to 8 feet tall can be maintained. If the plants are not pruned, this 6- to 8-foot fruiting canopy will gradually get excessively tall and harvesting will be difficult or impossible.

Before the start of the sixth year, continue to remove low twiggy growth and broken limbs and narrow the base of the plants to 8 inches in the area of the catch pans, if mechanical or catch frame harvest is planned.

Selective hand pruning for cane renewal is the method most growers are now using. This consists of thinning the oldest canes from the plant on an annual or biennial basis. Cut back one to three of the oldest canes in the center of the plant as close to ground level as practical. The objective is to prune out about 15 to 20 percent of the wood each year so the plant will be entirely renewed in 5 or 6 years.

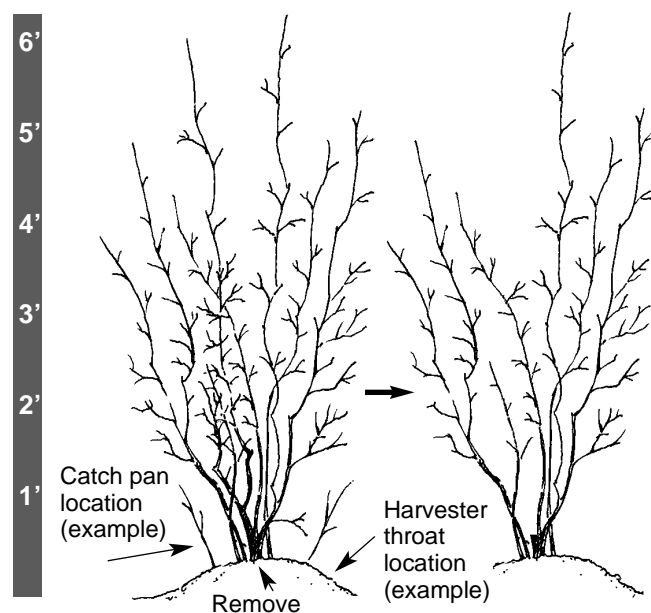
Most growers are using pneumatic pruners on large acreages or limb loppers and saws on small acreages. Pruning saws are used on large diameter canes. Blueberry wood is hard and requires good quality pruning equipment. Following pruning, the wood should be chopped as finely as practical with a flail mower so it

will rot rapidly and not build up diseases in the field. A rotary mower can be used if a flail mower is not available. **Where labor is available, removal of prunings from planting is desirable, especially large diameter canes.**

On some cultivars such as ‘Climax,’ which do not produce many canes, it may be necessary to make more heading cuts instead of removing entire canes. Cut to an outward growing shoot in most cases.

On canes that will be left but are too tall for the mechanical harvester or hand harvesting, make heading cuts to outward growing limbs to reduce the height of the plant.

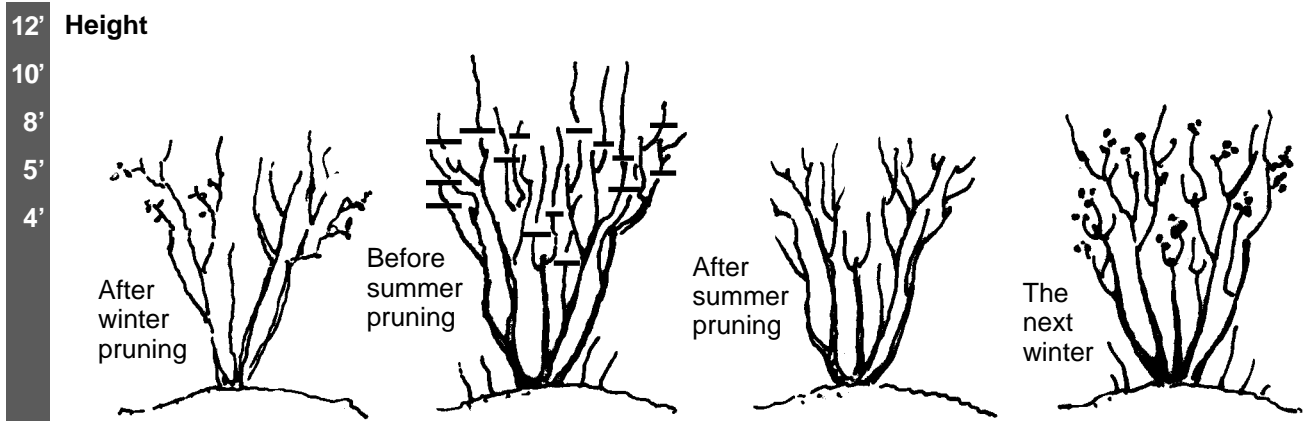
Probably the ideal time to do selective hand pruning for cane renewal is immediately after harvest. Additional sunlight allowed into the plant by pruning may benefit next year’s crop. However, because of the summer heat and difficulty in seeing the plant structure through the dense foliage, this has not been popular (Figure 9).



**Figure 9.** Sixth-year pruning; selective hand pruning for cane renewal begins

**Sixth year—other methods of pruning. Note: These systems should be considered experimental at this time since they have not been extensively tested.**

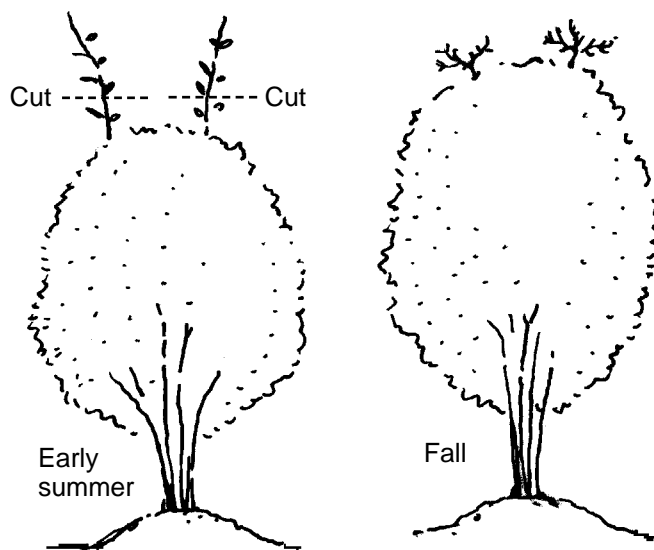
- Summer plus winter hand pruning for vigorous rabbiteyes. Growers who are hand pruning and wish to keep very vigorous rabbiteye blueberries at 6 feet in height may wish to use a combination of summer and winter pruning. By late July, new shoots that will grow well beyond the desired plant height can be identified and cut back to a height of no more than 6 feet. New shoots growing below 6 feet are cut back to about one-half their length. Very vigorous shoots developing from the ground are cut to 18 to 24 inches. If pruning is done too late in the summer, the new side shoots will not



**Figure 10.** A combination of winter and summer hand pruning of mature vigorous rabbiteye plants controls the height of rabbiteye blueberries

produce flower buds. A light winter pruning to thin out older canes will also be necessary (Figure 10).

- Summer mechanical or hand topping or heading back vigorous new shoots emerging above the fruiting canopy before late July can be beneficial. The pruned shoots should branch and form flower buds (Figure 11).



**Figure 11.** Summer mechanical tipping of vigorous shoots above the canopy encourages branching

- Moderate summer hedging helps many cultivars of rabbiteye blueberries that ripen too late in north Alabama to be hedged severely after harvest, regrow and form sufficient amounts of flower buds for next year's crop. A modest hedging of vigorous shoots immediately after harvest will leave many of the current season's shoots uncut to provide next year's crop. The ideal shape for this hedging is a "roof top" cut at about a 45° angle; however, a flat top hedging can also be used. The minimum suggested height for topping is 60 inches. The height of your cut should be based on your harvesting method or harvester dimensions. Each year the hedging is done about 2 or 3 inches higher to reduce ex-

cessive branching at the point of the cut. As the height increases with time, it will be necessary eventually to rejuvenate the plant by cutting it back to about 40 to 48 inches. Normally, this is done in a year when the crop is lost to a freeze. The best timing for rejuvenation is probably May. If done too early, the plants will regrow excessively. If done too late in the season, there will be very poor flower bud production on the regrowth.

If possible, it is best to combine moderate summer hedging with some removal of older canes in the plant to allow for a gradual rejuvenation of the plant. Summer tipping of vigorous new canes at 3 feet is recommended to increase branching of these canes (Figure 12).

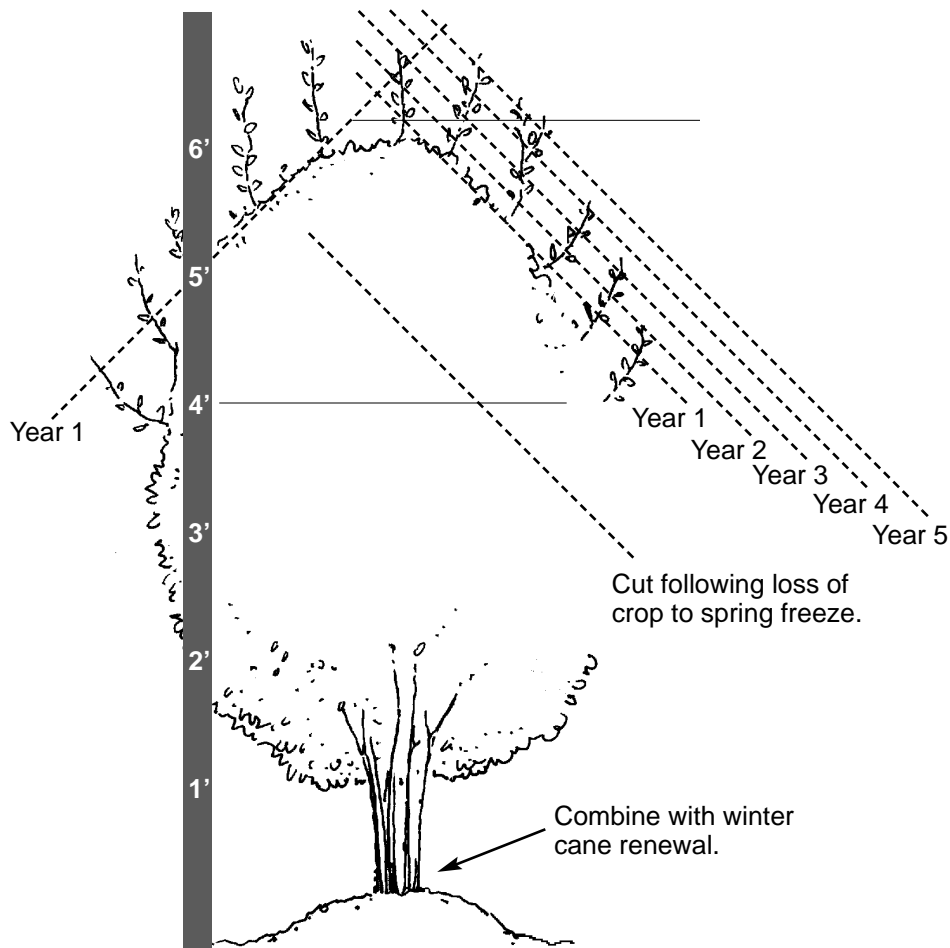
- Moderate selective hand hedging using a gasoline powered pruner can be done immediately after harvest and up to August 1 with good results. It is done in a manner similar to moderate summer hedging, but since it is done manually, allowances can be made for plants that need more fruiting wood left or that have an irregular shape. Leave plenty of fruiting twigs uncut to produce next year's crop.

- Several methods of severe hedging can rejuvenate rabbiteye blueberries. Half of the bush can be cut back to 3 feet immediately after harvest. The other half of the plant is cut back 2 or 3 years later (Figure 13).

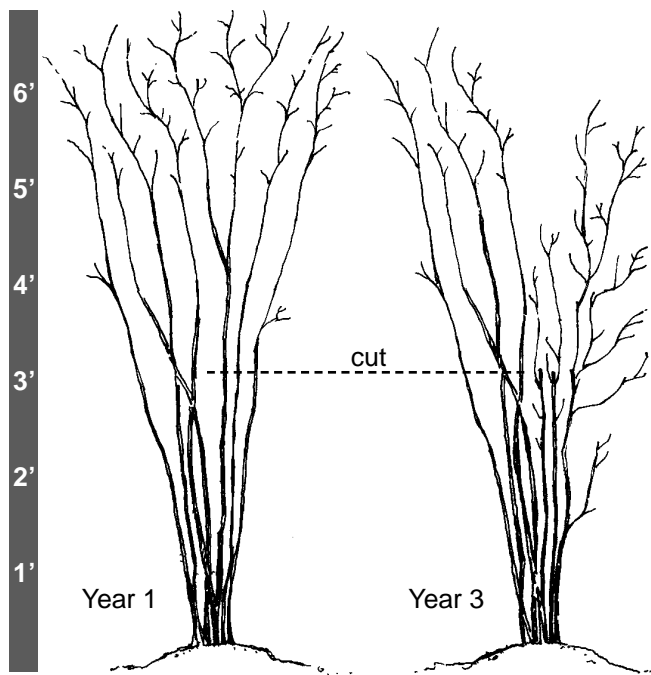
Severe hedging—cutting the plants back to 1 to 3 feet—can be conducted during the dormant season. There will be no yield the following year. For this reason, radical pruning of this nature is recommended only for cases of severely overgrown plants.

## Northern and Southern Highbush

Highbush blueberries require annual pruning to prevent overbearing, maintain vigor, and produce high-quality fruit. Thinning to increase fruit size is accomplished through pruning with blueberries. Blueberry fruit ripens both earlier and in a shorter period of time with moderate to heavy pruning. Overall, the effects of pruning highbush blueberries is very similar to pruning peach trees.



**Figure 12.** Moderate summer hedging of rabbiteye blueberries immediately after harvest. Each year the cutting height is raised by 2 to 3 inches. Combined with cane renewal, this may be a good method for controlling bush height while keeping canes flexible. Base the height of cut on your harvest method or harvester dimensions.



**Figure 13.** Radical hedging to rejuvenate severely overgrown bushes

Remove all flower buds from plants immediately after planting and following the first growing season in the field. Some flower buds are usually allowed to remain after two growing seasons so that a small crop will be produced in the third year; otherwise, pruning during the first several years involves making cuts to develop the main framework of the plant in the desired upright form to facilitate cultivation, spraying, harvesting, and other operations.

Blueberries are borne on the previous season's growth. Therefore, on bearing-age plants, pruning should be severe enough to encourage production of vigorous new growth each year. Weak or less vigorous cultivars will require more severe pruning than vigorous ones. Heavy pruning increases size and earliness, but at the expense of production. On bearing-age plantings, general guidelines for pruning are as follows:

- Remove low-spreading branches and branches growing through the center of the plant, especially weak and older branches.
- Cut back extremely vigorous 1-year shoots and also remove most small, slender branches.

- If earliness is important, remember that berries produced on small, slender laterals will usually be the first to ripen, so this should be taken into account in determining the number of these shoots to remove.

- Long, fruiting lateral shoots need to be tipped back so that no more than 4 to 6 flower buds remain.

Highbush blueberry plants generally reach their peak production at between 8 to 10 years of age. At this point, exercise care in pruning or production and quality will decline. A systematic program of renewal pruning is recommended for such plants. If carried out over a period of years, renewal pruning can ensure maintenance of plant vigor without serious reduction in production of high-quality fruit.

It is preferable to begin the renewal pruning process when plants are about 6 years old. First, remove any weak or diseased canes entirely. Then, among the remaining canes and starting with the older ones, cut back two per year, either to strong laterals or to within 1 foot of the ground. New, strong lateral branches will usually develop below the cut. Therefore, over a 4- to 5-year period a new plant framework is developed.

Summer pruning of southern highbush immediately after harvest is successful in Florida as a means of generating abundant new growth with fewer leaf diseases while letting more sunlight into the interior of the bush. Selective cane renewal combined with bench cuts is usually practiced.

Hedging of early ripening highbush and southern highbush blueberries after harvest has become a common practice in eastern North Carolina. It is important that the pruning be done soon after harvest (usually June). Highbush blueberries usually set plenty of flower buds on the late summer and fall growth. Because they are hand-harvested for the fresh market, the plants are kept fairly low. A "roof-top" cut with a 48-inch peak in the center and 40-inch height on the edges works well. The cutting height is raised or lowered by about 1 inch each year to remove "crow's feet." Dead wood removal and some cane renewal should take place during the winter. This pruning method has potential for southern highbush cultivars but should be considered experimental until it has been tested on each of the cultivars under your local growing conditions. Cane renewal is probably the best pruning method for southern highbush that is to be mechanically harvested for the fresh market.

## HARVESTING

The fruit of cultivated rabbiteye blueberries are borne in clusters made up of two to eight berries, while highbush clusters contain five to ten berries. The berries typically ripen in succession over a period of 6 to 8 weeks in rabbiteye and 2 to 5 weeks in highbush for a single cultivar. Some cultivars have a concentrated ripening and may be harvested in two to three pickings. Plants

should be picked about every 7 days. Berries with a reddish tinge are not yet ripe, and they usually turn blue 3 to 6 days before they develop their maximum sweetness, flavor, and size. Delaying harvest until the berries are fully ripe will result in higher quality, larger fruit, and greatly increased yields. Begin harvesting when about 15 to 20 percent of the berries are blue. If hand harvesting, pick with both hands and use your thumbs to gently roll berries from the cluster into the palm of your hand. Be sure all the ripe fruit is removed so there will be no overripe berries at the next picking. Handle fruit as little as possible so that the attractive, waxy bloom is not removed. To reduce bruising of the fruit, pick berries directly into boxes in which they will be sold on the fresh market. However, some grading of hand-harvested fruit may be necessary. Picking should be delayed until after the dew has evaporated off the fruit to help prevent the development of postharvest fungus diseases. There is a direct relationship between the temperature of the berries and the postharvest shelf-life of the fruit. Keeping the harvested fruit in the shade and using rapid cooling to lower the berry temperature to below 40°F can dramatically improve the maintenance of fruit quality after harvest. Berry splitting can be a serious problem in years with excessive rainfall during the harvest season.

Berries also may be removed by bending the canes over a canvas catch frame and tapping with a length of PVC pipe or plastic bat or vigorously shaking the limb. Hand-held, battery-powered mechanical vibrators with picking fingers may also be used on the fruiting shoots to detach the berries onto a catching frame. Over-the-row mechanical harvesters are also routinely used for harvesting both fresh market and processing fruit. A single harvester replaces up to sixty-four handpickers and can harvest 6 to 8 acres a day under ideal conditions. Generally, 20 to 30 acres are needed to justify the cost of a mechanical harvester. Mechanically harvested fruit require special postharvest cleaning to remove leaves and twigs and to sort out unripe, overripe, and damaged fruit.

If the blueberry crop is to be hand-harvested, four to six pickers will be needed per acre with as many as ten to fifteen being required at the peak of a concentrated ripening season. A good picker can harvest up to 18 pounds per hour (160 pounds per day or eighteen 12-pint flats) on plants with heavy crops. Harvest labor costs are much reduced if the location is favorable for pick-your-own (PYO) sale of fruit. Typical PYO customers will spend 1 to 2 hours picking 10 to 15 pounds of fruit.

## YIELDS

A blueberry plant will take from 6 to 9 years after field planting to reach full maturity and should remain productive for an estimated 30 to 40 years. Rabbiteye yields in well-managed irrigated plantings can be harvested during the second year in the field. Approximate yields in pounds for years 2 through 6 should be: 100-500, 500-1,000, 1,000-2,000, 2,000-4,000, 4,000-6,000, respectively, and greater than 8,000 pounds per acre after year 7. In the case of the less vigorous highbush cultivars, no returns can be expected until the third year after planting. A mature, healthy rabbiteye plant should produce 20 to 25 pints of fruit per plant, while highbush cultivars may produce 7 to 10 pints or 6 to 8 pounds of blueberries. About 275 to 350 rabbiteye and 200 to 300 highbush berries equal 1 pound of fruit. Average yields of mature rabbiteye plantings in full production under good conditions should range from 8,000 to 12,000 pounds per acre, while highbush may average 6,000 to 10,000 pounds per acre.

Rabbiteye harvest begins in south Alabama around the first week in June with harvest of the late cultivars being completed in late July. Harvest periods in northern Alabama are about 1 month later than in the southern region of the state.

## BLUEBERRY DISEASES AND INSECTS

Blueberry cultivars are subject to attack by a number of disease and insect pests, several of which may cause severe crop reduction or plant losses. The important disease and insect pests of blueberries are listed in Table 6. Diseases are less severe where good production practices are followed. Growers should take great care to start with clean, high-quality stock and to carefully monitor their plantings for atypical or unhealthy looking plants. Rabbiteye cultivars are more disease resistant than are highbush cultivars. At present, diseases are not

**Table 6. Important Blueberry Pests**

Diseases	Insects
Phomopsis cane and twig blight	Cranberry fruitworm
Botrytis blossom blight	Blueberry maggot
Anthraxnose	Japanese beetle
Mummy berry	Scale insects
Leaf spots	Leaf rollers
Phytophthora root rot	Plum curculio
Powder mildew	Bud mites
Botryosphaeria stem blight	Stem borer
Mushroom root rot	

normally a serious problem in Alabama. Insecticide sprays may be necessary where cranberry fruitworm or blueberry maggot is present or where a zero tolerance for Japanese beetle is required by certain processors. For specific chemical recommendations for disease, insect, and weed control, consult your county Extension agent and Extension publication ANR-478, "Small Fruits IPM."

## Suggested Supplemental Information Sources

### Books

- Rabbiteye Blueberries: Development, Production and Marketing. M.E. Austin. 1994. 160 pages. \$54.00. AgScience Inc., 114 Lake Avenue East, Auburndale, FL 33823.
- Blueberry Science. 1988. P. Eck. 284 pages. Rutgers University Press. \$47.00
- Texas Blueberry Handbook. 1988. M.L. Baker and K. Patten (eds.). 220 pages. \$15.00. (Make check payable to Blueberry Publications, Account 20190)  
Extension Horticulture—Blueberry  
Texas A&M Research and Extension Center  
P.O. Box 38  
Overton, Texas 75684
- Small Fruit Crop Management. 1990. G.J. Galletta and D.G. Himelrick (eds.). 602 pages. \$75.00. Prentice Hall Publishing. Call 1-800-223-1360 east of the Mississippi, and 1-800-225-7162 west of the Mississippi.
- Small Fruit Pest Management and Culture. 1989. D. Horton et al. (eds.). 116 pages \$15.00. (Make check payable to Cooperative Extension Service)  
Agricultural Business Office  
Room 215, Conner Hall  
University of Georgia  
Athens, GA 30602
- Highbush Blueberry Production Guide. 1992. M. Pritts and J. Hancock (eds.). 200 pages. \$45.00. Northeast Regional Agricultural Engineering Service, 152 Riley-Robb Hall, Cooperative Extension, Ithaca, NY 14853.
- Compendium of Blueberry Diseases. 1995. D. Ramsdell et al. 100 pages. \$30.00. APS Press, 3340 Pilot Knob Rd., St. Paul, MN, 55121. Call for information: 1-800-328-7560.

## Extension Publications

Commercial Blueberry Production. Pub. 2363. 1989. E. Puls, Jr. 35 pages. \$3.00. Publications Office, Room 128 Knapp Hall, Louisiana State University, Baton Rouge, LA 70803.

Commercial Blueberry Culture. Circular 713. 1989. G. Krewer and S. Myers. 16 pages. Single copy free. Extension Publication Office, Hoke Smith Building, The University of Georgia, Athens, GA 30602.

Establishment and Maintenance of Rabbiteye Blueberries. Bulletin 941. 1991. J.M. Spiers et al. 11 pages. Single copy free. Department of Information Services, Publications Section, Box 5446, Mississippi State University, Starkville, MS 39762.

Blueberry Production Guide for South Carolina. Circular 594. 1987. J.D. Ridley. 14 pages. One free copy. Bulletin Room, P & AS Building, Clemson, SC 29634-5609.

Commercial Blueberry Production in Florida. 1991. P.M. Lyrene and T.E. Crocker. 21 pages. \$5.00. University of Florida Publications, IFAS Building 664. University of Florida, Gainesville, FL 32611.

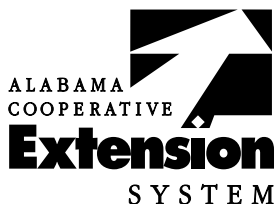
Commercial Blueberry Production Guide for North Carolina. 1979. C.M. Mainland. 30 pages. \$.50. Publications Office, Box 7603, N.C. State University, Raleigh, NC 27695-7603.

Diseases and Anthropoid Pests of Blueberries. Bulletin 468. 1984. R.D. Milholland and J.R. Meyer. 33 pages. \$2.50. Publications Office, Box 7603, N.C. State University, Raleigh, NC 27695-7603.

Highbush Blueberry Production. PNW 215, Washington, Oregon, Idaho. 1993. B. Strik et al. 73 pages. \$10.00. Bulletin Office, Cooperative Extension, Cooper Publications Building, Washington State University. Pullman, WA 99164-5912.



Rabbiteye blueberries ready for harvest



### ANR-904

**Arlic Powell**, *Extension State Program Leader*, Associate Dean, College of Agriculture, and **W.A. Dozier Jr.**, Professor, Horticulture, both at Auburn University; and **David G. Himelrick**, former *Extension Horticulturist*

Issued in furtherance of Cooperative Extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, and other related acts, in cooperation with the U.S. Department of Agriculture. The Alabama Cooperative Extension System (Auburn University and Alabama A&M University) offers educational programs, materials, and equal opportunity employment to all people without regard to race, color, national origin, religion, sex, age, veteran status, or disability.

UPS, 3.5M32, Revised April 2002, ANR-904