

GROWING BLACKBERRIES IN TEXAS



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GROWING BLACKBERRIES IN TEXAS

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The blackberry industry in certain areas of Texas is "big business." Notable is the increase of acreage near metropolitan areas to provide local markets with large attractive firm fruits of good quality for fresh consumption. In the Lindale-Tyler area the commercial acreage requires the operation of four canning plants and the services of hundreds of people during the harvest season.

The Texas blackberry industry began at Lindale in 1890 with less than 50 acres of berries and a small canning plant. By 1910, acreage had increased to 1,000 acres and two canning plants were operating. Fresh berries also were shipped in refrigerated cars to distant markets. By 1945, the blackberry production claimed an estimated 5,000 acres. The frozen pack was introduced about this time. Berries were put into 28-pound tin cans and frozen for use throughout the year by jelly and jam processors. By 1950, acreage had increased to approximately 6,000 acres with 45 percent of the crop being canned, 45 percent frozen and 10 percent going to the fresh market.

In addition to concentrated commercial plantings in Smith, Wood and Henderson counties, numerous small plantings exist in other parts of Texas. These plantings usually range from 1 to 5 acres in size and help supply local markets with fresh berries.

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LOCATION AND SITE

Two important factors to consider in the location of a commercial berry plantation are near-by markets and adequate labor supply. Since a high percentage of the current commercial crop of blackberries is processed, large plantings should be located near processing plants.

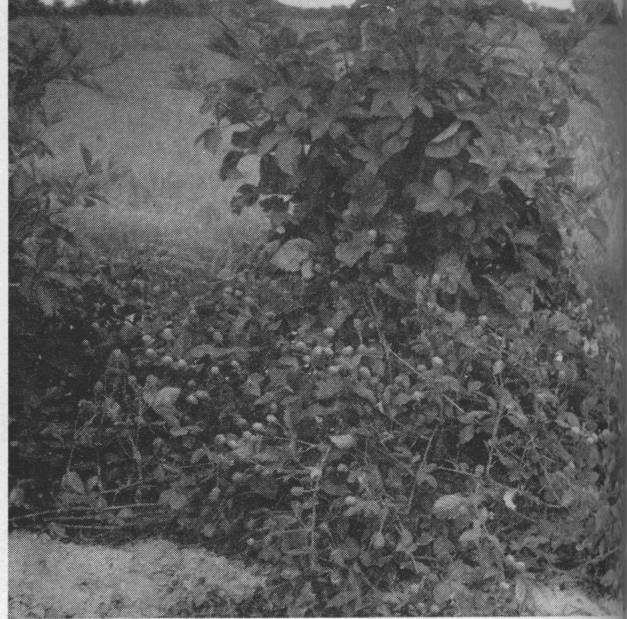
Berries do best on a general rolling topography, which aids in adequate drainage of surplus soil moisture. This reduces the possibility of plant loss from root rot, nematodes and souring of the deep roots. A gentle slope also permits free movement of air and reduces frost-pockets.

Both the blackberry and dewberry are readily adapted to several soil types, provided favorable moisture conditions prevail. A deep, fine-sandy loam soil with a good supply of organic matter is excellent for berries. The grower should determine if the soil is relatively free from soil-borne diseases and nematodes. Soils that recently have grown crops such as tomatoes, peanuts, sweet potatoes and roses or any of the cucurbit crops, such as melons or cucumbers, should be examined closely for these diseases. Sites previously planted to berries should receive special attention.

VARIETIES

Rapid changes have occurred in blackberry varieties grown in Texas in recent years. For example, Lawton, a standard commercial variety for several decades, has been almost replaced by newer improved varieties. The varieties listed in this publication are still grown in Texas for commercial or local market production or for home fruit production.

BRAZOS is an erect-growing blackberry developed by the Texas Agricultural Experiment Station and released in 1959. Its large fruit size (maintained over the entire fruiting season) and pleasing appearance make the Brazos particularly adapted to fresh market channels. It is receiving increasing acceptance as a processing berry. The comparative fruit size and maturity dates of Brazos, Humble, Lawton and Flint are listed in Table 1. With good production management practices, Brazos can produce more than 6,000 pounds of fruit per acre and a commercial yield up to 12,000 pounds per acre has been reported. Maximum yields are possible only on good berry soil with sound management practices. This variety, test-



The Brazos blackberry was developed by the Texas Agricultural Experiment Station. It produces heavy yields of unusually large fruit on strong upright-growing canes.

ed in several sections in Texas, appears to be widely adapted. Brazos probably will replace both Humble and Lawton as a commercial blackberry variety in Texas plantings.

Table 1. Comparative data on date of full bloom, time of harvest and fruit size of four blackberry varieties recommended for commercial plantings.*

Variety	Date full bloom	Date of harvest			Size of fruit	
		First	Full	Last	No. in 100 fruit, Pint	Weight in grams
Brazos	April 20	May 14	June 5	June 11	78	511
Humble	April 23	May 23	June 3	June 17	131	280
Lawton	April 25	June 3	June 15	June 28	176	207
Flint	May 3	June 8	June 27	July 25	116	330

*Data corrected to include 1961 results.

*Unpublished data from Texas Agricultural Experiment Substation No. 2, Tyler.

LAWTON is an erect-growing variety with good plant vigor and medium-early maturity. It is unusually vigorous, with the parent stool producing up to seven new canes each season. There are many laterals 2 to 3 feet long. The prickles are fewer than average on the cane and leaf, but they are curved and are longer than average. The large white blooms appear in late March. The harvest period extends throughout the month of June. Lawton, a standard commercial variety in East Texas for many years, is being replaced rapidly by Humble and Brazos because of their larger fruit size, higher quality berry and greater productivity.

HUMBLE is an introduction by E. C. Humble, Tyler, Texas. Its parentage is unknown. Its plant growth is more erect than procumbent or trailing. It is a vigorous, rapid grower. The canes are large, well-branched and can ably size a full crop of fruit. The fruit ripens a week to 10 days earlier, and it is larger, more attractive and sweeter than fruit of Lawton. Pickers express a decided preference for Humble because of its large fruit and fewer hooked prickles on the foliage and laterals. Its most serious short coming is a lack of fruit firmness, which reduces its value as a fresh market and processing berry.

FLINT is outstanding for its plant vigor, exceptional resistance to leafspot and anthracnose, and has clusters of 8 to 15 fruit that hang well for ease of harvest. The jet black fruit is firmer and of higher quality than Lawton and promises to lend itself readily to processing as well as a long life on the counter when marketed as a fresh fruit. Seed size is comparable to Lawton, but fewer per fruit. The fruit size is larger than Humble and maintains the size over the entire harvest season which is six weeks

Flint propagates readily from tip-layering, however, it appears to be reluctant to produce a high percent of plants from root cuttings.

The variety is a recent introduction of the Georgia Experiment Station and is the result of a cross between the upright growing Eldorado and the trailing Brainerd blackberry varieties.

EARLY WONDER (Texas Wonder, Dew-black) is a vigorous grower, with fruit that ripens in a 3-weeks' period. It is an early to mid-season variety and is grown widely in East and Central Texas. It is not as vigorous in growth as Brazos or Humble. It has fewer prickles on the leaf and cane than most varieties. It begins blooming the latter part of March. The berries are medium size, black, firm and of excellent quality. Yields are heavy and the fruit is attractive. Seed are medium size. Early Wonder is recommended for home consumption and local marketing.

YOUNG DEWBERRY is popular in Texas because of its large fruit and excellent flavor. Plants are vigorous and the fruit is easy to harvest. Yields have been above average in East Texas but light in Central and South Texas. The canes are susceptible to anthracnose. Sunscald causes some injury when the canes are tied to

stakes. The plants trail, with 2 to 3 new canes produced each season from the base of the main cane. This berry roots easily at the tip of any portion of the cane, when covered with soil. It has more prickles than most varieties and those on the canes are unusually long. These prickles are not considered a deterrent to harvesting since the fruit is produced on racemes 5 to 6 inches long growing perpendicular to the cane. The large, white flowers appear in April. The fruit ripens 2 weeks earlier than Lawton. The purplish-black berries are large, running about 69 to the pint. The few large seed are scarcely noticeable. The pack is attractive and is a favorite in local markets.

BOYSEN is a trailing variety with the canes, foliage and prickles characteristics of the Young dewberry. Vigor is poor to fair, making it a shy bearer. It is susceptible to rosette, leaf spot and anthracnose. The blooming dates are the same as for Young, but it begins maturing fruit about mid-May. Its extra large fruit has a reddish-purple cast. The seed are extra large. The flavor of the fruit is excellent. It is desirable for the fancy packed trade on local markets, but is too soft for distant shipping.

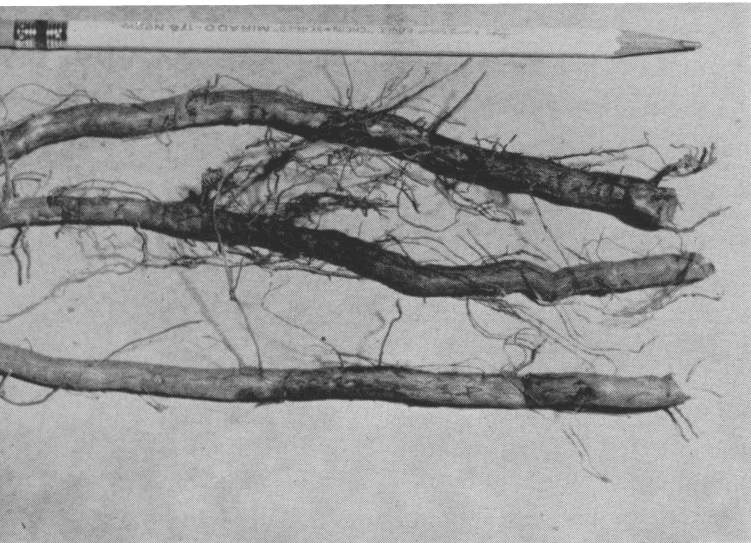
YIELDS

Regardless of the planting material used, no fruit will be borne the first growing season. Yields are extremely variable during the second season since they are based on the percentage of stand and size of plants obtained. Commercial growers in the Lindale section anticipate 50 to 100 lugs per acre from Lawton and 75 to 125 lugs from Humble during the second growing season.

Production increases rapidly during the third to seventh season, yields usually level off from the eighth to tenth year. If plant loss has been high during the early life of the plantation, yields may start to decline around the seventh year. Favorable yields from plantations with good stands and vigorous plant growth range from 300 to 450 lugs per acre.

PROPAGATION OF PLANTING MATERIAL

Most blackberry and dewberry varieties propagate readily from root cuttings. This method of propagation is economical since increase material is obtained readily by plowing a deep fur-



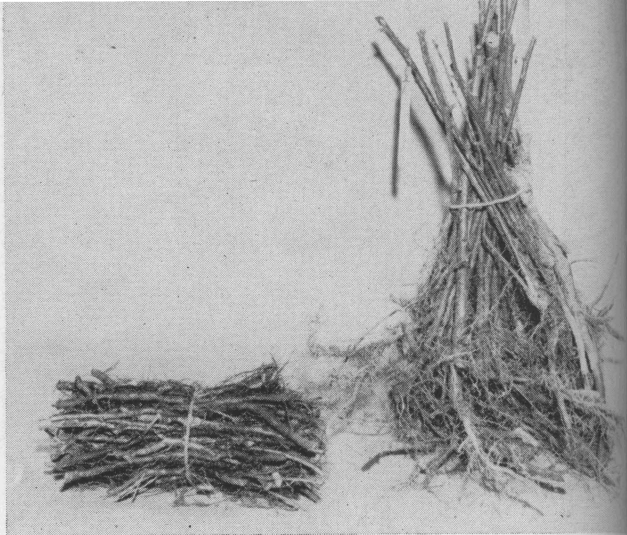
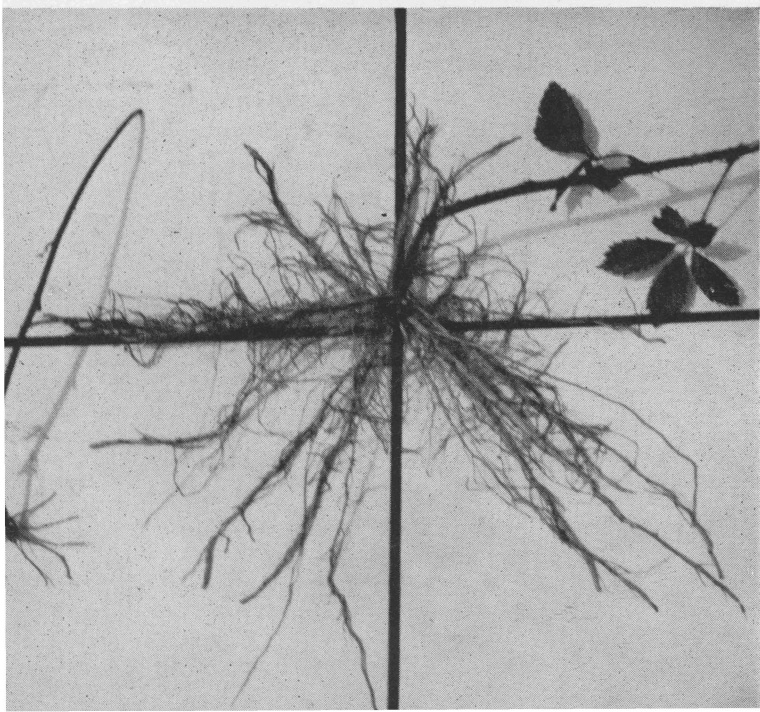
The principal method of propagating erect-growing blackberries is through the use of root cuttings. These cuttings should be pencil size or slightly larger.

row away from the plant row. The exposed roots are gathered and placed in damp burlap or polyethylene plastic bags to prevent drying. The roots are tied in a bundle and cut into 4 to 7 inch lengths. Root pieces with a diameter of $\frac{3}{16}$ to $\frac{3}{8}$ inch are preferred. Those of $\frac{1}{2}$ -inch diameter or more are too old and frequently do not produce a plant. Root pieces $\frac{1}{8}$ inch or less in diameter likely will not produce a strong, vigorous plant.

Sucker plants growing from the roots by cultivation or other injury can be used for planting, but usually are not vigorous growers. Plants grown from good root cuttings are strong and will come into production as early as one-year or sucker plants.

The dewberry cane can develop a root system at any place that the cane is covered with moist

A strong tip-rooted dewberry plant on the right compared to a weak, undesirable one on the left.



Blackberry planting material. Left, bundle of root cuttings; right, bundle of 1-year-old plants.

soil. This is called "layering" and most dewberries are propagated in this manner. Strong, vigorous plants, established where the tip of the cane has formed a new root system, are best for planting.

The new grower should select his planting material from high-yielding plants and from sources known to be free of nematodes and diseases.

PLANTING AND SPACING

The home gardner can use hand tillage tools or small equipment to plant blackberries in squares of 4 feet or allow the plants to grow hedge-like in rows spaced 6 feet apart. Dewberries to be grown on trellises usually are spaced 3 to 4 feet in the row with rows 8 feet apart. If an individual stake system is used, the plants can be set in 4-foot squares.

The commercial grower considers a 12-foot row as the minimum. There is increasing preference for the 14 to 16-foot row to permit cultural operations. Root cuttings are spaced 3 feet apart in the row and the plants are allowed to grow in hedge fashion. Many growers prefer to place two root pieces in the same spot to assure a more perfect stand. Throughout most of the berry growing sections of Texas, plantings can be made from November through March. However, plantings in late winter or early spring usually give best results. The tenderness of the young berry plant calls for care in preparing the soil so as to eliminate as many injuries as possible. The soil should be disked and left in the best possible state of tillage. The furrow in which the root cuttings or plants are to be placed should be

opened immediately before planting to avoid loss of soil moisture. In light sandy soil, root cuttings are dropped flat in the furrow and soil is firmed about each cutting by the feet of the operator. Depth of planting depends largely on the nature of the soil. In light sandy soils, the cuttings are planted 4 to 6 inches deep since such soils lose surface moisture readily and will allow the young canes to emerge from a greater depth. On the heavier soil types, the planting depth usually is 3 to 5 inches with no firming required. If 1-year-old or tip-rooted plants are used, the planting depth should be slightly deeper than they were growing when dug.

FERTILIZATION AND COVER CROPS

Deep sandy soils that have been depleted of organic matter and are low in the essential plant food elements usually respond to the addition of approximately 200 pounds per acre of a complete fertilizer, such as 8-8-8, 10-20-10 or 12-12-12. On heavier soils, the quantity of potash may be reduced. The vigor of the young plants at a height of 6 to 12 inches will give an indication of the amount of fertilizer needed. Fertilizer should be sidedressed slightly lower than the cuttings and 8 to 10 inches away from the plant row. It is not considered advisable to apply fertilizer in the row before planting because injury might result from "fertilizer burn" to the root cuttings or young plants. Early fertilizer application reduces its effectiveness by leaching, especially on light sandy soils.

In established berry plantations, an application of 300 to 500 pounds per acre of a complete commercial fertilizer, such as 8-8-8, 10-20-10 or 12-12-12, as a sidedressing prior to bud swell in February is recommended. Fertilizer should be applied 18 to 24 inches away from the berry plants to avoid damage to shallow feeder roots and to encourage a wide distribution of the root system. With established plantings, broadcast application of commercial fertilizer is preferred over band application since this method tends to cause a greater distribution of roots over a wider area, resulting in more efficient intake of moisture and nutrients.

Growing a fall or spring-planted cover crop in a berry plantation is desirable, especially when the soil is highly deficient in organic matter and is susceptible to wind and water erosion. The cover crops should receive an application of 35 to 50 pounds actual nitrogen before planting or after-



A large commercial blackberry plantation near Lindale, Texas. The strong, upright growth of the canes makes trellising unnecessary and the clean cultivation reduces competition from weeds and grass.

wards as a topdressing. Legumes require a fertilizer containing phosphorus.

Two major disadvantages may be encountered when cover crops are used in a berry plantation. Deep plowing to incorporate the cover crop with the soil cuts the berry roots, which in turn develop a large number of sucker plants which are difficult to eradicate. Aphids, thrips, stinkbugs and other insects feed on cover crops, especially legumes. Some of these insects attack the berry plant and its fruit after the cover crop has been plowed under.

Some growers consider it more economical to provide the required nutrients in a sidedressing and to allow the natural seeding of weeds and grasses to provide protection against wind and water erosion.

When a cover crop is grown in the berry plantation, a rotary-type mower or shredder can be used to cut it down before plowing under. This will help eliminate deep plowing to incorporate the cover crop in the soil.

CULTIVATION

In the young plantation, cultivation should be shallow so as not to disturb the berry root system and frequent to prevent grass and weed seedlings from becoming established and to prevent soil crusting. Frequent hoe work is necessary to remove weeds and grass in the berry row. This is one of the tedious and expensive operations in growing the blackberries. A newly emerged berry sprout is tender and easily broken. Rarely does a strong acceptable plant come from a root cutting which has lost its first sprout.

Cultivation should continue through late summer into early fall in sections with rainfall favorable for late growth of crabgrass and other plant pests.

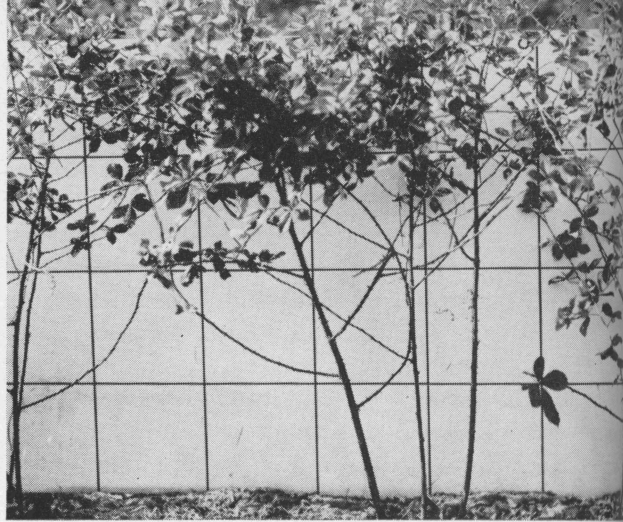
The tillage implement used most commonly and perhaps most economically in berry plantings is a spring tooth harrow with depth control. The mold board plow often is used in small operations where tractor equipment is not available. The disk harrow that can be regulated by the power lift on a tractor can be used to an advantage; otherwise, it should not be used since the lack of depth control permits it to cut many large feeder roots. One man with tractor equipment should be able to do all the cultivation required for 100 acres of berries each season.

PRUNING METHODS

Blackberry and dewberry plants require a full season to grow the wood that will produce fruit the second season. New shoots grow vigorously from the crown and roots. During late summer and early fall, they form flower buds at intervals along their length. If headed back early in the growing season, these shoots usually will develop side branches along which the lateral buds form. Early in their second season, the 1-year-old shoots or canes produce leafy shoots from the lateral buds. A few compound leaves first appear, and then single blossoms and blossom clusters, which develop into the fruit. After fruiting, the cane gradually dies. The root system lives for many years, sending up new shoots to replace the canes that have fruited and died.

Ordinarily no pruning is required during the first year because the young plants tend to develop a number of side branches. During the second and later seasons, the new shoots grow rapidly and

Blackberry plants following fruiting and before pruning out the old canes and thinning the young ones.



The same blackberry plants after removal of the old fruiting canes and the excess young canes.

appear reluctant to develop side branches. Blackberry varieties which produce erect canes and are grown in a hedgerow should have the new shoot growth tipped to prevent breakage by wind and cultural operations, and to encourage maximum development of lateral and side branches. The height selected for tipping varies according to the preference of the individual grower, fertility of the soil and available moisture. Usually a height of 3 to 4 feet is desired, with some tipping done at the 5-foot level. The increase of side branches is encouraged further by clipping them following the fruit harvest. All old canes that have produced fruit should be removed. Weak and spindly shoots should be pruned to permit the remaining canes to develop and produce the next season's fruit crop. The removal and burning of the old canes immediately after fruit harvest will help control insects and diseases that attack the blackberry plant.

Dewberry or other plants with trailing canes, such as the blackberry, require no pruning during the first growing season. Pruning during the second and later seasons depends on whether the trellis system is used or the vines are allowed to remain on the ground. Research at Substation No. 2, Tyler, on growing the Regal-Ness berry on trellises and under a canopy of its own vine growth shows that yields are higher when the young canes are topped at 30 inches and the old canes are removed after harvest.

INSECT CONTROL

Soil Insects

The white grub, known as the May beetle in the adult stage, attacks roots of young berry plants. The full-grown grub is about 1 inch long, usually

white with a brown head, and three pairs of legs and a curved body. Injury by these grubs generally occurs where berries are planted on previously infested land that has been in pasture or grass sod. Most of the common species which appear in Texas live in the soil for 2 years before emerging as adults.

The grower planting berries in fields that have been fallowed for several years or on land that has been in pasture or grass sod should be especially watchful of these pests. If grubs are in the soil, at least one intervening crop, followed by clean cultural practices before the berries are planted, should be grown on the land. Deep plowing and frequent stirring of the soil during the winter before the cane fruits are planted will aid in controlling these insects.

Wireworms sometimes attack the roots of berries and the practices recommended for white grubs also will reduce the number of these insects.

Cane and Bud Insects

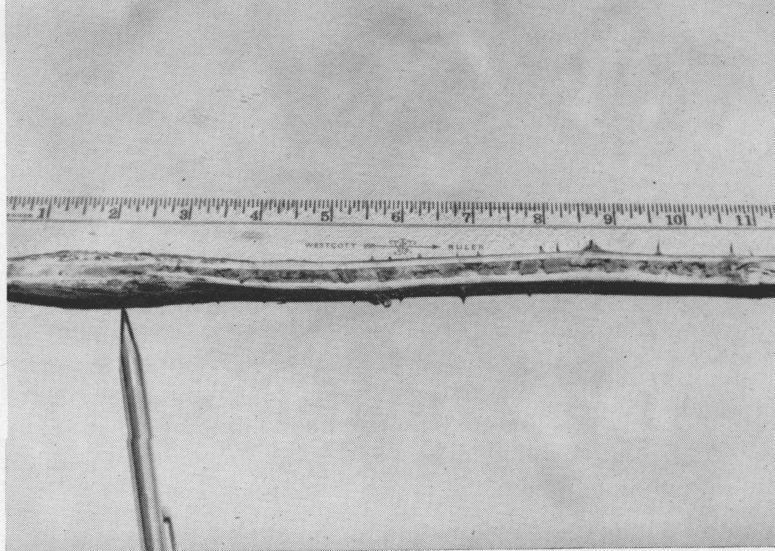
The red-necked cane borer is a major pest of berry canes. In East Texas, it rapidly is becoming serious. Infested canes have irregular spindle-shaped swellings or galls 1½ to 2 inches long which usually show several longitudinal splits in the bark on the lower parts of the young cane.

The full-grown larva is ⅝ to ¾ inch long with a brown head and whitish, slender body. The adult is a bluish-black slender beetle about ⅜ inch long with a shiny coppery red thorax or neck. Adult beetles usually appear in the spring or early summer and deposit eggs on the young canes. If infested canes are cut open, larvae may be found in the pith within the galls or about 10 inches above the galls.

Infested canes with enlarged swellings should be removed and burned during the winter or at the time old canes are removed after fruiting. This practice will reduce damage to the following berry crop. If the cane borers develop in the berry plantings in damaging numbers, wild or neglected berry bushes in the vicinity should be destroyed.

The strawberry weevil has existed in East Texas for several years, but not until 1960 did it cause serious damage in berry plantings.

Life history studies of this insect have not been worked out under Texas conditions. Ac-



The red-necked cane borer is a serious insect pest of blackberries. The cane above, split down the center, exposes the borer at "X" and the pencil points to the characteristic swelling of the cane that is caused by this insect.

ording to those developed in other parts of the country, the insect overwinters as an adult and becomes active in early spring, about the time buds begin to appear. The female makes a puncture in the berry bud and inserts an egg. After egg laying, the strawberry weevil girdles the stems of the buds below the damaged area, where it may hang on the partly severed stem or fall to the ground.

The small whitish, legless larvae or grubs feed on the pollen and later on other parts of the bud. After about 4 weeks, the grubs transform to the pupa stage. This stage lasts 5 to 8 days, then the insect emerges as an adult in late spring.

Adult weevils feed for a time on berries and horsemint, then seek hibernating quarters where they remain until the following spring.

The first insecticide application should be made when *buds begin to appear*. Second application should occur *10 days later*. Sprays generally give better results than dusts. Apply 3 quarts of DDT, (containing 2 pounds technical material per gallon) or 1 pint of parathion (containing 2 pounds technical material per gallon) per acre in sufficient water to obtain thorough coverage. Do *not* apply DDT after fruit begins to form, nor parathion within 15 days of harvest.

Foliage Insects

Berry foliage and the tender tips of young canes may become infested with aphids or plant lice. Aphids generally do not build up in sufficient numbers to cause serious injury to the plants. If damaging infestations should appear, they can

be controlled by spraying or dusting the plants with malathion. Apply a 4 or 5 percent dust, or a spray which consists of 2 teaspoons of 50 percent malathion emulsifiable concentrate per gallon of water. If ground equipment is used, apply 1½ pints of malathion emulsifiable concentrate (5 pounds per gallon) per acre. Nicotine sulfate also may be used for aphid control. Follow directions on the manufacturer's label for dilution recommendations. Malathion and nicotine sulfate can be applied within 1 day of harvest.

Spider mites occasionally attack the foliage late in the season. These small pests suck sap from the underside of the leaves. When infestations are severe, the upper surface of the leaves turn bronze-colored. Severe infestations may cause early defoliation. If control measures are needed apply Kelthane (1.62 lb. per gal.) as a spray at the rate of 2 to 3 quarts per acre. Kelthane can be used within 2 days of harvest. Two applications at 7-day intervals will give satisfactory control.

Grasshoppers may migrate into berry fields, especially where a large hopper population exists. These insects should be controlled before they move into the berry field. Check areas around berry plantings early in the season and begin control measures if young hoppers are found. Grasshoppers can be controlled by spraying or dusting with toxaphene, aldrin, chlordane or dieldrin. Refer to MP-339, *Guide for Controlling Insects on Corn, Sorghum, Small Grains and Grasses in Texas*, for the amount of insecticides to use. Follow the restrictions listed in MP-339 on the use of these materials, especially in areas where livestock are feeding. Insecticides listed for grasshopper control should not be applied to the vines after the first fruit begins to form.

DISEASE CONTROL

Major Leaf and Cane Diseases

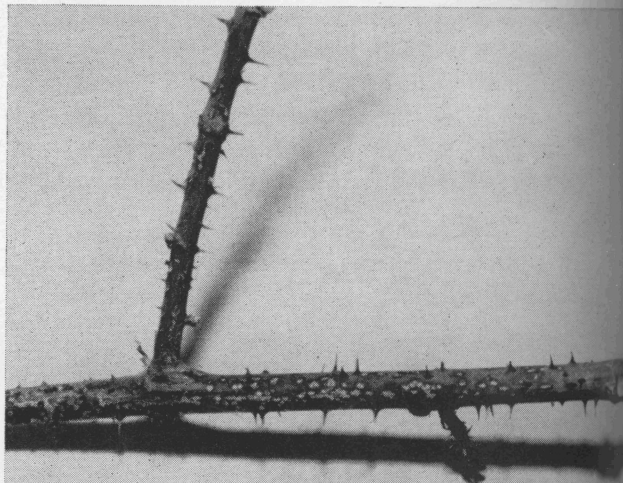
Orange Rust. This is the most serious bacterial or fungus disease in commercial plantings. In some cases, the entire planting is lost. Affected leaves have a velvety feel and are orange-yellowish. The disease first appears as small-yellowish dots scattered over both leaf surfaces. The dots break open, exposing large, orange-reddish areas. Infected plants never recover.

Remove and destroy diseased plants, including the roots, in the berry patch and in fence rows and abandoned fields, as soon as the disease is observed. Avoid touching healthy plants with diseased material. Do not cultivate diseased plants when the leaves are wet.

Anthracnose. This fungus disease is the most common cane and foliage disease of blackberry and dewberry. Small, purplish, slightly-raised spots occur on new shoots. Gradually the spots enlarge and become lens-shaped or oval, with a slightly-raised, purplish edge. The center of the spot gradually becomes grayish and sunken. Small spots on the cane run together forming larger, irregular areas. Small purplish-bordered leaf spots form with definite edges. Considerable infection occurs during early spring while the buds are unfolding.

Trailing-type berries, such as Boysen, Young and Ness, are highly susceptible. Erect types, such as Humble, Texas Wonder, Dallas and Lawton, are less susceptible. Use Krenite or Elgetol as a dormant spray. After the first cluster is out, but before the first bloom is open, spray with dichlone, captan, ferbam or zineb. Repeat this application, with the exception of dichlone, when the young canes are 8 to 10 inches tall. Do not apply dichlone after the bloom stage. Make the last ferbam application 40 days before harvest and the last zineb application 14 days before harvest. Repeat with a third foliage spray immediately after the fruit is harvested. Sprays should be applied in a fine mist. Apply dosages as the manufacturer directs. Enough spray pressure should be used to cover both leaf surfaces and the cane. A spray rig with a minimum of 250 pounds pressure is needed in commercial plantings.

Anthracnose lesions or scars on a 1-year-old blackberry cane. This disease reduces growth and yield of the blackberry plant.



Septoria Leaf Spot. This is a fungus disease. It may cause serious loss of leaves. It is similar to the leaf spot phase of anthracnose, but the spots on leaves remain small and more regular in outline. The edge of the spot is purple and similar to anthracnose. The center of the spot is light brown or tan. For control of leaf spot, follow the directions given for anthracnose.

Minor Leaf and Cane Diseases

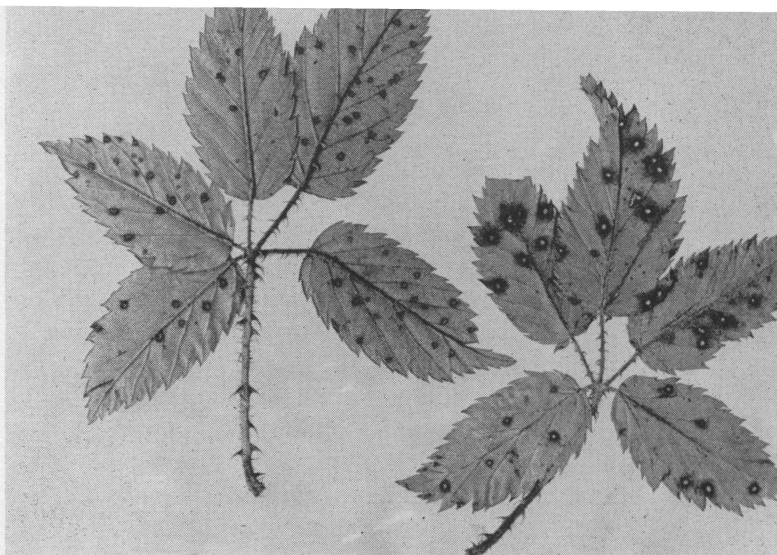
Cane Gall. Large bark-splitting swellings or galls form along the stems in usually long masses. Seed berries are produced during dry years.

No control is known. Destroy affected plants. Avoid resetting healthy plants in the same place. Plant stock grown in plantings free of the disease.

Rosette. This fungus disease is sometimes known as double blossom or witches broom. A bunched or clustered-type growth appears in the spring on the fruiting cane. Fungus spores appear on the diseased blossoms. They are scattered by wind, rain and possibly by insects. The period of infection is mostly from March through June. The disease is most common in Southeast Texas and along the Gulf Coast. Production in this area may be limited by this disease. When there is little disease, remove and destroy young infected plants. In heavily infested plantings, mow both old and new cane growth near the ground immediately after harvest. Add nitrogen to encourage new growth after the mowing operation. Spray two or three times at 10-day intervals after mowing with 4-4-50 Bordeaux mixture.

Powdery and Downy Mildew. Dewberries trained on low trellises or on the ground sometimes are attacked by these diseases. Ordinarily the infestation is not severe enough to justify the use of a fungicide. Under extreme conditions, the use of sulfur (dust or wettable) or the use of a 4-4-50 Bordeaux spray gives control.

Leaf Curl. This virus disease is recognized first by the foliage being abnormally dark green and wrinkled. Downward curling of the leaf edges occurs. Plants are smaller, weaker and less productive. The disease is thought to be spread by species of aphids or leafhoppers, probably from wild berries. In recent years, the disease appears more important in the Lawton variety in the Lindale area of East Texas. It is not carried over in the soil.



Septoria leaf spot causes a pronounced circular lesion on the foliage of blackberries as shown in this photo.

Remove and destroy diseased plants. Use transplants taken from fields where the disease does not occur.

Mosaic. This virus disease occurs less frequently than leaf curl. It is thought to be spread by aphids. Leaves at first show a pale mottling. Canes are somewhat shorter each year. New fruit is crumbly and insipid. Leaves become smaller and narrow, and arch downward at the margins in many cases. Mottling becomes well defined as the summer advances. A general bronzing follows. Plants eventually lose vigor, become unproductive and die.

For control follow the directions given for leaf curl.

Streak. At present, this is a minor virus disease, but it should be watched closely to prevent its spread. Tip leaves of young canes show a peculiar curling. The leaf midrib is at first sharply hooked or recurved. The leaf curls downward and backward, sometimes rolling into a cylinder. Curling is most severe on young leaves of rapidly growing parts. On year-old infected plants, the canes are shortened and the leaves are close together. In extreme cases, the leaves occur as a rosette. The young canes are discolored irregularly with dots and vertical stripes of dark blue or purplish tint. The normal green outer layer of the cane only is affected. The stripes do not extend into the wood or pith.

For control, follow the directions given for leaf curl.

Fruit Diseases

Sterile-plant. This virus disease sometimes is referred to as nubbins, 3-seeded, He-berry and buck

shot. Sterile-plant is a common disease of blackberries and dewberries. Flower parts are dried. Poorly developed fruit occurs in the same cluster with normal fruit. As the virus spreads through the plant, the set of normal fruit lessens. Plants eventually are characterized by an apparent increase in vigor and a large number of new canes per crown. There are fewer lateral branches and canes are of smaller diameter than the healthy plants. The method of virus transmission is unknown. No effective control is known. Diseased plants should be dug up and destroyed.

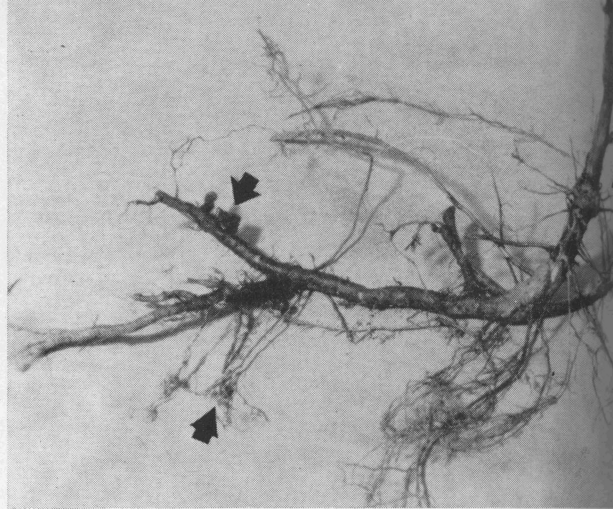
Fruit Rots. Several bacterial and fungus diseases attack the fruit. Fruit may be damaged at any time in the field or until it reaches the consumer.

Careful handling is important in the picking, packing and shipping operations. Pack only sound berries, cool the pack as soon as possible and eliminate rough handling during transit.

Root Diseases

Crown Gall. Damage is similar to that of drouth or lack of plant food nutrients. Large, warty galls form on the roots or at the base of the canes. The bacteria causing the disease gain entrance through wounds that may be caused by insect or mechanical injury. Affected plants should be dug up and destroyed. New plants should not be reset in infested soil. Control soil insects. Avoid planting sites such as land where brambles have been grown recently and known to be infected with crown gall, old peach or plum orchard land, old nursery land and areas receiving drainage from old bramble fields. If possible, select a site where cotton, corn, grain sorghum, oats or other feed row crops have been grown for several years. All nursery and planting stock should be examined carefully for galls of any kind especially on the lower stems and roots. Do not plant root stocks with galls or plants that have had the galls pruned. Roots of nursery stock may be treated before planting. Soak them for 10 minutes in a solution of one part corrosive sublimate to 1,000 parts of water before setting out.

Hairy Root. This is a minor bacterial root disease. Symptoms are small wiry roots growing singly or in bunches from the main root or from the base of the stem. For control, follow the directions given for crown gall.



Crown gall disease on the roots and crown of a 1-year-old plant.

Oak Root Rot (Mushroom Root Rot). The disease may be of major importance in plantings of blackberries and dewberries in East Texas following the removal of oak trees. Growth of the entire plant or certain branches may be retarded. The leaves, small and few in number, turn yellow and fall prematurely. Branches may die back. To diagnose the disease, remove the soil from the diseased crown. Areas of decayed bark or wood are found on the crown and larger roots. Peel back the bark from the wood on the dead areas. Fan-shaped, felt-like, white, mold growth is found between the bark and the wood. Within the bark of decayed parts, shiny, dark-brown or black, root-like or cord-like strands occur over the surface of the crown or roots in a branched system. Mushrooms of the disease fungi generally occur in the fall at the base of affected plants. Whether they develop depends on the weather and extent of decay.

Dig and destroy as much of the affected root system as possible. Do not reset healthy plants in infested soil. In clearing new land, remove as much of the oak tree stumps and root systems as possible.

Root Knot. Plants show lack of vigor. Stunting, wilting and yellowing of leaves often become apparent. Loss of leaves may follow. Plants may die. Roots removed carefully by digging show swellings or galls which are smaller than those caused by crown gall. Root knot is caused by a small, microscopic round worm known as nematode. Swellings in the root prevent normal plant food nutrients and water movement.

Cultivate and fertilize to provide ideal conditions for plant growth. With new plantings, avoid

soil that is known to be infested. Use disease-free transplants. If possible, select a site where corn, grain sorghum, oats or other feed row crops have been grown for several years.

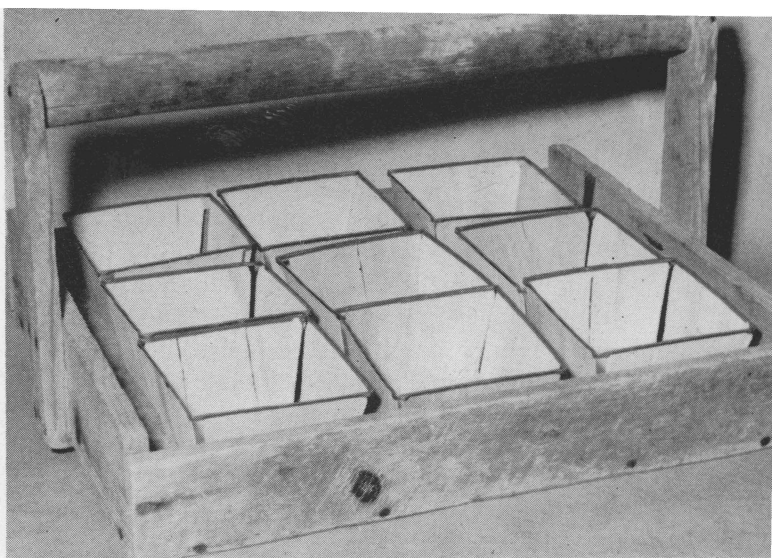
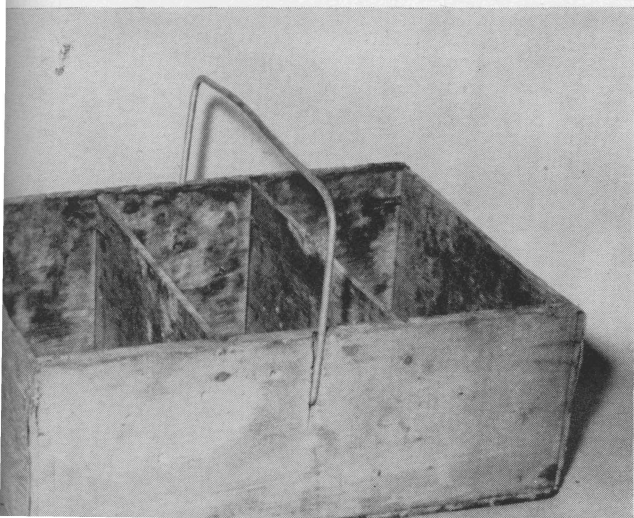
Other Nematodes. Where plants are showing slow decline, unthriftiness or slow growth, and there is no apparent reason, nematodes other than root knot may be suspected. Apparently healthy plants may tend to wilt in the day and revive at night. Dig suspicious roots with a shovel. Affected roots may be forked, crooked or brushy in appearance. Root systems may be small and stubby with excessively branching roots. Small roots may be larger near the tip end. Abnormal brown or black streaks or spots may occur on roots. To diagnose the trouble, wash the remaining soil from the roots with water and allow excess water to dry. Compare normal plant roots with those suspected. If nematodes are suspected, collect samples of roots and adjacent soil in a plastic bag and send to the Plant Disease Diagnostic Laboratory, Agricultural Extension Service, College Station, Texas.

Harvest Practices, Costs and Labor Requirements

Blackberry and dewberry fruit, unlike many other fruits, cannot be harvested and utilized satisfactorily if the fruit is not fully ripe. When blackberry fruit is ripe, it is plump and black. There are a few exotic varieties, such as Crystal White and Iceberg, that have other colors when ripe.

Because of the extremely perishable nature of blackberry and dewberry fruits, they should be harvested frequently. Harvest should begin as soon as sufficient fruit is ripe to justify the expense

A lug commonly used in harvesting blackberries; it has a detachable handle and holds about 15 pounds of fruit.



An economical carrier made from easily available material.

of picking. Fruit of the dewberry, being less firm than the blackberry fruit, requires almost daily or every second-day harvest.

The commercial berry grower prefers to use a wooden lug with a detachable handle for a picking container. Its gross weight when full of fruit is 18 pounds with a net weight of 15 pounds of berries. If marketed as fresh fruit, most growers use the pint berry box with 24 boxes to a crate. However, there is a growing preference for the half-crate which contains 12 pint berry boxes. A carrier that holds 9 to 12 pint boxes is used in the field and the fruit is placed directly in the container that will be marketed.

In determining the labor required to harvest the average crop of blackberries, most growers figure on five pickers to the acre with an additional supervisor of operations. The supervisor hires the labor, sees that all ripe fruit is gathered at each picking and checks each picker's container for low-grade fruit or foreign matter. Some supervisors also do the weighing and pay pickers as each lot of fruit is checked out.

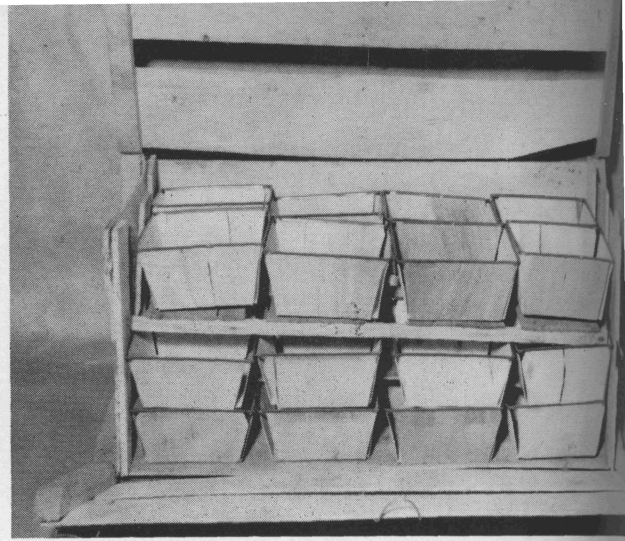
The cost of harvesting blackberry and dewberry fruit varies considerably among varieties. It is based largely on fruit size and type of vegetative growth. (See Table 1.) The cost also varies within the same variety, being based on contract, piece work or the daily wage price agreed on. However, the average commercial grower figures on paying by the lug. Additional items such as weighing, transportation and supervision bring the total cost of harvesting to approximately half the market value of the fruit.

MARKET OUTLETS

Canning plants are the marketing outlet for 90 percent of the East Texas crop, with approximately 10 percent marketed as fresh berries. Of the 40 to 50 percent of canned blackberries the majority are usually packed in No. 2 and No. 303 cans, 24 per case. In some years, the U. S. Army has purchased large quantities of canned blackberries. Cafes and hotels also purchase limited quantities of No. 10's for pies and cobblers. The No. 2 and No. 303 cans of blackberries are distributed through retail store outlets in the Southwest and Midwest.

Forty to 50 percent of the crop is frozen in local canning plants. Berries for freezing are received from the growers, washed and packed in 28-pound cans. These cans are transferred rapidly to cold storage (mostly in Dallas and Houston) where they are quick frozen and held for preserve making later in the year.

The estimated 10 percent of the crop that is sold as fresh berries goes to market in 12 and 24-pint and 16-quart berry crates. Pint berry boxes are more popular at this time at retail food stores and with housewives. Refrigeration is necessary for fresh blackberries. Unless refrigerated, the



A collapsible berry crate with 24 pint boxes.

berries lose their eye appeal and sell slowly in the retail food stores. Brazos and Humble are larger and more attractive in appearance than Lawton. Good size, attractive black color and reasonable sweetness are the most desirable characteristics for fresh market berries.

Many small local-market berry growers in several sections of Texas market their crop by allowing customers to pick their own fruit. The grower usually furnishes the containers and charges a unit price per pint, quart or gallon. Other growers harvest their berries and sell to local grocery stores, supermarkets and fruit stands.

Pointers for Profitable Production

- Select** a well-drained site that is free of soil-borne diseases.
- Choose** varieties adapted to the prevailing soil and climatic condition.
- Obtain** planting material from high-yielding planting stock that is free of disease injury.
- Space** berry plants for ease of working and for high yields.
- Fertilize** crop for large yields of high-quality fruit.
- Cultivate** to control competing vegetation and to encourage steady growth.
- Prune** plants to obtain regular production, ease of harvesting and longer plant life.
- Control** insects and diseases to insure blemish-free fruit and healthy plants.
- Harvest** on schedule for continuous production of higher quality fruit.



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