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PRODUCTION GUIDE FOR  
SEMI-ERECT THORNLESS BLACKBERRIES  
IN VIRGINIA

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## PRODUCTION GUIDE FOR SEMI-ERECT THORNLESS BLACKBERRIES IN VIRGINIA

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### I. Introduction

Blackberry plantings have been made more practical in the eastern U.S. by the work of plant breeders in selecting adapted, highly productive thornless blackberry cultivars. Thornless canes are easier to handle during pruning, training, and harvesting. Easy harvest, large fruit size, and high yield make these cultivars adaptable for sales by "pick-your-own" (P.Y.O.) harvest methods.

The cultivars 'Black Satin' and 'Dirksen Thornless', and the new cultivar 'Hull', do not revert to a thorny condition; they are more productive and more winter hardy than other thornless cultivars. Winter hardiness may not be great enough for the coldest regions of Virginia. Fruits are tart, but use of sugar as required in recipes for other kinds of blackberries appears to result in very acceptable thornless blackberry products (see SP-35 for recipe suggestions).

These cultivars are "semi-erect" in growth habit, i.e., shoots grow prostrate along the soil surface during the first summer after planting, but more erect shoots are produced in subsequent years. New shoots produced at or below the soil line are vegetative during their first season of growth; these "1st-year canes" or primocanes become dormant during winter and are referred to as floricanes or "2nd-year canes" from that point onward. Buds become active on 2nd-year canes in early spring (e.g., mid- to late March); shoots which grow from these buds are known as "fruiting shoots" since they are the structures on which flowers and fruit will be produced. Canes and fruiting shoots die after fruiting (i.e., they are biennial), but this may not occur until the winter following harvest of their fruit.

Vegetative or 1st-year shoots on vigorous, mature (3 years or older) plants may reach lengths of 20 to 30 feet with diameters approaching 2.0" near the plant crown. Although excessive growth or vigor can complicate or interfere with production activities, it is important that adequate vigor be maintained. The plants must produce sufficient canes to support next year's crop while simultaneously maturing the current year's fruit. This may be accomplished if plants are protected from insects (e.g., crown borers, cane borers, and psyllids), water stress, or competition from weeds; and if nematodes, root rots, or other diseases (e.g., orange rust and rosette) do not become problems. Annual dormant-season pruning of new canes and adequate spacing between plants are required to regulate fruit loads to reduce competition within and among plants, and to facilitate movement of people and equipment between rows during harvest, pesticide application, etc.

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## II. Location, Site and Soil

Location of the farm is perhaps a critical factor in deciding whether or not to plant this crop and in selecting an appropriate planting size. The location should be close (preferably within 25 miles) to the center of an intended direct-market population, and size of the planting may be limited by the number of potential customers within this radius. Frontage, or access to frontage, on highly travelled roads may improve the potential for planting in areas where local population densities are low.

Planting sites with gentle slopes, higher elevation than most surrounding topography, sandy loam soil, 30" or more of potential rooting depth, and availability of water for irrigation are preferred. It is important that the site be easily accessible to customers and adaptable to establishment of traffic patterns and parking areas, if pick-your-own sales are intended.

The soil should have been in cultivation for at least 2 years, and it should not have been planted with crops which are subject to verticillium wilt (tomatoes, potatoes, tree fruits, etc.) during the past 3 or 4 years. Sites recently cleared of trees and bushes should be planted to small grains or corn for 2 years to permit removal or deterioration of root remnants which may harbor diseases, and to ensure that no perennials remain.

Soils which are known to be heavily infested with verticillium or which are very likely infested (e.g., old peach orchard sites) should be fumigated before planting, or they should be completely avoided.

It is important that wild blackberries and raspberries be eliminated from the planting site and from adjacent areas; this helps in controlling certain insects and diseases which could harm productivity. Orange rust and certain other diseases, as well as insects, may travel considerable distances on air currents, etc., so it is desirable to obtain neighbors' cooperation in eliminating wild blackberries on their land too.

Mineral nutrients, pH, and nematode populations should be assayed in soil samples taken 18 to 24 months before the planned planting date so that lime, fertilizer, fumigants, etc., can be purchased and applied according to soil laboratory and plant clinic recommendations.

## III. Purchasing and Handling of Planting Stock

Plants should be ordered during mid-summer of the year before planting, but delivery should be delayed until March or early April. Transplanting should occur as soon as the plants are received. Early planting is desirable, and the specific delivery date should be as early as weather and soil conditions will permit in a given region of the State.

Transplants of semi-erect blackberries are traditionally produced by rooting or layering of shoot-tips. Considerable variation in size of the root system can occur among resultant rooted tips. Producers are urged to purchase dormant, top quality, "one-year" rooted-tips rather than "seconds" or "No. 2's", etc., since the latter may have insufficient root systems and poor survivability.

Dormant rooted tips may be stored at 34° to 40°F in plastic bags if transplanting must be delayed after delivery from the nursery. Such refrigerated storage involves less risk (than does "heeling-in" or temporary planting) of damaging or losing the buds from which new canes will develop. "Heeling-in" is an acceptable practice if refrigeration is not available, but care must be exercised during subsequent digging and transplanting operations to avoid injuring tender buds and elongating shoots.

Some nurseries are now producing transplants by use of small stem cuttings, and methods similar to tissue culture are being adapted. This work is needed to increase propagation rates and to reduce or maintain prices, but resulting transplants may require more care. Producers who purchase such transplants should be prepared to irrigate, and to maintain a high degree of weed control in the field. It may be useful to consider growing these kinds of transplants in pots or in nursery rows for one year before transplanting to the field.

Do not allow the root systems of any transplant type, whether dormant tip-rootings or leafy plants from cuttings, to become dry and shrivelled during storage or transplanting.

#### IV. Plant Spacings and Planting Methods

Spacings of 6 to 8 feet in the row and 10 feet between rows are suggested for use with the 6' vertical 2-wire trellis. The transplanting operation may be accomplished entirely by hand using hand tools such as a spade or post-hole digger to pry open a planting slit or to dig a transplant hole. It seems more efficient, however, to open a planting trench with tractor-mounted equipment and then to place transplants and cover root systems by hand; the remainder of the trench can then be filled in by use of a cultivator, etc. Tractor-mounted transplanting machines are available, but the cost must be scrutinized with reference to the number of acres which a producer is likely to establish. It probably won't be economical to purchase machines for the limited acreages (1/2 to 10 acres) which Virginia producers should consider.

Regardless of transplanting method or equipment, it is essential that rooted-tips be oriented properly, i.e., with roots spreading laterally downward and with the succulent "tip-bud" or crown bud pointed upward or horizontally. The soil must be tamped firmly around the roots but care must be taken not to damage the crown bud which should be placed approximately 2 inches below the back-filled soil surface. Application of water immediately after transplanting is beneficial as a source of moisture and to further settle soil around the roots.

The "handle" or shoot to which the crown is attached should be severed at the ground line as soon as transplanting has been accomplished.

#### V. Fertilizers, Soil Management, and Irrigation

Fertilizer suggestions (Table 1) are presented for the producers' reference. These suggestions are intended for the "usual" situation, so modifications may be required when plants respond with either too much or too little growth of 1st-year canes.

Table 1. Fertilizer recommendations for semi-erect thornless blackberries.

First Growing Season:

Time to Apply	Method of Application	Kind of Fertilizer <sup>1</sup>	Amount to Apply
At planting	None	None	None
Just after growth starts in the spring	Spread uniformly in 4" bands around, but not closer than 6" from the transplant's stem or "handle".	Ammonium nitrate	1/2 to 1 ounce per transplant

Second Growing Season and Each Growing Season Thereafter:

Time to Apply	Method of Application	Kind of Fertilizer <sup>2,3</sup>	Amount to Apply
Just before growth starts in spring	Spread uniformly in a 3' wide band over the row, or side-dress with 1/2 recommended on each side of the row. Side-dressing bands should be 1' wide and 16" to 18" from row-center	Same as above	3.0 to 7.0 lbs. per 100' of row length

1. Lime should be applied (according to soil test results) 6 months to 1 year before planting.
2. Phosphorous and potassium should be applied (according to soil test results) and incorporated with the soil at least 2-3 weeks before planting. Only nitrogen is recommended during the year of planting.
3. The soil should be tested every 2 years for acidity, phosphorous, potassium, calcium and magnesium. If these tests indicate a pH of 5.7 or higher, and medium or high levels of the above nutrients, only nitrogen is needed on an annual basis. Lower pH readings, or low levels of individual nutrients indicate a need for lime and/or a more complete fertilizer such as 10-10-10.



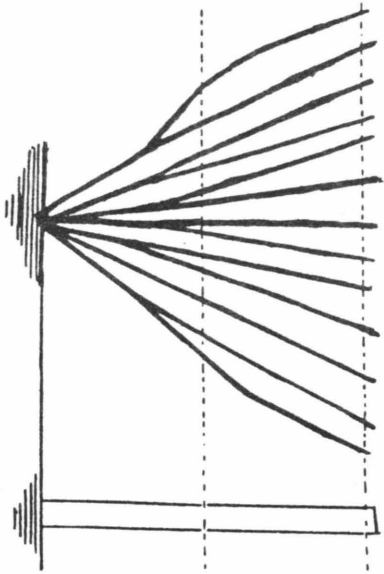


FIGURE 1A  
Vertical 2-wire trellis and fan pattern of training with minimum branching of canes. Note use of long laterals to maintain desired "density" of canes within the allotted trellis space. This is most often applicable in young plantings.

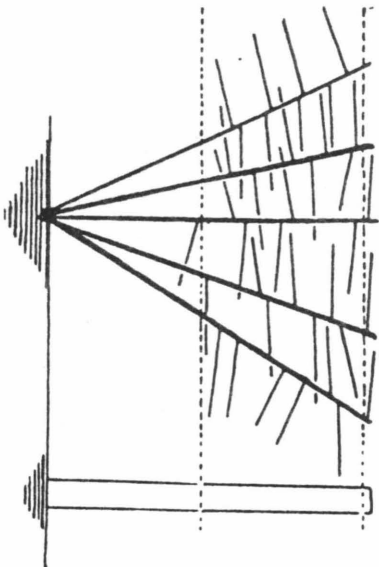


FIGURE 1B  
Vertical 2-wire trellis and fan pattern of training with highly branched erect canes as may be produced on mature crowns of semi-erect cultivars.

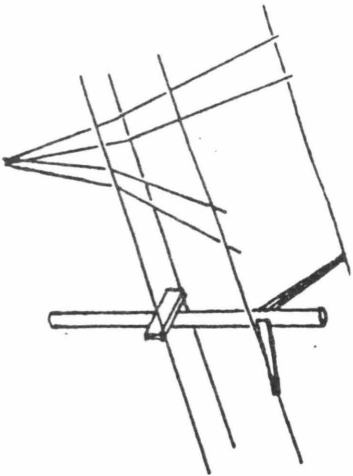


FIGURE 1C  
4-wire horizontal trellis or "wide-topped" trellis with canes trained in an inclined fan pattern. Fruiting shoots on the outward slanting canes tend to dangle downward for easy visibility.

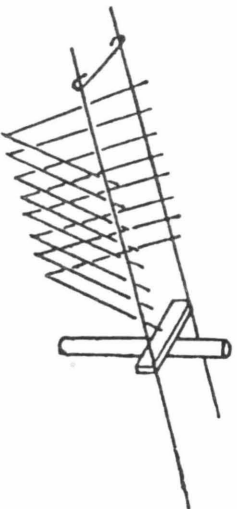


FIGURE 1D  
Horizontal 2-wire trellis with canes trained to both wires. Note the "between-wire retainer" which keeps wires from spreading apart when fruit load gets heavy. Canes tied to wire located at about 4 1/2 feet height with plants spaced 3 to 4 feet apart in the row.

It is suggested that a grass (fescue) sod be established between rows, or that a fall-planted overcrop (spring oats) be planted for disking in the spring. A 4'- to 5'-wide grass-free, weed-free strip must be maintained under the trellis. This can be accomplished by use of recommended herbicides (request most recent recommendations from your local Extension Agent), or other methods in combination with hand-hoeing or manual weed removal.

An adequate supply of water is necessary to produce large fruit size and high yields. It is also needed to maintain sufficient vigor so that enough new canes are produced to support a crop in the following year. It is generally recommended that plants receive one acre-inch of water during each 7- to 10-day interval of the growing season; the amount of water can be reduced if trickle or similar irrigation systems are employed. These lower-volume methods of irrigation will also reduce the risks of fruit rots by avoiding the need to wet the foliage and fruit during application of water. However, clean water and a filtration system are needed for trickle systems; the producer is urged to consult Extension personnel and commercial suppliers for complete information on designs, operational specifications, etc.

#### VI. Trellising, Training, and Pruning

Trellising is recommended to support heavy yields which may exceed 20 or 30 lbs. per plant in well-grown, mature plantings. Several types of trellis can be used, but the type chosen will affect or relate to the training system which has been selected. A vertical, 2-wire trellis (Figures 1A, 1B, and Item A below) has supported heavy loads of fruit, it is fairly simple in construction, and it is the most economical to construct. More complicated designs (Figures 1C and 1D) have been tried in research plots or by producers. Advantages of the latter trellis types may be better visibility of fruit for easier harvesting, allocation of vegetative and fruiting canes on different parts of the trellis to reduce competition between these growth phases, greater surface area for better exposure to sunlight and for greater yield capacity, reduced damage to canes by cultural or harvest operations, reduction in time required for tying canes, etc. These trellis types are more complicated or expensive to build, and adaptation of plant growth habits for training on these structures have not been fully evaluated; producers are cautioned to employ them only after careful consideration of the involved extra costs and risks. The wide-top trellis (Figure 1C) may permit closer spacing of plants in the row (e.g., 3 feet), but may require wider spacing (e.g., 12') between rows.

These cultivars seem well adapted to the "fan-system" of training (Figures 1A and 1B). This system (or pattern) gives good distribution of foliage to sunlight, and it distributes fruit uniformly over the surface of the trellis. Such distribution of foliage and fruit is beneficial for uniform application of pesticides. It also allows for better air circulation within the canopy, and should aid in drying of foliage and fruit after rains or heavy dew to minimize severity of fruit rot problems.

It should be pointed out that the weakest part of the plant may be in the junction between canes and the crown. Application of too much force when bending canes into place on the trellis can disrupt this connection completely, or it may break the vascular system at this point so that canes die or fruit poorly during the next year. It is also essential to avoid

breaking canes above ground, and it must be emphasized that healthy functioning canes are more important than a "perfect" pattern on the trellis.

Pruning and training suggestions are outlined below for adapted semi-erect cultivars with 6' x 10' spacings and a 6' vertical, 2-wire trellis. Other spacings, training systems, and trellises will require adaptation of these suggestions for best results. The producer should be alert for changes as more information is accumulated on growth and fruiting habits of this crop.

#### A. Trellis Suggestions

1. End posts should be 10' long (6' to 6.5' above ground and 3.5' to 4' below ground) with minimum diameters of 6" to 8". Sturdy braces or anchors are required to prevent end posts from leaning (or from being lifted in the soil) under stresses caused by wire-tightening procedures or by the weight of fruit and foliage on trellis wires.

Line posts should be placed 25' to 30' apart in the row. These posts should be 4" minimum in diameter and 8' in length with 2' of this length in the ground and 6' above ground.

2. Wires (9 gauge or slightly smaller) should be stretched and loosely stapled at the 36" or 40" and 72" heights on line posts but securely fastened to end posts.
3. The trellis may be constructed either before planting or during the first growing season. It should be completed before shoots emerge, or at least before they are long enough to interfere with trellis construction. This will avoid damage to shoots which may, if growth is vigorous, provide a partial crop one year after planting.

#### B. Pruning and Training

1. First year (i.e., year of planting)
  - a. Remove the above-ground portions of the cane (i.e., the "handle") completely after planting.
  - b. Do not summer-prune; avoid damage to developing shoots as these may, when vigorous, provide a crop in the following year.
  - c. If broadcast herbicides are providing good weed control, shoots may be left on the ground (growth habit is prostrate) during the 1st summer. If weed control is poor or if sod middles have been established, tie new shoots to the trellis as soon as they are long enough to reach the bottom wire. Shoot tips will tend to take root and produce new plants during late summer or fall; tip-rooting must be prevented (or resulting daughter plants must be removed) to maintain desired plant spacing in

and between rows. Tip-rooting is inhibited by some recommended herbicides; shoots should be picked up and tied to the trellis before rooting if no herbicides are used.

- d. During the late dormant period (i.e., just before buds begin to swell in the spring), retain 2 or 3 of the most vigorous canes (remove all others), train and tie these shoots to the trellis in a uniform "fan" pattern. Head canes and laterals back to remove dead or small-diameter (less than 1/4") wood and shorten retained canes to 7 or 8 feet in length for the 1st fruiting season.
2. Second year (includes 1st fruiting season)
    - a. Strip buds from the lower part (i.e., within 18" to 20" of the soil) of each retained cane after buds have swollen and produced 1/2" to 1" of new growth. This will eliminate fruiting shoots whose berries would otherwise have contacted the soil and become unusable. Chemical pruning agents have been used in some regions, and local testing may permit us to recommend such practices in the future. Stripping buds from the lower canes may be omitted where labor supply or costs are limiting factors, but this may affect plant capacity to maximize yields of usable fruit.
    - b. Remove or sever shoots (canes) which were retained in dormant pruning, as soon as harvest has been completed for the year; usually in mid- to late August, depending upon the cultivar.
    - c. Summer-prune by removing 10" to 12" from tips of new main shoots after they have become long enough to tie in place on the top wire of the trellis. Generally, cuts should be 4" to 6" above the top wire after tying. There may be increased danger of cane blight if summer pruning is done too soon before, during, or after periods of rainfall or irrigation, etc. Removal of shoot-tips may not be needed in some training systems.
    - d. Prevent rooting of shoot tips, during late summer and fall, by tying shoots up; use of recommended herbicide programs may coincidentally prevent tips from taking root.
    - e. During late dormancy, select and retain 3 to 8 of the most vigorous main canes produced during the preceding year for production of fruit in the following summer. Adjust the number of canes per plant according to the amount of growth which occurred during the previous summer. Train canes in a fan pattern away from the crown and place ties where canes cross each trellis wire. Lateral shoots may be shortened to lengths of 10 to 20 inches; or if they are vigorous and originate below the bottom wire, they may be pruned longer and tied to the upper trellis wires as though they were main canes. Head-back (i.e.,

shorten) main canes as necessary to prevent competition among plants, but allow shoots of adjacent plants to overlap a foot or two at their ends. Total retained cane lengths (main canes plus laterals) of 20 to 50 feet are probably appropriate, depending upon plant size or vigor, for this age plant.

### 3. Third year and after

- a. Follow the same pruning procedures as for the second year (2a-e, above), but the growth habit of these cultivars changes as the plants and crowns become larger and more mature. There may be a relatively small number of very large diameter canes and few or no small diameter canes originating from a given crown; in this case, the laterals may bear almost all the fruit. Care must be taken to ensure that sufficient laterals are retained during dormant pruning to total a length of approximately 55' (e.g., 37 laterals averaging 18" in length) (See Figure 1B). The suggestion for leaving 55' of laterals is based upon preliminary observations and it is subject to change as more information is accumulated.
- b. Plants which bore heavy fruit loads while producing numerous canes or long laterals during the previous year should be pruned to the highest number and length of retained canes. Total cane lengths of approximately 100 feet per plant are suggested for large, highly vigorous plants.
- c. Plants that have low vigor should be pruned to retain fewer canes. Low vigor may indicate that pruning was not severe enough in the previous year. Low vigor may also be caused by insufficient rainfall and irrigation, insufficient nitrogen (or other) fertilization, or by the effects of insects (esp. red raspberry crown borer) and diseases.
- d. Excessive vigor may be the result of pruning which was too severe during the previous season, too much nitrogen, or too much rainfall and irrigation. Excessive vigor also may result when winter injury reduces or eliminates cropping in the previous year. In the latter case, the grower should be cautious in adjusting his pruning severity; such vigorous vegetative growth is not likely to recur when a full crop load is present on the plant.

## VII. Harvesting and Sale

The harvest season for semi-erect thornless cultivars extends for approximately a month in each cultivar. The fruits of all these cultivars turn black several days before they are fully ripe. They may be harvested while slightly immature, firm, and quite tart, for use in processed products (jams, jellies, etc.) to which sugar is normally added; they also may be transported for sale in this condition. However, fruit will not be sweet enough for consumption without (or with a minimum of) added sugar unless

it is fully ripe at harvest. Fully ripe fruit is easily ruptured during harvest or in the picking container after harvest. Pick-your-own customers may prefer fully ripe fruit, and the producer will likely realize higher harvested poundage if fruit is allowed to ripen fully. The producer will have to educate customers to harvest selectively by demonstrating the difference in amount of force required to separate "ripe" and "fully-ripe" fruit from the pedicle (fruit stalk). It will probably help if harvesters are permitted to taste the difference between "ripe" and "fully-ripe" fruit. Fully-ripe fruit will be much easier to remove from pedicles, drupelets (individual segments of a fruit) will be quite plump and rounded in outline, and it is not so shiny in appearance as those which are less mature. Some producers harvest once per week, but others harvest 2 or 3 times each week; the shorter intervals reduce losses from rots and over-maturity.

Either quart or pint containers may be used by producers who harvest fruit to sell from roadside markets, etc. These are convenient sizes for the customer, and larger containers increase the risk of damage to fruit from the weight of overlying fruit or by the spread of fungi within containers. Refrigeration will generally result in more rapid cooling of fruit at the centers of these containers than in larger containers.

Larger containers (e.g., 4 to 10 quarts) may be better for P.Y.O. sales volume, but it is important that some means be used to contain juice for customer usage and to prevent stain damage to the customers clothes or vehicles. Customers are often required to provide their own containers; this has some advantages. However, the producer can also provide containers for loan or sale to the customer. Five-quart plastic paint buckets have been relatively inexpensive and convenient to use. These may be easily washed for re-use, but wooden or pulp containers would be stained and unsightly after a single sale. Washing of plastic buckets can be avoided and other kinds of harvest containers may be reusable if stout (3-4 mil thick) plastic bags are used as "liners" during harvest. Such liners can be tied shut and used as inexpensive containers in which to transport fruit from the farm. Care must be used in closure, to prevent plastic bags from leaking; it may be safest and still inexpensive to place closed bags of fruit inside other larger bags and then to tie again.

Fully ripe fruit should be used within a day of harvest, but less mature fruit may be stored for a few days if fungicides have been employed to prevent fruit rots in the field, if fruit is refrigerated promptly, and if it is handled carefully during harvest and transport.

#### VIII. Pests and Diseases

Insects, diseases, and other pests are often dismissed as unimportant aspects of blackberry production. However, yield potential can be reduced from 10 or 12 tons per acre to a negligible amount if producers do not treat or prevent certain problems. The more serious insect damages and potential losses observed by this author on semi-erect thornless cultivars in Virginia have been due to crown borers, plant bugs, psyllids, red necked cane borers, Japanese beetles (in fruit), June beetles (in fruit) and click beetles (in fruit). Other insects such as horntails, army worms, corn borers (or ear worms), and certain gall-forming wasps have been observed to damage first-year canes. High populations of mites have been observed, but the extent of their effects upon yield have not been ascertained. These cultivars

may also be damaged by fruit-rotting fungii, orange rust, cane and leaf rust, double-blossom (or rosette), fire blight, and crown gall to name some of the more serious diseases.

Rabbits and ground hogs have been observed to cause severe damage by stripping bark from the lower canes during winter, and deer may be expected to graze on young shoots as well as bark. Birds can reduce yield if they are present in large numbers during fruit ripening, but this author has not observed serious bird damage on these cultivars to date. Evidence of racoons feeding on fruit has been observed, but yield losses have not been estimated.

These and other pests or diseases may reduce yields considerably, but information on economic thresholds is generally lacking. Control or preventative measures are available for some but not all of these pests and diseases; contact your local Virginia Cooperative Extension Service Agent for information on diagnosis of problems and recommendations for treatment or control.

