Blackberry Growth & Development

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Blackberry Origin

- Native to Asia, Europe, North & South America
- Used in Europe for over 2,000 years
  - Consumption
  - Medicinal purposes
  - Keep out marauders

Terminology-Brambles

- Blackberry canes last for two seasons – (Biennial canes with perennial roots)
  - Primocane – The first year shoot or cane on a blackberry.
  - Floricane – A flowering and fruiting cane the season after it was produced.

Terminology-Brambles

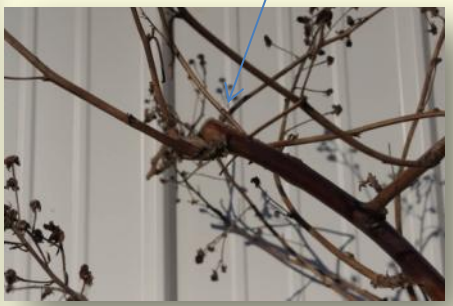
- Blackberry canes last for two seasons – (Biennial canes with perennial roots)
  - Primocane – The first year shoot or cane on a blackberry.
    - These shoots grow vigorously due to apical dominance and only a few lateral branches develop from leaf axils.
    - Topping promotes lateral branch development.

Terminology-Brambles

- Blackberry canes last for two seasons - Biennial canes with perennial roots)
  - Floricane – A flowering cane the second season
    - Often called a fruiting cane
    - Lateral shoots formed the second season terminate in flowers

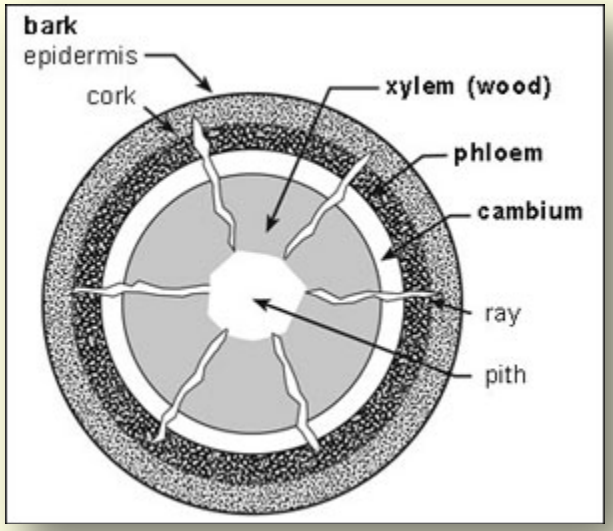
Early spring

Note: topping & branching



Dead - Winter after fruiting

Primocane Stem Anatomy



Woody Stem Cross section

Photo courtesy: U. Missouri Extension

Photo courtesy: Sara Long, UK

Pith

Xylem

Phloem

Cambium

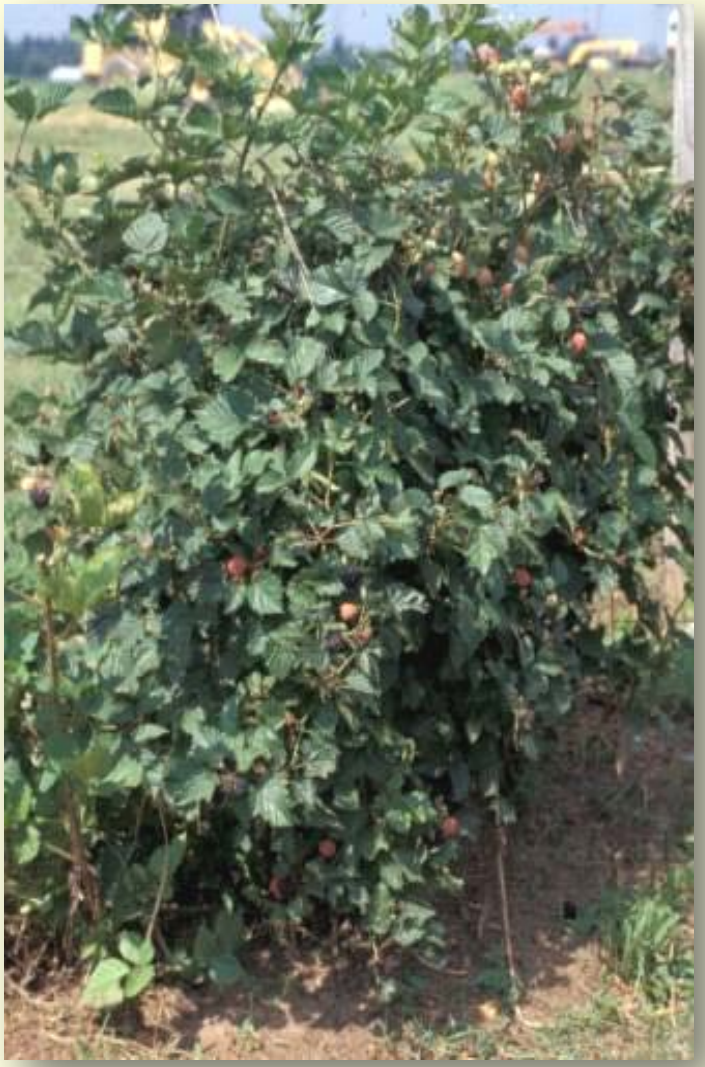
Primocane

Shoot bud

Floricane after fruiting

Erect Thorny Blackberry Characteristics

- Trellising not done
- Hardiest varieties winter killed at about -17 F
- First berries to be harvested
- Fruit are sweet
- Seeds are relatively small
- Most growers and pickers do not want to deal with the thorns



Thorny Blackberry Thorn Variations

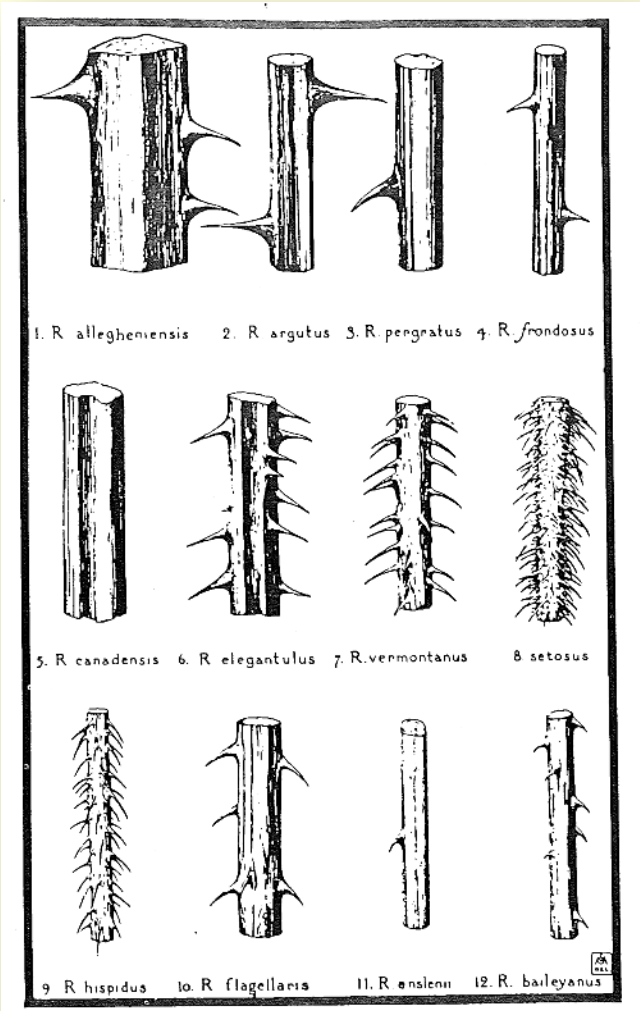


Fig. 1. Variation in thorn size, shape, and density on canes of blackberry species (3).

Picture courtesy: HortScience 1984 19(2), p. 184

'Kiowa'

Erect Thornless Blackberry Characteristics

- Trellis recommended
- Winter killed at about -10 F
- Second in sequence to be harvested
- Seeds are larger than those of thorny erect varieties.
- Generally have the lowest production of the blackberry types

'Apache' & Cal Blake

Semi-erect Thornless Blackberry Characteristics

'Triple Crown'
Reed Valley Orchard

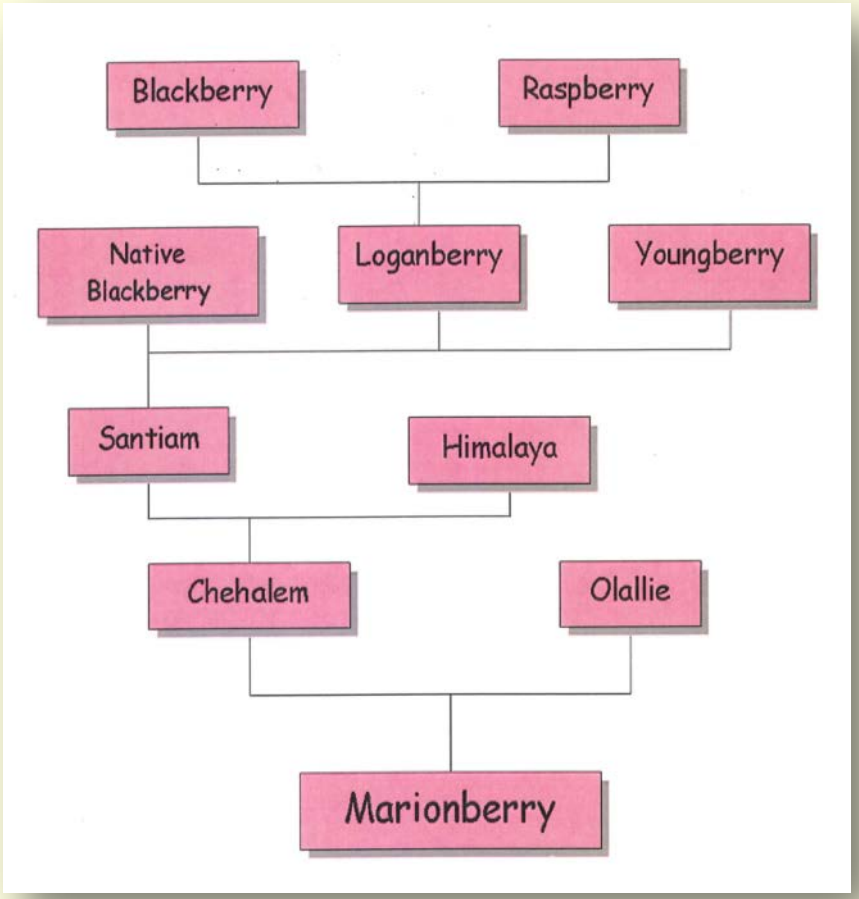
- Mostly developed by USDA, MD
- Trellis required
- Winter killed at about -10 F
- Third in the berry harvest sequence
- Fruit are generally tart until very ripe
- Berries and seeds are large
- Most productive varieties.

Trailing Blackberry

- Trellis required
- Winter killed between 14 and -7 °F
- Generally fruit early in the blackberry production season
- Berries are high quality, large and soft
- Production may be low due to winter injury

Growing wild in Italy

Trailing Blackberry Heritage



Picture courtesy: transpacificfood.com/marionberry.htm

- Loganberry - 1880
  - Judge J.H. Logan, backyard breeder, Santa Cruz, CA
- Boysenberry - late 1920's
  - Rudolf Boysen, CA developed
  - George Darrow & Walter Knott, USDA, tracked down
  - Knott's Berry Farm, Beuna Park, CA
- Youngberry - 1926
  - B.M. Young, Morgan City, LA
  - Phenomenal X Mayes Dewberry
- Santiam, rich flavor, low yield
  - R. ursinus X Logan, natural hybrid
- Chehalem - 1936
  - George Waldo, USDA, Corvallis, OR
  - Excellent flavor small seeds
- Olallie - 1950
  - George Waldo, USDA, OR
  - Black Logan X Youngberry
  - Excellent for Processing, poor hardiness
- Marion - 1956
  - George Waldo, USDA, OR
  - Chehalem X Olallie seedling
  - Outstanding productiveness
  - Large size & high superior flavor
  - Large numerous spines

Thornless Evergreen Trailing Blackberry

- Black Diamond - 2005
  - Chad Finn & others, OR & NZ
  - NZ 8610L-163 X Kotata
  - Easily grown
  - Thornless
  - Vigorous, disease resistant
  - Relatively hardy
  - Productive
    - 6-10 tons/A, OR
  - Fruit
    - Black, 1.5" long, firm & sweet
    - Seeds quite large
    - Very late season
    - Firm enough for some fresh market uses

Additional Thornless Trailing Cultivars Released by USDA, OR

- Black Pearl
- Nightfall
- Obsidian
  - Early ripening
- Metolius
  - Early ripening
- Waldo
- Siskiyou
- Black Butte
- Kotota
- Pacific
- Cascade

'Black Butte'
Picture courtesy: Wikipedia

Primocane-Fruiting Thorny & Thornless Blackberry Characteristics - Dr. John Clark, U. of AR

'Prime-Ark®45'

- Light tellis recommended
- Hardiness ?
  - Have withstood temp. of 10° F
- Produce two crops
  - Floricane Mid Jun.- Mid Jul.
  - Primocane Mid Aug.-Oct.
- Performance variable due to location
  - Temperatures of 85° F or higher in Aug. and early Sept. reduce yield, fruit size and quality

Recommended Blackberry Cultivars for Kentucky

- Erect Thorny
  - Chickasaw
  - Kiowa
- Erect Thornless
  - Natchez
  - Osage?
  - Ouachita
  - Apache
- Semi-erect Thornless
  - Triple Crown
  - Chester
- Trailing
  - Boysen (not hardy in KY)
  - Marion (not hardy in KY)
  - Black Diamond ?
  - Siskiyou ?
- Primocane-Fruiting, Thorny
  - Prime-Ark®45
- Primocane-Fruiting Thornless
  - Prime-Ark® Freedom

Thorny Blackberry Varieties

Chickasaw (1988)

- Season – mid
- Yield – high
- Fruit size – large 11 g
- Flavor – V. good 9.6% SS
- Moderately hardy
- Excellent flower and fruit fertility, very attractive berry
- Moderately resistant to anthracnose, no orange rust observed, unknown rosette

Kiowa (1996)

- Season – long (6 weeks)
- Yield – moderate
- Fruit size – V. large, 13 g
- Flavor – 8, 10% SS
- Firmness – good, excellent storing and handling characteristics
- Moderate hardiness
- Susceptible to orange rust, some resistance to rosette

Natchez Thornless Erect Blackberry

- Ripens first, Arapaho season
- Berry 8-9 g, size remains large all season
- No sterile drupelets
- Good flavor and sweetness, comparable to Arapaho averaging 9.5% SS
- Yield (2 X Arapaho)
  - 9,000 lb/A - KY
  - 11,900 lb/A - IL
- Fruit storage and handling potential good
- No orange rust or rosette observed, limited fruit anthracnose

Ouachita Thornless Erect

- Earlier than Apache with similar hardiness
- Attractive 6-7g berry
- Excellent flavor, 10+% soluble solids
- Excellent yields, 4,919 lb/A avg. (02-03)
- Good post harvest handling
- Vigorous plant
- Resistant to rosette, no orange rust reported

Osage Thornless Erect

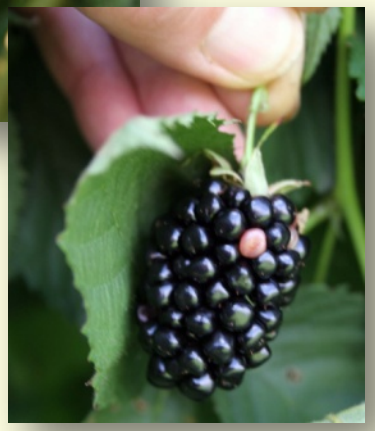
Osage

Photo courtesy John Clark, Univ. AR

- Plants first available 2013
- First harvest 5 days after Natchez
- Berry 6-7 g
- 11% SS
- V. firm, excellent flavor, glossy
- No white drupelets
- Low red drupe development
- Excellent shipping
- Untested in Kentucky

Apache Thornless Erect Blackberry

- Ripens after Ouachita
- Very attractive, largest thornless erect berry, 8-10 g, size remains large all season
- No sterile drupelets
- Very good flavor and sweetness, 10.6% SS, stores well
- Highest yielding of erect thornless varieties
- Vigorous plant
- White drupelets – genetic problem
- Tolerant to rosette, high level of orange rust resistance

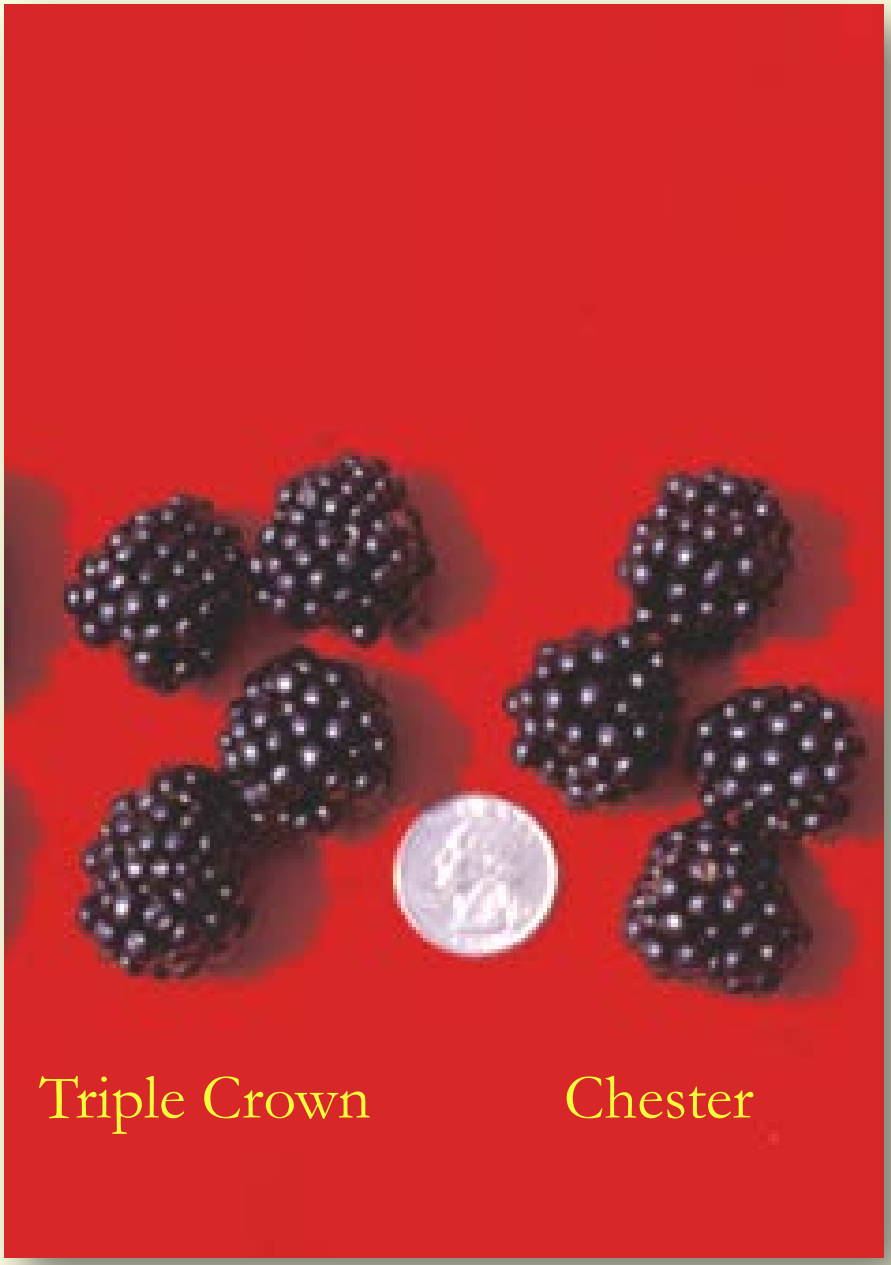


Triple Crown Thornless Semi-erect

- Ripens with or slightly after Hull Thornless
- Attractive, largest thornless semi-erect berry, 7.6 g
- Very good sweet aromatic flavor with pleasant aftertaste, 11.1% SS
- Lower yields than Chester and Hull
- Berries firm, but do not hold up as well as Chester and Hull
- Resistant to rosette, orange rust, and phytophthora

Chester Thornless Semi-erect

- Latest semi-erect thornless to ripen, 10 days after Hull
- Attractive, second largest semi-erect thornless berry
- Berries tart, 9.5% SS
- Large seeds, 6g berry
- Highest yields
- Berries firm, and hold up fairly well
- Resistant to rosette and orange rust, most resistant to cane blight, susceptible to phytophthora


Triple Crown
Chester

Prime Ark® 45 Primocane-Fruiting Thorny

'Prime-Ark®45'

- Released 2009
- Recommended for commercial production
- Fruit average 2-6 g
- Excellent flavor, firmness and storage equal to that of 'Ouachita'
- Fruit color remains black

Primocane-Fruiting Blackberry Evaluation
Established 2010 (Kentucky State University)

	2011		2012		2013	
Yield (lb/A)						
	Floricane	Primocane	Floricane	Primocane	Floricane	Primocane
Prime-Jan	586	921	-	572	-	3,305
Prime-Ark 45	552	3,904	-	2,213	-	8,812
Berry Size (g)						
Prime-Jan	3.4	2.2		2.6	-	3.5
Prime-Ark 45	4.1	3.8		3.3	-	4.7
Harvest Date						
Prime-Jan	6/17-7/14	8/11-10/29	-	7/26-10/11	-	7/18-10/22
Prime-Ark 45	6/17-7/18	8/11-10/29	-	7/26-10/11	-	8/1-10-22

Prime-Ark® Freedom Primocane-Fruiting Thornless Blackberry

- Large berries, good flavor, 10.4% SS (AR)
- Floricane crop ripens 7 days before Natchez
- Produces large berries into the fall
- No orange rust observed
- Not for shipping
- Recommended for home production & local marketing
- Plants available 2014

Prime-Ark® Freedom

Photos courtesy John Clark, Univ. AR

Prime-Ark Blackberry Evaluations
Kentucky State University

Planting established 2011

Variety	Yield (lb/A)		Fruit Wt. (g)		Harvest date	
	2012	2013	2012	2013	2012	2013
Prime-Ark® 45	583	3,795	3.0	4.9	7/26-10/11	6/24-10/22
Prime-Ark® Freedom	156	760	3.8	6.3*	7/26-10/4	6/27-10/22

* Averages 9.0 g in AR

Lowe, J., K. Pomper, S. Crabtree, J. Clark, and J. Strang

How Do Thorny and Thornless Blackberry Varieties Compare?

- Sensory study to evaluate preferences for color, flavor, texture, and overall appeal, 2012

Thornless Erect	Thorny
Apache	Chesapeake
Ouachita	OAL-W6
	Kiowa
	Chickasaw

Methods

- 60 sensory panelists
- Four 3-way randomized trials for each panelist
- Fresh fruit provided from UK Princeton Farm and commercial grower in Central KY
- Semi-erect cultivars not ripe at time of evaluation, not included

Table 1. Blackberry Evaluation on Flavor, Color, Texture, and Overall Ranking, Lexington, KY., 2012

	Flavor[1]		Color[1]		Texture[1]		Overall Ranking[2]	
★ [4]Apache	5.641	a[5]	6.525	bc	5.838	a	7.864	a
★ Ouachita	5.297	ab	6.572	c	5.666	a	7.846	a
Chesapeake	5.585	a	6.136	abc	5.809	a	7.648	a
OAL-W6	5.271	ab	5.864	ad	5.621	a	7.330	ab
Kiowa	4.728	bc	5.990	ab	5.311	ab	6.750	ab
Chickasaw	4.440	c	5.366	d	4.917	b	6.100	b
ANOVA F-test	6.22	***[3]	10.76	***	4.63	***	4.95	***

1 Blackberry flavor, color, texture: 1 = Least preferred; 8 = Most preferred.

2 Rating blackberry for overall appeal: 1 = Unappealing; 12 = Most appealing.

3 Asterisks indicate levels of significance: *** = 0.01.

4 The order of varieties followed by Overall rankings' mean.

5 Means within a column followed by the same letter are not significantly different (Tukey's HSD, $P < 0.05$).

★ Thornless erect varieties

Initial evaluation

- Thornless erect varieties regularly rated higher for flavor, color, and texture

NC Trial 2001

Variety	Color	Firmness	Flavor	Overall	Plant type
Arapaho	4.533 d	4.533 ef	4.133 b	4.7 d	thornless
Navaho	4.600 d	4.800 f	4.200 b	4.7 d	thornless
Apache	4.667 d	4.333 de	4.067 b	4.3 d	thornless
Chickasaw	3.667 c	4.067 d	3.733 b	3.8 c	erect thorny
Kiowa	3.733 c	3.600 c	4.333 b	3.5 c	erect thorny
Shawnee	3.000 b	3.133 b	1.733 a	2.6 b	erect thorny
Black Butte	1.600 a	1.600 a	1.300 a	1.6 a	erect thorny

Similar sensory trial, rating on 1 = "poor" to 5 = "Excellent"

Blackberry Dormancy

Bud break

- Blackberries enter the endodormant phase due to shortened photoperiod and moderate to low temperatures in the fall.
- They break dormancy after sufficient chilling.

  200-400 hr. below 45° F

Blackberry Flowering

- Thornless semi-erect blackberry superior yield is due to
  - Many fruiting laterals per cane
  - Many flowers per inflorescence
  - Large fruit
- Flowering time correlates with time of harvest

- <u>Flowering sequence in thorny</u> erect and trailing blackberry occurs first in the axillary buds in the mid or bottom portions of canes and then moves toward the basal and upper sections of the canes.

- <u>Flower sequence in thornless</u> semi-erect blackberries, once the terminal flower forms is acropetal. (moves from the infloresecence base upward)
- Floral development occurs until up to late June

Blackberry Flowering

- In thorny blackberries floral initiation can occur as early as September.
- Inflorescence development begins in mid October in 'Black Satin'
- All buds of 'Hull Thornless' remain vegetative until March.
- The time of floral initiation can vary significantly with location (WV, AR, OR)
- Most vegetative buds remain vegetative over the winter
- Little or no growth occurs during the winter

Bud Development in Semi-erect Thornless Blackberry - F. Takeda & M. Wisniewski

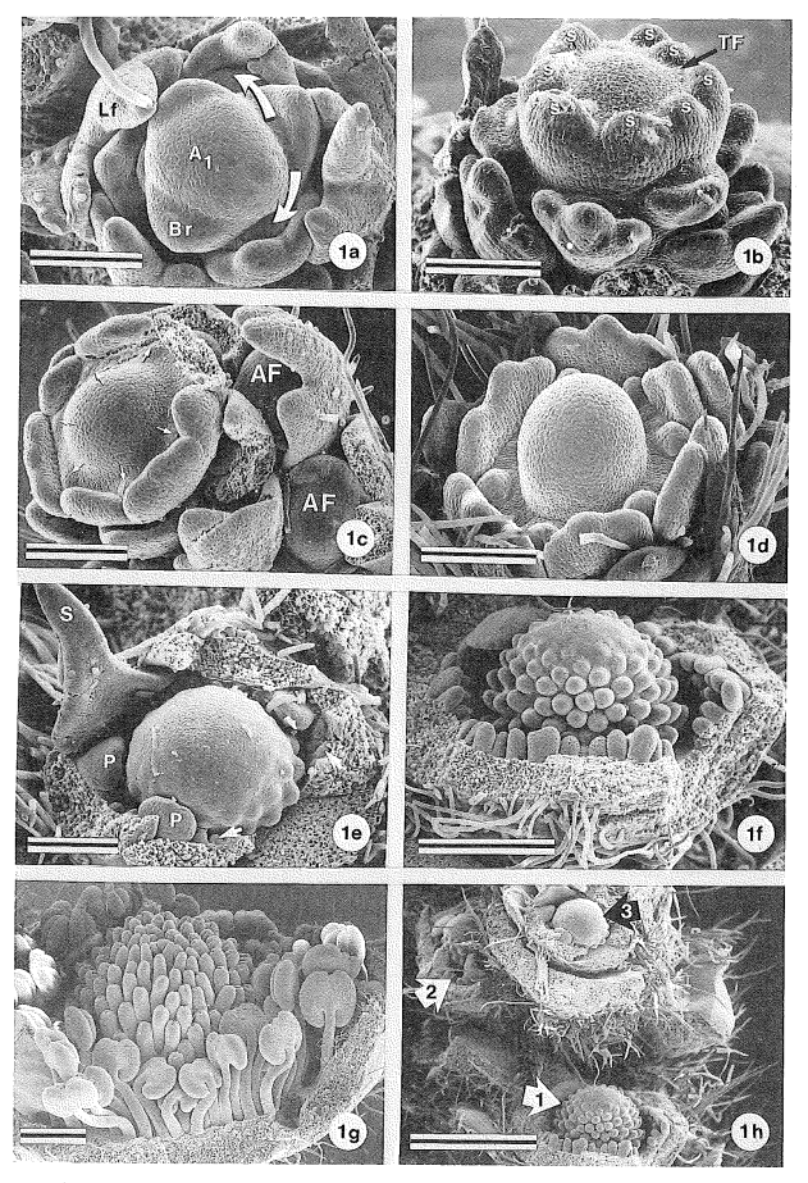


Photo courtesy: J. Amer. Soc. Hort. Sci. 114:528-534

1a Early March development of inflorescence axis (A_1)

1b Mid March primary axis, early terminal flower development, s=sepals

1c Late March inception of petal primordia & enlargement of receptacle

1d Later petal stage

1e Early April at bud break pistil & stamen development

1f Later pistil & stamen development

1g Later anther and pistil development

1h One week post-bud break helical acropetal flower differentiation, terminal flower removed, numbers indicate order of differentiation

Bar = .2-1.0 mm

Blackberry Flower

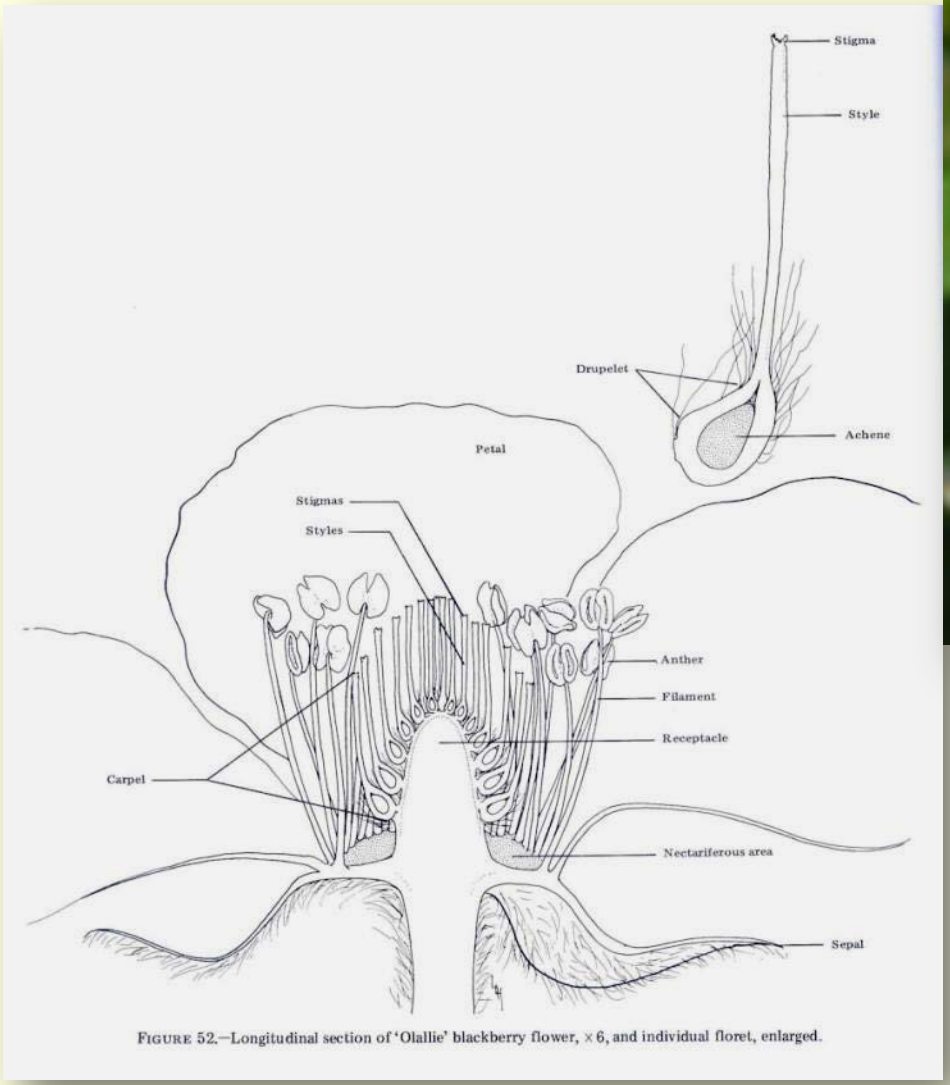


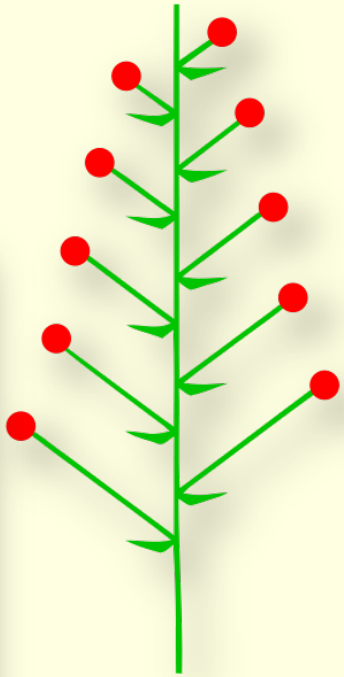
FIGURE 52.—Longitudinal section of 'Olallie' blackberry flower, × 6, and individual floret, enlarged.

Picture courtesy: Wikipedia

Insect pollinated
Does not require cross pollination

Drupelets only develop around fertilized ovules.
Sterile carpels in some varieties

Blackberry Flower Structure
A Raceme



A raceme

Drawing courtesy: Wikipedia

Traditional Training Systems

Erect Thorny
Not trellised

Largest canes produce largest fruit

Semi-erect thornless
two wire trellis

Semi-erect thornless
Four wire trellis

Thornless Erect Blackberry Pruning

- Plants tipped at a height of 3'
- In the spring, 1/3 to $\frac{1}{4}$ of the total number of canes on the plant are removed, preferentially taking out smaller diameter canes and those with red-necked cane borer.
- Lowest laterals are removed and remaining laterals are cut to about 12-18" in length

Training & Trellising Thornless Erect Blackberries

Training & Trellising Thornless Erect Blackberries

Dr. John Clark, U. of Arkansas
Clarksville Station

Thornless Erect Blackberry Yield, 02'-05'

Variety	Yield (lb/A)[1]	Avg. berry wt. (g)[1]	Soluble solids (%)[1]
Apache	7,435 a	7.5 a	10.6 a
Arapaho	1,569 b	4.0 b	10.1 b

[1]Means within a column followed by the same letter are not significantly different (Duncan Waller LSD $P \leq 0.05$)

Thornless, Semi-erect Blackberry Yield, 02'-05'

Variety	Yield (lb/A)1	Avg. berry wt. (g)1	Soluble solids (%)1
Chester	23,845 a	5.8 b	9.5 b
Hull Thornless	21,025 a	5.6 c	8.1 c
Triple Crown	14,090 b	7.6 a	11.1 a

[1]Means within a column followed by the same letter are not significantly different (Duncan Waller LSD P≤0.05)

Minimal Pruning Training

Thornless, Semi-erect Training Systems, 02'-05'

Training system	Yield (lb/A)[1]	Avg. berry wt. (g)[1]	Soluble solids (%)[1]
Conventional	17,999 b	6.6 a	9.5 b
Minimal pruning	21,308 a	6.1 b	9.6 a

[1]Means within a column followed by the same letter are not significantly different (Duncan Waller LSD P=0.05)

Rotatable Cross Arm (RCA) Trellis

- Pioneered by
  - Herbert Stiles, VPI
  - Fumi Takeda, USDA Appalachian Research Center
- Marketed by
  - Richard Barnes, Trellis Growing Systems, LLC, Fort Wayne, IN http://trellisgrowingsystems.com/

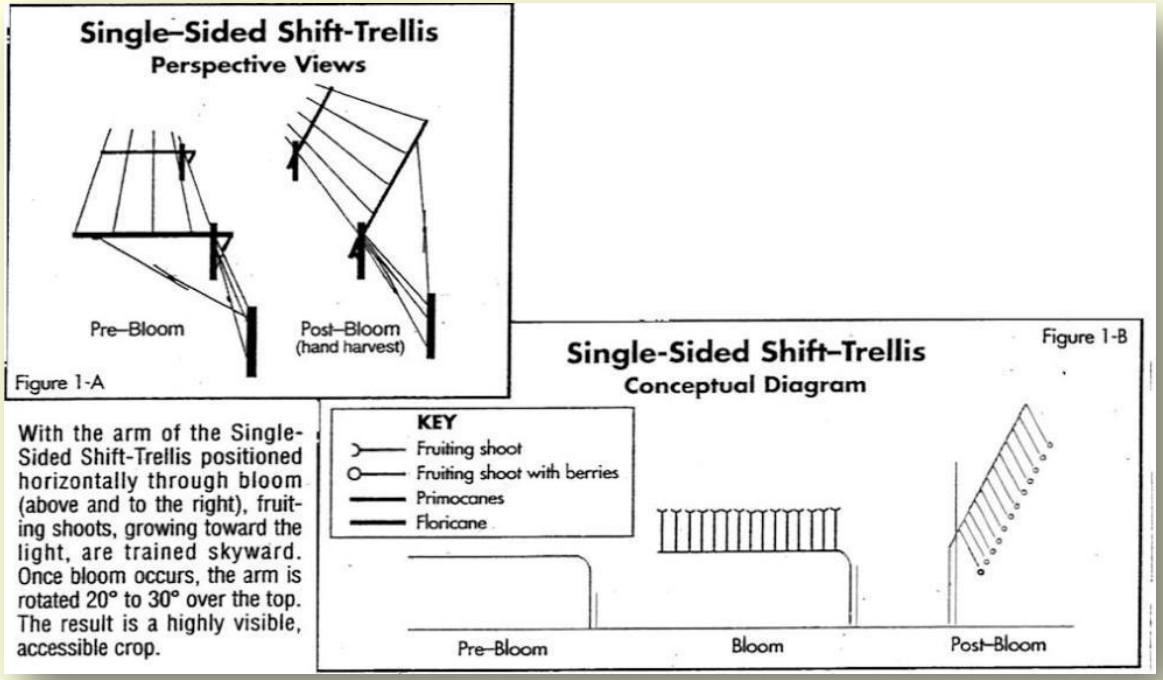


Photo courtesy Herbert Stiles, Virginia Tech.

RCA Trellis

Training canes horizontally produces more lateral canes for fruiting

80% of nodes produce flower shoots

RCA Trellis – 'Triple Crown'

Plants 5-6' apart
10-12' row spacing

Obtain more fruit and better quality fruit with fewer main canes

RCA Trellis

Get 4-6 lb marketable fruit per ft row
Reduces harvest labor 33%

Blackberry Fertilization

- **First Year**
  - Band 50 lb N/A or
  - (4-11 lb N/100' row)
    6" from plants 60 days after planting
- **2nd & Succeeding Years**

  Spring
  - 50-150 lb N/A or
  - (3.5-10 lb N/100' row)

  Fall
  - For middles, canes dormant 15-25 lb N/A or
  - (0.5-0.7 lb N/100' row)
- **Primocane Fruiting**
  - N recommendations about the same as for other blackberries, but benefit from a mid-summer N application following floricane harvest

Base amount of fertilizer applied on leaf color and cane growth

**No more than 40 lb N/A/yr on RCA trellis blackberries

Foliar Analysis
Blackberries & Raspberries

- Need recent soil test
- Sample Aug. 1-20
- 60 leaves/variety
- Fully matured leaves, mid portion of non-fruiting canes (primocanes)
- Healthy leaves
- Select clean leaves or rapidly wash
- Dry on paper towel

Roundup injured

Winter Injury

- Associated with
  - Mild fall temperatures and early fall freezes
  - Drought stress
  - High N
  - Late N applications
  - Low mid-winter temperatures

Thornless varieties
Loose 10% of crop for each degree below 0°F

Note:
Dry pith

Alive and dead canes & buds

Winter injury

Photos courtesy:
Mike Ellis, Ohio State Univ.

Bud injury

- **Winter injury**
  - Associated with some of the canker diseases
  - Fungi do not seem to produce cankers unless tissue is winter injured.
  - Fungicide sprays do not reduce winter injury or cankers in this case

Picture courtesy: Mike Ellis Ohio State Univ.

'Siskiyou' Trailing Blackberry Hardiness

3 oz row cover protected to -15°F

Table 2. The effect of vertical or horizontal cane orientation and winter protection [covered or not covered with a 1.5 oz/yard^2 (50.86 g·m^{-2}) rowcover (Grow-Guard-51; Atmore Industries, Atmore, AL)] from Dec. 2009 to Mar. 2010 on cane injury and flower shoots emergence on 'Siskiyou' blackberry at Kearneysville, WV, in 2010.

Lateral cane orientation	Winter protection	Live lateral cane length (cm/plant)[z]	Flowering shoots (no./plant)	Yield (kg/plant)[y]
Vertical	Not covered	556 c[x]	118 c	3.2 b
Vertical	Covered	918 bc	157 c	4.4 b
Horizontal	Not covered	1317 b	241 b	5.7 a
Horizontal	Covered	2287 a	348 a	6.3 a

[z]Distal sections of lateral canes that were shriveled were pruned back to green peridermal tissue in Spring 2010 and the remaining lateral cane was measured to the primary cane; 1 cm = 0.3937 inch.
[y]1 kg = 2.2046 lb.
[x]Mean separation within columns by differences of least squares means of SAS (SAS Institute, Cary, NC) Proc Mixed. Means within the same column followed by a same letter not significantly different at $P = 0.05$.

F. Takeda and J. Phillips, 2011

Blackberry Fruit Type
Aggregate

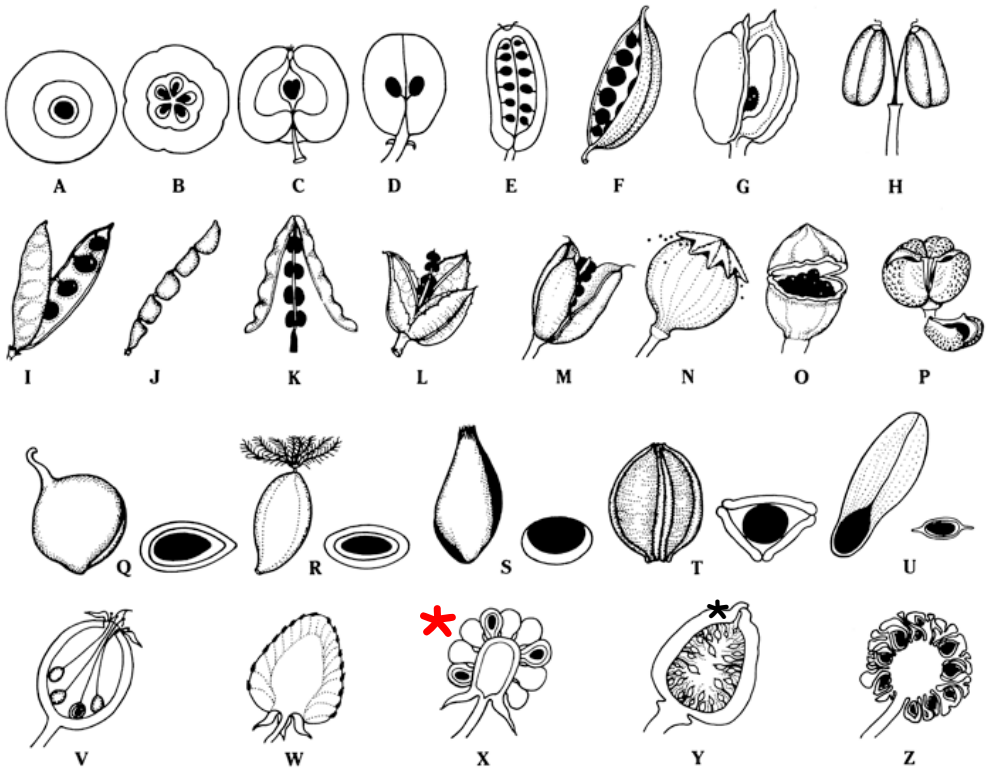


Photo courtesy: plantnet.rbgsyd.nsw.gov.au

Drupes
Drupelets

Blackberry v.s. Raspberry

- Receptacle remains in blackberry fruit and is left on the plant with raspberries

Photo courtesy: http://fruit-crops.com/rubus.html

Sunburn

White Drupelets
(Associated with Sunburn)

'Apache'

- John Clark, U. AR
  - Higher prevalence in some cultivars
  - Seems to be associated with an abrupt temperature increase and a drop in humidity
  - Hot dry air increases UV exposure

White Drupelets - Due to Insects

Apply at red berry stage (Brigade 10WP 3 day PHI moderate for both)

Brown stink bug

Thrip Photos courtesy: Ric Bessin

Delegate 25WG (1 day PHI or
Entrust 80WP (1 day PHI)

Stink bug nymph

Assail 30SG (1 day PHI) or
Actara 25WB (3 day PHI)

Blackberry Fruit
Non-Climacteric

- Fruit do not produce ethylene during the ripening process
- Fruit have a high respiration rate

Harvest - KY

- Thorny
  - June 15-July 15
- Thornless erect
  - June 16-Aug. 5
- Thornless semi erect
  - July 1- Sept. 1
- Thorny & Thornless Primocane fruiting
  - June 15 – July 15
  - Aug. 15 - Oct. 29

- Pick gently lifting berries with thumb and fingers
- When harvesting for sale, don't pick fruit when dead ripe

Post-harvest Processes

- Respiration
- Acid changes
- Pectic changes
- Esters for flavor and aroma are produced
- Pigment changes
- Moisture loss

Fruit pH increases as acids are metabolized.

Blackberry Quality Maintenance

- Ideally harvest blackberries when they are cool and dew has dried off.
- Place berries in the shade immediately after harvest.
- Refrigerate 40 to 60 minutes after harvest
  - For every hour after harvest that bramble fruit are not refrigerated, one day of storage life is lost.
  - Reducing the temperature also slows growth of disease and decay organisms.
  - Leads to produce sweating, when warmed up though.

Handling Fresh Produce

Produce	Temp. F	Rh (%)	Sprinkle
Apples	30-40	90	No
Blackberries	31-32	90-95	No
Broccoli & Greens	32-35	90-95	Yes
Bell Peppers	45-50	90-95	Yes
Muskmelons	32-34	75-80	No
Tomatoes, green	55-70	85-90	No
Tomatoes, ripe	45-50	85-90	No
Watermelons	36-40	75-80	No

Red Cell, Red Drupelet, Color Reversion in Stored Blackberries

(Penelope Perkens-Veazie, NCSU)

- Occurs a day after being in storage, black fruits start showing red drupelets

- Found in both thorny & thornless varieties
- Found more in
  - Certain varieties
  - Early fruit
  - Shiny blackberries
  - Lower storage temp (35 F)
- Associated with pH anthocyanin color shift
  - Red drupelets 3.04
  - Black drupelets 3.41
- The jury is still out on this one

Bramble Antioxidants

Table 1. Bramble (*Rubus* spp.) phytochemical and antioxidant values. Fruit grown at the UK Horticulture Research Farm, Lexington, Kentucky, 2009 and 2010.

2010 Cultivar	Total Phenolics[z]	Total Anthocyanins[y]	FRAP[x]	TEAC[w]
Blackberry				
Triple Crown	469	184	38	69
Hull	562	219	46	75
Chester	451	184	38	66
Chesapeake	223	102	30	53
OAL W-6	333	159	30	57
Chickasaw	242	115	28	46
Kiowa	413	207	34	64
Black Raspberry				
Mac Black	1112	637	49	121
Jewel	918	562	47	106
Red Raspberry				
Heritage	277	97	19	34
Caroline	264	72	19	36
Yellow Raspberry				
Anne	154	6	17	25
LSD	116	60	5	11

z Total phenolics expressed as mg chlorogenic acid/100 g fresh weight.
y Anthocyanins expressed as mg cyanidin 3-glucoside/100 g fresh weight.
x FRAP total antioxidant activity expressed as µmol ascorbic acid equivalents/g fresh weight.
w TEAC total antioxidant activity expressed as µmol Trolox equivalents/g fresh weight.
v Mean separation within years by Fisher's LSD at P = 0.05.

Archbold et. al, 2010. University of KY

Spotted Wing Drosophila (SWD)

Drosophila suzukii

- Found all across KY this past summer
- Female can puncture fruit and lay eggs
  - Serious problem in soft fruit particularly later in season
    - Fall raspberries
    - Blackberries
    - Blueberries
    - Strawberries
    - Peaches

Photo courtesy
Patty Lucas

Photo courtesy G. Arakelian
Los Angelis county Ag. Commissioner

Photo courtesy
Martin Hauser, UC IPM

Questions?

Natchez

Apache

Triple Crown