

2005 Bramble Agent Training

Table of Contents

- 2 Blackberry Certification Program
- 47 Blackberry Cultivars In Depth
- 87 Bramble Disease Control
- 105 Bramble Life Cycle and Environmental Requirements
- 139 Estimated Costs of Producing, Harvesting & Marketing Harvesting & Marketing Blackberries in the Southeastern United States
- 169 Fresh Fruit & Food Safety
- 204 IR-4 Program: How it Works and What is in the Pipeline for Brambles
- 235 Pruning & Training Brambles
- 277 Significant Insect Pests of Significant Insect Pests of Caneberries and Caneberries and Management Options Management Options
- 338 Update on Blackberry Production in South Georgia
- 361 Weed Control in Brambles

Blackberry Certification Program

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Myron Fountain N.C. Crop Improvement Association, Inc. Primary Purpose of the Micropropagation Unit at NCSU

To meet the increasing need of small fruit and vegetable industries in North Carolina, the southeast and other areas for virus-indexed, disease-free, true-to-type vegetatively propagated and certified planting stocks. Primary Function of the Micropropagation Unit

To develop and maintain: *Nuclear Stock in vitro cultures (tissue culture plants). *Nuclear Stock Mother plants. ***Foundation plants (first generation** from Nuclear Stock Mother plants) that are: virus-indexed, true-totype and disease and pest-free.

Micropropagation Unit Programs

*Sweetpotato *Strawberry *Blackberry *Blueberry

Status of blackberry crop in the Southeastern U.S.

*New cultivars from the U of AR breeding program.
*Only one nursery in the region (N.C.) that produces micropropagated virus-indexed Certified plants.
*Rapid increase in commercial blackberry acreage.
*Insects, viruses and other pathogens are often spread with nursery planting stocks.
*Diseases can reduce marketable yield and longevity of blackberry plantations.

Status of blackberry viruses in the U.S.

*Most research has been done on raspberry viruses in the Pacific Northwest
*Research on blackberry viruses was initiated in 2000 at: NCSU (Z. Pesic-VanEsbroeck, T. Guzman & G. Fernandez) U of AR (R. Gergerich) USDA-ARS-OR (R. Martin)

Blackberry virus project at NCSU was initiated in 2000

 Decline of cultivated blackberries in commercial plantings as early as 2-3 years after planting.

2. Virus-like symptoms on plants.

3. Reduction in marketable yield and berry quality.

Blackberry virus survey in 2001 & 2002 North Carolina, South Carolina and Virginia

Sites: 5 in North Carolina 4 in South Carolina 1 in Virginia Cultivars: Apache, Arapaho, Black Satin, Choctaw, Chickasaw, Chester, Kiowa, Lochness, Navaho, Rosborough, Shawnee & **Triple Crown Sample collection: 1. Leaves from primocanes and floricanes, roots** and seed from symptomatic blackberry plants. 2. Leaves from primocanes and floricanes from asymptomatic blackberry plants.



Blackberry virus survey in 2001 & 2002 North Carolina, South Carolina and Virginia

Virus detection by ELISA (Agdia) for: Tobacco ringspot virus-**Tomato ringspot virus Tobacco** streak virus **Raspberry bushy dwarf virus** Impatiens necrotic spot virus Tomato spotted wilt virus *dsRNA for unknown viruses

Blackberry virus survey in 2001 & 2002 North Carolina, South Carolina, Virginia & Arkansas

Tobacco ringspot virus (leaves, roots, seed) Tomato ringspot virus (leaves, roots, seed) Raspberry bushy dwarf virus (leaves, roots) Impatiens necrotic spot virus (leaves, roots) **Tobacco streak virus - negative** Tomato spotted wilt virus - negative Two new crini viruses characterized at USDA-ARS, Corvallis, OR: **Blackberry yellow vein virus Beet pseudo yellows virus**

Table 1. Incidence of six blackberry viruses in three states

State	Location	Positive samples/total samples					es
		TRSV	ToRSV	TSV	RBDV	INSV	TSWV
North	1	71/76	37/80	0/76	1/76	37/80	0/76
Carolina	2	1/46	13/52	0/46	0/46	1/39	0/33
	3	92/187	105/161	0/152	2/152	53/152	2 0/152
	4	93/136	30/100	0/80	0/80	34/80	0/80
	*5	0/6	0/6	0/36	0/63	1/6	0/6
South	6	11/44	28/47	0/44	0/44	7/25	0/34
Carolina	7	6/6	6/6	0/6	0/6	2/7	0/6
	8	1/3	3/3	0/3	0/3	nt	nt
	9	3/10	10/10	0/10	0/10	nt	nt
Virginia	10	0/42	0/42	0/12	0/12	2/20	0/20
nt-not te	ested						

Blackberry variety trial Cunningham Research Station



Arapaho *Tobacco ringspot virus*





Kiowa Impatiens necrotic spot virus

Triple Crown *Impatiens necrotic spot virus*





Arapaho Tobacco ringspot virus Impatiens necrotic spot virus

Arapaho Tobacco ringspot virus Impatiens necrotic spot virus



Unidentified virus(es) (dsRNA)

In 2003 a crinivirus associated with a chlorotic line pattern in blackberry was detected in cultivated blackberry plants in North Carolina, South Carolina and Arkansas.

Martin, R.R., I.E. Tzanetakis, R. Gergerich, G. Fernandez and Z. Pesic. 2004. Blackberry Yellow Vein Associated Virus: A new Crinivirus Found in Blackberry. Acta Hort 656:137-142.

Virus Survey in August 2003

*Sites: 6 blackberry plantations in North Carolina & South Carolina.

*Leaf samples were collected from 29 plants with virus-like symptoms, 2 samples/plant.

*Symptoms: vein yellowing, mosaic

Incidence of BYVV

Site	Cultivar	Reaction
1	Kiowa, Chester	+
2	Dirkson, Navaho	+
3	Chester, Apache, Hall	+
4	Apache, Arapaho,	
	Chester, Kiowa	+
5	Apache, Choctaw	+
6	Kiowa, Arapaho, Navaho	· +

29/29 plants tested (+) for BYVV.

Either one or both leaf samples from the same plant tested (+) for BYVV.

One sample tested (+) for RBDV, and all samples tested negative for TRSV & ToRSV.

Vector? Whitefly, species ????

Blackberry plants infected with BYVV alone are usually asymptomatic.

Co-infection with the second virus (synergism) is required for symptom expression.

How many viruses infect blackberry in the Southeastern U.S. ???

RANGE OF SYMPTOMS OF *BLACKBERRY YELLOW VEIN VIRUS* ON SEVERAL BLACKBERRY CULTIVARS. THESE IMAGES ARE FROM FIELD PLANTS THAT COULD HAVE HAD MIXED INFECTIONS THOUGH THEY TESTED NEGATIVE FOR *RASPBERRY BUSHY DWARF, TOBACCO RINGSPOT, TOMATO RINGSPOT* AND *STRAWBERRY NECROTIC SHOCK* VIRUSES. A. ARAPAHO; B. NAHAVO; C. CHOCTAW; AND D. KIOWA



Arapaho Agrobacterium crown gall

Systemic orange rust



Management of plant viruses and other pathogens and pests in nurseries and cultivated blackberry plantings

Use of Certified micropropagated virus-indexed and disease and pestfree stocks to establish nursery blocks and commercial plantings.
Micropropagation & Certification

Micropropagation:

- * Propagation of plants by meristem tipculture in the laboratory.
- * Some cultivated blackberry plants in the Southeastern U.S. originate from virusindexed Nuclear Stocks.
- * Micropropagation does not necessarily mean that plants are free of viruses and other pathogens or true-to-type.

Certification:

* Production of micropropagated virusindexed and true-to-type blackberry plants under strict protocols and in compliance with the Certification standards to maintain cultivar identity, purity, and freedom from designated diseases and pests (plants viruses, anthracnose, crown gall, systemic orange rust, Phytophthora root rot, dagger nematode, etc.).

In North Carolina, blackberry plants are inspected by the N.C. Crop Improvement Association, Inc., and tagged as Foundation, Registered and Certified stocks by the N.C. Foundation Seed Producers, Inc.

Protocol for Blackberry Propagation

1. Plant selection 2. Meristem tip-culture (Nuclear Stock in vitro TC plants) **3 Nuclear Stock Mother plants** 3. Virus-indexing 4. Evaluation for trueness-to-type **5. Foundation plants** 6. Certified nursery



Summary

Many viruses infect blackberries but only a few things that can be done to minimize the impact of the diseases caused by these viruses.

- *No chemicals to control viruses directly: removal of infected plants.
- *Nematode and aphid-borne viruses: chemicals can help to control virus vectors and reduce virus spread. *Pollen-borne viruses: no chemicals.

Summary

- *Breeding efforts to develop resistant cultivars. *Use of biotechnology to develop resistant cultivars.
- *Use of Certified virus-indexed planting stocks is critical to establish new plantings.
 *The additional cost of these plants is small compared to the overall cost of establishing a new planting.



Acknowledgments

*College of Agriculture and Life Sciences, NCSU *Department of Plant Pathology *Southern Region Small Fruit Consortium *N.C. Foundation Seed Producers, Inc. *N.C. Specialty Crops Program

N.C. Certification standards for: Sweetpotato Strawberry Blackberry

Blackberry Cultivars In Depth

John R. Clark Professor of Horticulture University of Arkansas Fayetteville, Arkansas

Guidelines for Discussion

 Assume trailing types
 Double blossom/ will not be used or adapted (Pacific susceptibility Northwest material) important • Fresh market only – postharvest (PH) info pertinent

rosette (DB/R) • Chilling requirement important (hours below 45F in winter)

Guidelines for Discussion

- Any potential cultivar to be considered will be mentioned (if known about by author)
- Best estimate of advantages and disadvantages
 will be emphasized
 - Personal testing experience references largely will be from Clarksville, Ark., summer highs 90-100F, winter lows 0-12F, 35 degrees N lat; Bluecrop BB ripens 5 June, Redhaven peach 28 June; Chandler SB 15 April



Arapaho

- Arkansas, 1993
 Thornless, erect
 Medium, 5-7 g (ave. 5 g)
 Ripe 4 June 20 June
 Yield med.-low, 4-6,000 lb/a
- Flavor very good, 10%
 SS
- PH potential very good, just behind Navaho DB/R- resistant Chilling 400-500 hours Tip dieback has limited use in cooler areas; hardiness concerns in colder areas

Arapaho



Arapaho: Recommendation

- Has performed better in the deep South than Arkansas, likely due to less winter injury
- If trials in your have been good, plant further
- Greatest benefit is the best PH early variety; but competes with Mexican late season fruit in south Ga.?
- Useful in medium-chill areas and also DB/R resistance
- Be aware of lower yields, tip dieback, some variation in year-to-year yields

Navaho

- Arkansas, 1989
 - Thornless, erect
 - Medium, 5 g ave.
- Ripe 15 June 20 July
- Yield med.-high, 8-10,000 lb/a
- Flavor exceptional;very sweet fruit, 11-12% SS

- PH potential great the best of all blackberries tested by JRC
- DB/R- resistant
- Chilling 800-900 hours; not for low chill areas but use of Dormex can address this concern
 Orange rust susceptible

Navaho



Navaho: Recommendation

- If trials in your have been good, plant further
- Is not low chill, so if planting in areas with less than 800 hours of chilling, consider Dormex use –Gerard Krewer the expert
 Use orange rust-free stock

Apache

- Arkansas, 1999
- Thornless, erect
- Large, 7-10 g; (ave. 8 g)
- Ripe 20 June- 20 July
- Yield med.-high, 7-10,000 lb/a; best of Ark. thornless
- Flavor between Navaho
 and Arapaho Good!
 11% SS

- PH potential –similar to Arapaho
- DB/R resistant -similar resistance as other Ark. thornless
- Chilling not confirmed;
 500-800 hours?
- White drupe limitation

Apache



White Drupes



Apache: Recommendation

- If performing well in area, plant further
 Low chill use still a concern so verify adapted to your area
 - Major concerns with white drupes; rainfall seems to greatly increase this problem

Ouachita

Thornless, erect
Berry size 6-7 g
Ripens <u>between</u> <u>Arapaho and Navaho</u>; average 12 June
Yields usually among highest of any Ark. thornless

Flavor <u>near that of</u> <u>Navaho</u>; 10% SS
PH potential very good, <u>much like Navaho</u>
DB/R –<u>similar resistance</u> <u>as other Ark. thornless</u>
Data indicates that is <u>likely mid-low chilling as</u> <u>Arapaho</u>;

Ouachita



Ouachita: Recommendation

- Trial commercial plantings recommended (only released in 2003)
- Excellent PH capability so should fit in for shipping
- Ripens between Arapaho and Navaho so provides a continuous fruiting period
- Chilling appears similar to Arapaho so hopefully as well adapted to medium-chill areas

Chickasaw

- Arkansas, 1999
 Thorny, erect
 Large, 7-12 g; (ave. 10 g)
 - Ripe 11 June- 1 July
- Yield high, 10-12,000 lb/a; best of Ark. group
- Flavor near Shawnee, Kiowa, 10% SS

PH potential –between Kiowa and Arapaho
DB/R –susceptible
Chilling not confirmed; likely 500-700 h
Virus concern!

Chickasaw



Chickasaw: Recommendation

- DB/R susceptibility a major limitation in areas where this disease occurs
- PH potential not fully determined commercially
- Merits are large berries and high yields
- Virus concern is major; not fully determined the virus involved but most common Arkansas cultivar with virus symptoms
- Possible concern with Botryosphaeria cane blight also (seen in Ga.); susceptible in lab tests

Kiowa

- Arkansas, 1996 PH potential fair to • Thorny, semi-erect good, exceeds • Very large, 9-14 g (ave. 12 g) • Ripe 12 June – 23 July • Yield high, 7-12,000 lb/a, long season

 - Flavor good, similar to Shawnee, 10% SS
- **Choctaw and Shawnee** • DB/R- susceptible, but not as severe as other thornies
 - Chilling 200 hours lowest of Ark. group

Kiowa



Kiowa: Recommendation

- Key point is PH handling and if good, an excellent choice; Some indicate great success, some less so
- Key value is very large size so possible premium value?
- Should be very useful in low-chill areas
 - PYO folks like this one even with thorns

Choctaw

- Arkansas, 1989
 - Thorny, erect
 - Medium-small, 4-6 g (ave. 5 g)
- Ripe 30 May-18 June
- Yield, med.-very high,6-14,000 lb/a
- Flavor good, some consider the second-best Ark. thorny variety

- PH potential very poor in US; good in Central Mexico
- DB/R- susceptible
- Chilling 300 hours?

Choctaw: Recommendation

- Due to poor PH, don't plant in US for shipping
- Central Mexico and possibly other nonrainfall areas is very good and highly recommended for early ripening
 Merit is the earliest cultivar – earlier than
 - Arapaho by 5-10 days

Cherokee

• Arkansas, 1974 • Thorny, erect • Medium-small, 4 g • Ripe 14 June – 15 July • Yield, med -6,000 lb/a • Flavor, Very good, some consider the best Ark. variety

PH potential very good, proven commercially
DB/R- susceptible
Chilling 500 hours?
Cherokee: Recommendation

- Hesitant to fully endorse as is older and should have caught on by now
- But a proven PH shipper with very good flavor
- Consider revisiting in trials
 - Not for low chill areas, is small fruited, and DB/R susceptible

Other Arkansas Varieties: Recommendations • Shawnee (1983) too soft for shipping • Comanche (1974) too small and not high yields

• Cheyenne (1977) don't see merit over Chickasaw or thornless but does have good firmness

Chester Thornless

- USDA Beltsville, MD, 1985
- Thornless, semi-erect
- Medium, 5-7 g
- Ripe 1 July 15 Aug.?
- Yield very high-25,000 lb/a (not in Arkansas)
- Flavor fair to good, among best USDA thornless

- PH handling excellent– commercially the most important
- DB/R- no report
- Chilling- 900 hours

Chester Thornless: Recommendation

- Excellent variety based on yield, PH handling, proven performance in mostly non-southern areas
- Note later season than other cultivars heat in the South; not very commonly grown in the South
 - Evaluate closely for season and adaptation prior to planting

Triple Crown

- Thornless, <u>semi-erect</u>
 Medium-large, 6-8 g
 Ripe late July 10 Aug.?
- <u>Yield high</u>
- Flavor probably best among USDA thornless
- PH handling fair
 DB/R- no report but assume resistant
 Chilling not reported

Triple Crown: Recommendation

- PH handling reports not generally positive so some concern for shipping – be careful here
 Should be more adapted to the South than Chester or other semi-erect thornless based on
 - background
- Note later season than Arkansas cultivars
 - Evaluate closely for season and adaptation prior to planting extensively

Tupi

- EMBRAPA, Pelotas, RS, Brazil
- Thorny, erect
 - Large, 7-9 g
- Ripe "early to midseason" (not tested in Arkansas)
- Yield 3.8 kg/plant in Brazil; roughly 9-15,000 lb/a
- Flavor "well balanced sweetness/acidity"

- PH handling? Currently the hottest cultivar in Central Mexico
- DB/R- no report; possibly susceptible with Comanche as a parent
- Chilling-?? Assume low due to developed in a low chill area

Tupi





Tupi: Recommendation

Should be trialed in low-chill areas; likely not hardy in mid to upper South
Determine PH potential
Be careful with DB/R
Very nice large berry so worth examining
Plant availability in US?

Other Cultivars: Unable To **Comment on Fully To** Recommend • Chesapeake - thorny, mostly erect; up to 15 g; not as firm as Chester; hardy • Rosborough – adapted to deep South • Loch Ness - thornless; not grown commonly in US but popular in Europe



Prime-Jan® Primocane-Fruiting Blackberry







All photos are property of the University of Arkansas, Fayetteville, AR.

Prime-Jim[®] Primocane-Fruiting Blackberry







Prime-Jim® and Prime-Jan®

- <u>*Thorny*</u>, erect
 - Medium, 5-6 g
- Floricane crop ripe 5-10 June
- Primocane crop <u>late July</u> <u>until frost??</u>
- Flavor similar to other thorny varieties

- *Not for shipping* as PH potential similar to softer thorny varieties
- DB/R- *susceptible*, at least on floricanes
- <u>Recommended for home</u> <u>gardens only</u>
- <u>Heat in summer can</u> <u>damage flowers and</u> <u>subsequent fruit</u>

Comparison of Arkansas vs Oregon Primocane Fruit









Prime-Jim and Prime-Jan: Recommendation • Intended for home garden use • PH not adequate for shipping • Only value commercially would be as a *limited trial*

Propagating Nurseries and Descriptions of Arkansas Varieties

- <u>www.uaex.edu</u> then go to agriculture, then horticulture, then fruits, or
- http://aragriculture.org/horticulture/fruits_nuts/default.asp

Bramble Disease Control Guido Schnabel Clemson University

- Raspberries
 - Gray mold
 - Spur and cane blight
 - Phytophthora root rot

- Blackberries
 - Viruses
 - Double Blossom
 - Orange rust, Cane rust
 - Crown gall

Raspberry Diseases

- Gray mold (*Botrytis*)
 - blossom blight and fruit rot
 - likes cold and wet conditions
- Control options
 - prune for good air circulation
 - fungicides



Gray mold on strawberry

Gray mold fungicides

	Management	Amount of Formulation	Effectiveness (+)			
Pest/Problem	Options	per Acre	or Importance (*)	REI	PHI	Comments
Botrytis gray mold	Rovral WDG	1-2 lbs	+++	24 hrs	1 day	Rovral is labeled for all brambles. Rovral WDG and 4L should be mixed with a protectant fungicide such as Captan in a minimum of 100 gallons per acre. Do not make more than 4 applications per season. Do not make more than 2 consecutive applications before switching to a chemical with different mode of action.
	Rovral 4L	1-2 pts	+++	24 hrs	1 day	
	Ronilan DF	1-2 lbs	+++	12 hrs	9 days	Ronilan is labeled for raspberry only . For control of <i>Botrytis</i> sp. apply in a tank mix with a protectant fungicide such as captan in a minimum or 100 gallons of spray per acre. Do not apply more than 8 lbs. of Ronilan DF per acre per crop season. Do not apply through irrigation or during rain. If heavy rain or a 24 hr period of wettness follows application, than retreatment is necessary.
	Elevate 50WDG	1.5 lbs	+++++	12 hrs	12 hrs	Begin application at 10% bloom and continue through harvest. Avoid making more than two consecutive applications of Elevate before switching to a fungicide with another mode of action. Do not apply more than 6.0 lbs of material per acre per year.
	Switch 62.5WG	11-14 oz	+++++	12 hrs	0 days	Begin application at early bloom and continue on a 7- 10 day interval. Do not exceed 56 ounces of product per acre per year. Make no more than two sequential applications before using a fungicide with another mode of action.
	Endura	8 oz	+++++	12 hrs	0 days	No more than 2 sequential applications of Endura should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Endura per acre per crop year
	Pristine	18.5-23 oz	+++++	24 hrs	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Pristine per acre per crop year.

Cane blight (Coniothyrium fuckelii)

- Symptoms
 - Vascular lesions under bark
 - Black spores on surface
- Control
 - Topsin-M, Copper
 - spray new canes at 6-8", 12-15", 3 wks later



Spur blight (Didymella applanata)

- Symptoms
 - fungus destroys fruiting spur
 - leaves die from
- Control
 - Heritage is susceptible
 - Topsin-M and Nova



Double blossom; Rosette

Blackberry Diseases (Rosette; Cercosporella rubi)

• Yield impact

 infected blossoms do not form berries, berries of non-infected parts are poor quality

• Variety susceptibility

- Shawnee 100%
 susceptible, Choctaw
 40%, Triple crown 20%
 erect thornless –resistant
- Fungicides



Rosette fungicides

		Amount of				
	Management	Formulation	Effectiveness (+)			
Pest/Problem Options		per Acre	or Importance (*)	REI	PHI	Comments
Rosette (Double blossom)	Abound FL	See note	+++	1 day	1 day	Bordeaux mixture will cause leaf burn if applied on hot days or combined with insecticides.
	Pristine	6.2-15.4 floz	+++++	4 hrs	0 days	No more than 2 sequential applications of Abound should be made before alternating with fungicides that have a different mode of action. Do not apply more than six applications of Abound per acre per crop year.
	Nova 40W	18.5-23 oz	+++++	1 day	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Pristine per season.

Orange rust (Gymnoconia nitens)

- Symptoms:
 - shoots are weak, spindly
 - Blisters (aecia) underneath leaf surface
- Control
 - Navaho, Darrow, Humble and Purple and Black raspberry very susceptible
 - Remove infected plant
 - Fungicides to prevent spread



Orange rust on wild blackberry



Leaf and cane rust (Septoria rubi)

- Symptoms
 - spots on canes and leaves
 - infected canes are unproductive
- Control
 - Shawnee, Choctaw and some older cultivars are susceptible
 - prune out infected canes
 - fungicides



Rust control with fungicides

	Management	Amount of Formulation	Effectiveness (+)	DEI	DIII	
Pest/Problem	Options	per Acre	or Importance (*)	REI	PHI	Comments
Cane and leaf rust, orange rust, and yellow rust	Nova 40W	1.25-2.5 oz	+++++	1 day	1 day	Nova is registered for use on blackberry and raspberry. Nova is also active against powdery mildew. Begin applications as early as bud break, and continued applications on a 10-14 day schedule, depending on disease(s) and disease severity. Do not apply more than 10 oz/A per growing season.
	Cabrio EG	14 oz	+++++	1 day	0 days	No more than 2 sequential applications of Cabrio should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Cabrio or other strobilurins per acre per crop year
	Pristine	18.5-23 oz	+++++	1 day	0 days	No more than 2 sequential applications of Pristine should be made before alternating with fungicides that have a different mode of action. Do not apply more than four applications of Pristine per season.



Biological control of Crown Gall



		Amount of				
	Management	Formulation	Effectiveness (+)			
Pest/Problem	Options	per Acre	or Importance (*)	REI	PHI	Comments
Crown gall	Galltrol	1 plate/1-5 gal	++	0 days	NL	Usually applied as a dip to root cuttings. One container can treat as many as 10,000 root pieces. This biological control bacterium has not controlled all strains of the crown gall bacterium found in South Carolina but has reduced the incidence of crown gall in peaches. Local data on brambles is not available. All brambles are susceptible. Avoid wounding of roots during planting because wounds are required for infection.
	Nogall	100g/gal	++	0 days	0 days	One 100 g pack of Nogall, when mixed into a slurry with 1 gallon of water, treats up to 4,000 seeds, up to 1,000 seedlings and depending on their size, 100-2,000 cuttings.

Phytophthora root rot



Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Phytophthora root rot	Ridomil Gold EC	¹ / ₄ pt/1000 linear feet in a 3 ft. band	++++	12 hrs	45 days	Ridomil is labeled only for raspberries aand can be applied anytime during the spring.
	Aliette WDG	5 lbs	++++	12 hrs	60 days	The first foliar application of Aliette WDG should be applied after bud break with at least 1-3 inches of new growth and repeat applications applied on a 45-60 day interval. Do not apply more than 4 applications during the growing season. A fall application can be applied at least 30 days prior to leaf drop. Do not tank-mix Aliette WDG with copper compounds. When applied prior to or after copper, the pH of Aliette WDG should be raised to 6.0 or above (See label for detailed instructions.). Do not use adjuvants which enhance pesticide penetration with Aliette WDG. For raspberries only: Copper can cause phytotoxicity on black raspberry cultivars if used with Aliette. It is also an occasional problem on red raspberries.

Blackberry Viruses

	Abbreviation Host t		Prevalence in the Southeast	Detected combinations			Vectors
Tobacco ringspot virus	TRSV	Blackberry	high	х	х	х	nematodes
Tomato ringspot virus	ToRSV	Blackberry	medium	Х		х	nematodes
Raspberry bushy dwarf virus	RBDV	Blackberry	medium				pollen
Impatiens necrotic spot virus	INSV	Blackberry	high	х	х		thrips
Blackberry Yellow Vein virus	BYVV	Blackberry	?				whitefly
Beet Pseudo Yellows virus	BPYV	Blackberry	?				whitefly

Summary chart for fungicides, insecticides, and horticultural practices

Developmental	Dormant	Green tip	Shoots 6" long	Early bloom	Cover sprays	Harvest	After harvest
Stage		_	_	(5-10%) and			
U				full bloom			
Disease	Crown gall	Anthracnose	Anthracnose	Botrytis	Anthracnose	Botrytis	Mummy berry,
Controlled	(Galltrol,	(Copper,	(Copper,	(Rovral,	(Copper,	(Rovral,	rusts,
(Fungicides)	Nogall)	Sulfur,	Sulfur, Cabrio,	Ronilan,	Sulfur, Cabrio,	Ronilan,	Anthracnose
	_	Cabrio,	Abound,	Elevate,	Abound,	Elevate,	(Cut canes
	Anthracnose	Abound,	Pristine)	Switch,	Pristine)	Switch,	back to 12"
	(Destruct	Pristine)		Endura,		Endura,	stumps)
	nearby		Various rusts	Pristine)	Botrytis	Pristine)	
	hosts)	Spur blight	(Nova, Cabrio,		(Rovral,		Rosette
		(Cabrio,	Pristine)	Rosette	Ronilan,	Rosette	(Bordeaux,
		Abound,		(Bordeaux,	Elevate,	(Bordeaux,	Abound,
		Pristine)	Powdery	Abound,	Switch,	Abound,	Pristine)
			mildew	Pristine)	Endura,	Pristine)	
		Septoria leaf	(Sulfur, Nova,		Pristine)		Septoria
		spot	Cabrio,	Powdery		Septoria	leafspot
		(Copper,	Abound,	mildew (Nova,	Rosette	leafspot	(Copper,
		Cabrio,	Pristine)	Abound,	(Bordeaux,	(Copper,	Cabrio,
		Abound,		Pristine)	Abound,	Cabrio,	Abound,
		Pristine)	Septoria leaf		Pristine)	Abound,	Pristine)
			spot (Copper,	Mummy berry		Pristine)	
			Cabrio,	(cut and	Septoria		Phytophthora
			Abound,	remove witch's	leafspot	Phytophthora	root rot
			Pristine)	brooms)	(Copper,	root rot	(Ridomil)
					Cabrio,	(Ridomil)	
			Phytophthora		Abound,		
			root rot		Pristine)		
			(Ridomil,				
			Aliette)				

BRAMBLE LIFE CYCLE AND ENVIRONMENTAL REQUIREMENTS

Rubus Taxonomy (Batology)

- Family:Rosaceae
 - Subgenus Ideobatus raspberry (200 species)
 - Rubus ideaus -red
 - R. occidentalis -black
 - R. neglectus- purple

Subgenus Eubatus - blackberry (>>> 200 species)

- R. allegheniensis
- R. argutus
- R. cuneifolius
- R. canadensis
- R. frondosus
- R. ursinus (most often cited, but not always actual parent)

Dewberries

Dewberries are basically smaller, prostrate, low-chill blackberries

Native to the southeastern US.

- Can be any species or cultivar of trailing blackberry
 - R. baileyanus (eastern US)
 - R. ursinus (western US)
 - etc

Center flowers in cluster open first vs outer in erect types (now murky)

Plant Morphology Growth Habit

Perennial roots
Biennial shoots:
primocane (first year)
floricane (second year)
Phenology Plant Life Cycle

First year

- Canes grow but do not produce fruit*
- Called primocanes
- Second year
 - Canes produced last year bear fruit and die
 - Called floricanes (fruiting canes)

* Primocane fruiting brambles are the exception

Plant growth - plant parts



Animation of bramble life cycle



Primocane Fruiting Raspberries and Blackberries

First year

- Canes grow and produce fruit on tips of cane in late summer to fall of first year
- Usually pruned in winter to ground
- Second year
 - If canes are not pruned in winter, fruiting will commence in spring from mid section down
 - 10% of total yield

Animation of primocane fruiting



The Raspberry Plant



perennial roots



perennial roots

red raspberry

black raspberry

The Blackberry Plant





biennial canes (suckers from roots)

perennial root system

trailing thornless

upright thorny

Climatic requirements

Raspberries

- Cool temperate summers, sustained winter temperatures, winter injury -20°F
- Blackberries
 - Warm temperate summers, tolerates fluctuating winter temperatures, winter injury at 0°F

Flower initiation

Short day, lowering temps Flower buds initiated in terminal bud Changes from a vegetative bud to a reproductive bud Continues down cane Raspberry fall and spring Blackberry fall ,winter and spring?

Inflorescence development

- Development controlled by temps
 - Low temps stop development
- Rapid differentiation and development in spring
- Budbreak
 - Short, lateral, leafy branches terminate in an inflorescence
- Number of flowers vary w/cvs

Primocane fruiting

Initiate flower buds in summer internodes below tip continue to elongate for short period of time but no new lateral buds

Lateral buds on upper portion of cane grow and produce lateral branches with lateral flower buds

Flowering to fruit

	Ouachita	Apache	Arapaho	Navaho
50% bloom	7 May	5 May	4 May	7 May
Peak Fruiting	19 June	30 June	11 June	1 July
No. days	42	56	38	55

Dormancy



Winter temperatures

Chilling requirement (hrs <45F)
 Blackberry 400-1000 (AR types)
 Raspberry 250-1400 (Anita and Latham)

Chilling Units (hrs 35-45F)



Dormancy - State of Rest

Shorter days and cool temps Canes stop growing Acquire hardiness Maximum hardiness 1-2 months later (Jan) Cannot resume growth even if temps are warmer Blackberries??

- Early fall frosts
 - Can growth slows/stops
 - Plant slowly becomes more cold hardy
 - Early onset of below normal temps. can cause damage
 - Earlier and lower temps cause more severe damage
 - Dieback and death of canes

 Late maturing cvs and plantings with poor management practices, subject to this type of injury

- Injury during dormancy
 - Most hardy period
 - Genetic hardiness primary factor, environment close second

Type of bramble	Low temp limit (°F)	
Red raspberry	-20	
Purple raspberry	-10	
Black raspberry	-5	
Blackberry	0	

Late season freezes

- Cane gradually decrease in hardiness
 - Even a few days above 28F in low chilling types
- Cvs resistant to low midwinter temps can suffer late season freeze
- Symptoms include:
 - Dieback of canes
 - Failure of laterals to develop
 - Weak lateral growth
 - Normal initial growth followed by collapse
- Interior of bud is black or conducting tissue is black (damaged)

- Freeze during flowering
 - 28°F
 - Raspberries and early fruiting blackberries
 - Pistils most tender
 - Flowers develop black centers 1-2 days after freeze
 - Fruit does not develop or only few drupelets

Blackberry Winter" cold spell that occurs while blackberries are in bloom return of polar air mass after warmer air masses have begun to dominate.

Winter injury...in general....

Red>black and purple raspberries
 Erect>Trailing
 Thorny>thornless

Raspberry winter injury





Summer Temperatures

Raspberries

70°F optimum

Blackberries

~80°F optimum

Heat, bright sun and low humidity
Reduce fruit size and yield
Sunscald fruit

Light Response

Raspberry light response



Temperature response





Summer temps

Ave # days/yer above 86°F Blackberries: zones 6-8 Raspberries: zones 3-4 (PNW or high elevation)

Wind

Winter
 Strong cold winds desiccate canes
 Summer
 Wind and handling can decrease yield

Southern adapted raspberries?



Estimated Costs of Producing, Harvesting & Marketing Blackberries in the Southeastern United States

By Charles Safley Gina Fernandez Otilia Boldea North Carolina State University

Study Objectives

- 1. Estimate the costs of growing, harvesting and marketing blackberries
- Evaluate the effect of varying prices and yields
- 3. Evaluate the profitability of establishing a blackberry planting

Procedures

- Budget was based on a 1 A blackberry planting
- 2. Production practices were based on management practices recommended by Extension Specialists and Farmers
- 3. Equipment costs were based on 2003 purchase prices

4. Input prices were collected from dealers who supply NC blackberry growers

Equipment Investment – Prep Year Tractor, 60 hp 25,300 Truck, 1/2 Ton 25,000 **Boom Sprayer** 750 Chisel Plow, 7ft 3,000 5,000 Disk, 9ft, 2-row Rotary Mower, 7ft 2,600 **Irrigation Well** 2,000 Total \$63,650

Equipment Investment – 1st Year **Plastic Layer/Fumigator** \$7,000 Soil Auger 425 **Drip Irrigation & Pump** 6,031 **Fertilizer Injector** 400 **Utility Trailer** 2,000 **PTO Blast Sprayer** 3,100 \$18,925 Total

Equipment Investment – 2nd Year

Fruit Scale Utility Refrigerators Portable FACU (2) Total



5,000

<u>5,000</u>

\$10,225
- Portable Forced-Air Cooling Unit (FACU)
- Designed to fit in a standard size pick-up truck.
- Used to keep berries cool as the fruit is being transported to the wholesale market
- AG-414-7, Cool & Ship: A low-Cost portable Forced Air Cooling Unit, Michael D. Boyette, NC Cooperative Extension Service

 http://www.bae.ncsu.edu/programs/extension/p ublicat/postharv/ag-414-7/

- Advantage of the Cool and Ship System Inexpensive low initial cost compared to a stationary cooling facility.
- Reusable—can be disassembled for easy transport.
- Transportable—no need for a refrigerated truck.
- Versatile—can be used for a variety of produce.
- Energy Efficient—takes less energy than a stationary facility.
- Protects the Produce—prevents condensation or contamination.



Pictorial View Top and One Side Removed for Clarity





Blackberry Yield Pattern (Pounds per Acre) **Projected Yield** Year 0 lbs $\mathbf{0}$ 1 0 lbs 10,000 lbs 2 3 thru 9 12,500 lbs 10,000 lbs 10

Labor Requirements Prep Year May 28 Total 65 1st Year March 49 April 123 Total 225

Labor Requirements 2nd & 10th Years 500 May June 482 1,120 Total 3rd - 9th Years May 639 June 626 1,403 Total

Assumptions – Labor Costs

1. Labor Costs

- a. Hired employees: \$8.25 per hour
- b. Owner/operator: \$16.39 per hour
- 2. Costs intended to represent "True" Labor costs not just Wage Rates. Includes: a. FICA
 - b. Unemployment Insurance
 - c. Workers' Compensation
 - d. Adjustments for paid leaves

Assumptions – Annual Expenses at Full Production

1. Land Charge \$ 0.00 2. Management charge 0.00 3. General overhead expenses 30.00 4. General operating capital 45.29 18.00 5. Property taxes 40.00 6. Miscellaneous costs 7. Internet service 60.00 8. Grower meeting expenses 348.00 \$541.29 Total

Assumptions

Marketable Yields

 Marketable Yields
 50% sold at a PYO operation
 50% sold wholesale to a grocery store (s)

Estimated Costs for the Prep Year (\$/A)

Site Preparation\$ 4034.1 %Blackberry Plants3,81938.2 %(1,090 plants)

 Trellis Supplies
 5,186
 52.0 %

 Other
 562
 5.6 %

 Total Cost
 \$9,970

Estimated Costs for the 1st Year (\$/A)

Planting Prep & Planting \$ 1,109 28.0 % **Trellis Construction** 1,045 26.4 % Replanting (100 plants) 408 10.3 % 449 11.3 % Maintenance 116 2.9 % **Pruning Expenses** 21.1 % 838 Other Total \$ 3,965

Estimated Costs with a Yield of 10,000 Pounds Per Acre (\$/A)

Harvest/Marketing\$11,87276.5 %Irrigation4022.6 %Maintenance1,74211.2 %Other1,4989.7 %Total\$15,514

Estimated Costs with a Yield of 12,500 Pounds Per Acre (\$/A)

Harvest/Marketing	\$16,019	81.9 %
Irrigation	392	2.0 %
Maintenance	1,674	8.6 %
Other	<u> 1,476</u>	7.5 %
Total	\$19,561	

Harvest & Marketing Expenses for a Yield of 12,500 lbs per Acre (\$/A)

	Equ	Mat	Labor	Total
Prep Activities	0	0	49	49
PYO Harvest	0	781	738	1,519
Wholesale:				
- Harvest	36	1,568	10,244	11,848
- Refrigeration	639	0	0	639
- Transportation	701	0	1,180	1,881
Clean-up	0	0	82	82

Harvest and Wholesale Marketing (11,500 lbs/A)

• 6 week harvest season Harvest blackberries 4 times a week • Wholesale market requires a 100 miles round trip and 3 hours Truck costs = \$14.60 per hour Portable FACU = \$0.242 per hour Refrigerator = \$0.194 per hour Manager costs = \$ 16.39 per hour

Estimated Net Revenues per Acre

Price (\$/lb)	8,500	10,500	12,500	14,500	16,500
1.15 2.00	-5,044	-2,459	126	2,712	5,297
1.20 2.25	-3,769	-884	2,001	4,887	7,772
1.25 2.50	-2,494	691	3,876	7,062	10,247
1.30 2.75	-1,219	2,266	5,751	9,237	12,722
1.35 3.00	56	3,841	7,626	11,412	15,197

Estimated Breakeven Yields for Various Price Combinations

PYO Price	Wholesale Price	Breakeven Yield
(\$/Ib)	(\$/lb)	(Ibs/A)
\$ 1.15	\$ 2.00	12,402.0
\$ 1.20	\$ 2.25	11,112.5
\$ 1.25	\$ 2.50	10,066.0
\$ 1.30	\$ 2.75	9,199.5
\$ 1.35	\$ 3.00	8,470.5

Annual Flow	of Funds	for Blackberries
Year	Net Cash	Accumulated
	FIOW	Cash Flow
0	-\$ 9,970	-\$ 9,970
1	-\$ 3,965	-\$ 13,935
2	\$ 3,235	-\$ 10,700
3	\$ 3,876	-\$ 6,823
4 	\$ 3,876	-\$ 2,946
5	\$ 3,876	\$ 930
6	\$ 3,876	\$ 4,806
7	\$ 3,876	\$ 8,683

Accumulated Cash Flow



Summary

- Labor is the most expensive cost category (70% @ 12,500 lbs/A)
- If price combination is \$1.25 & \$2.50 per pound, you will need a minimum volume of 10,066 lbs to cover expenses in years 3 through 9

3. Cash Flow analysis reveals that blackberry production can be a profitable venture

!!!!Warnings!!!!

All budgets are only guides and are not substitutes for calculating costs and returns!
 Do not expand without a market!
 Do not enter without a market!

Estimated Costs of Producing, Harvesting & Marketing Blackberries in the Southeastern United States

Charles Safley: 919-515-4538 charles safley@ncsu.edu

Gina Fernandez: 919-513-7416 gina fernandez@ncsu.edu

Fresh Fruit & Food Safety

SRSFC Bramble Agent Training Savannah, GA Feb. 8, 2005

Dennis J. Osborne, Ph.D., J.D. Douglas C. Sanders, Ph.D. Donn R. Ward, Ph.D. NC State University, Raleigh, NC



Food Quality is an option

Food <u>Safety</u> is an entitlement

We have a <u>right</u> to expect safe food

Consumers See Problems



1996, 97, 98, 99 – Berries from Guatemala and elsewhere Cantaloupes

Growing discussion in trade publications Newsletter articles

Outbreaks Keep Doubling



Produce associated foodborne illness outbreaks per year more than doubled from 1973 to 1987 and from 1988 to 1998

Source: CDC Foodborne Outbreak Surveillance System

Number of Produce-Associated Outbreaks by Decade, 1973 - 1997



Estimated Frequency of Foodborne Illness in Humans in the U.S.*

- Escherichia coli 0157:H7
- Salmonella spp.
- Campylobacter spp.
- *Listeria monocytogenes*
- Escherichia coli 0157:H7
- Salmonella spp.
- Campylobacter spp.
- *Listeria monocytogenes*

- 73,480 cases in 1999
 1,412,498 cases in 1999
 2,453,926 cases in 1999
 2,518 cases in 1999
- 61 deaths582 deaths124 deaths
- 504 deaths

*Emerging Infectious Disease, Vol. 5, 1999. (http://www.cdc.gov/ncidod/eid/vol5no5/mead.htm)

Selected Produce-Associated Outbreaks, 1990 - 1997

Year	Pathogen	Vehicle	Cases	State	<u>s Source</u>
1990	S. chester	Cantaloupe	245	30 A	Central Merica (CA)
1990	S. javiana	Tomatoes	174	4	US
1990	Hep. A	Strawberries	18	2	US
1991	S. poona	Cantaloupe	>400	23	US/CA
1993	O157:H7	Apple cider	23	1	US
1993 \$	S. montevided	o Tomatoes	84	3	US
1998	Salmonella	Cantaloupe	s ?	?	Mexico?



National Program Basis

"The Guide" – FDA's <u>Guide to Minimize</u> <u>Microbial Food</u> <u>Safety Hazards</u> <u>for Fresh Fruits</u> <u>and Vegetables</u>



The "Guide" **Outlines** GAPs A Voluntary Framework, Not a Regulation

GUIDANCE FOR INDUSTRY Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables U.S. Department of Health and Human Services Food and Drug Administration Center for Food Safety and Applied Nutrition (CFSAN)



<u>Good</u> <u>Agricultural</u> <u>Practices</u>

GAPs

Reduce Vulnerability density crops & procedures most likely associated with foodborne illness

Develop procedures that will reduce the risk of a foodborne illness outbreak

Monitor procedures to keep produce safe Verify that your produce is consistently safe



Personnel Cleanliness

Proper hand-washing is the best method of reducing contamination

Probably the #1 source of food-borne illness is unsanitary worker conditions
Field Work:

Field Sanitation

Bins, Harvest Containers

Field Equipment Field Packing



Packing Facility Sanitation General sanitation storerooms, packingline Pest control birds, rodents, pets **Worker Health and Hygiene** Handwashing **Personal Health and Injuries** Training **Pick-Your-Own**



Proper Hand-Washing Removes Microbes

re you there God. It's me, Margaret. We're moving today. I'm so scared God. I've never lived anywhere but here. Suppose I hate my new school? Suppose everybody there hates me? Suppose they don't wash their hands after they use the bathroom? Suppose I get some terrible bacterial infection from them? Please help me, God. Thank you.

Two Conflicting Impulses: Search for Order and Security VS. Appetite for Novelty and Risk-taking

Reduce Risk

"Preventing is Better Than Curing"



Risk Is:

The chance that a condition or set of conditions in produce handling will lead to a hazard in the flow of your operation



Prevent Microbes from contaminating fresh produce

Rather than

Rely on corrective action after contamination



Manage Fresh Produce Risk

Ferenciae system for assuring the safe production of food products

Prevention rather than inspection

Sanitation's Importance **Only Cooking Removes All Pathogens From Fresh Produce** Some Crops Are Field-Packed, So Harvest Crews Must Have Food Safety Training

Prevent Cross-Contamination in Food Service

Employees and managers must recognize the value of training and importance of personal health and hygiene



Prevent Cross-Contamination: In-Home



Remove Outer Leaves

Prewash

Rinse

Bacteria Can Hide

Even though a surface may appear smooth, there are many places for bacteria to hide



http://www.asmusa.org/edusrc/biofilms/hires/044h.jpg

Salmonella Recovery from Stainless Steel



Cantaloupe Netting Infiltration



Cantaloupe Dye Infiltration



J. Food Prot. 66 (10), pg 1809, Cantaloupe Sanitation



2000 - 2001

Food retailers direct more attention to fresh produce food safety because of consumer demand

 Large packinghouses start adopting GAPs



2002 - 2004



National Third Party Audit Program

New Recall Program for Fresh Produce

Extensive Applied Research Program

The Food Safety System of the United States





Old Way vs. New Way



Rodent Control



Hand Washing

Courtesy Gene McAvoy

Change in Practices....



.....requires trust in new practices

Food Safety ? It's Just Common Sense





IR-4 Program: How it Works and What is in the Pipeline for Brambles

Roger B. Batts NC State IR-4 Field Research Center





THE PURPOSE THE PROCESS THE PRODUCTIVITY IR4 impact for BRAMBLES



THE PURPOSE



IR-4 Program

- Interregional Research Program No. 4
- Established in 1963
- Cooperative project between the federal government, university researchers, extension personnel and the agrichemical industry



Funding for IR-4

- USDA Cooperative State Research, Education and Extension Service (CSREES)
- USDA Agricultural Research Service (ARS)
- Agrichemical companies
- Grower organizations



Goal of IR-4

To provide pest management solutions to growers of fruits, vegetables, and other minor/specialty crops for the benefit of consumers, growers and food processors.

"FILL THE TOOLBOX"



What are Minor Crops?

- 300,000 acres or less
- Most fruits, vegetables, herbs, nuts, spices, nursery and landscape plants are considered minor crops.
- Approx. 10,000 acres of blackberries and 20,000 acres of raspberries grown in US*



Minor Crops ≠ Minor Value

- Minor crops make up >50% of total crop value in 26 states. 100% of Hawaii's crop value and 98% of Florida's.*
- Minor crops account for over \$40 billion in sales annually.
- Approx. 40% of total crop sales in the U.S.

* Source: 1997 Census of Agriculture, United States summary AC97-A51



Minor/Specialty Crop Value

1997 Census of Agriculture

State California Florida Georgia Idaho Michigan Oregon Texas Washington Others

<u>Value</u>

- \$14,400,000,000
- \$ 4,700,000,000
- \$ 1,100,000,000
- \$ 945,500,000
- \$ 1,100,000,000
- \$ 1,400,000,000
- \$ 1,100,000,000
- \$ 2,300,000,000
- \$12,654,500,000

Total

\$ 39,700,000,000



- High cost associated with registering a pesticide (Estimated \$50 million*)
- Low return on cost of registration
- High value crops may mean greater liability
- FIFRA reregistration requirements
- Food Quality Protection Act



THE PROCESS



IR-4 Project Requests

Who submits Project Clearance Requests (PCR's)

- Producers
- Commodity organizations
- Extension personnel
- Agricultural scientists



Submit a Request: http://ir4.rutgers.edu/Docs/FOODRequestForm.htm




Research Planning

Annual Food Use Workshop

Where active projects are prioritized

•Growers •Commodity groups •University Research and Extension Personnel



Regional Field Coordinators/ Headquarters Coordination



National Research Planning



Where research projects are designated for the coming year



*30-month timeline begins with approved protocol



IR-4 Regions





EPA Regions





IR-4 Research Facilities





IR-4 Yearly Workload

IR-4 will conduct approximately 100 residue studies involving 600-700 field trials annually.

2005 = 94 studies; 681 field trials





Product Registration



The petition is sent to EPA

where it is reviewed.



If everything is in order, a tolerance is granted (MRL) and a registration follows.



A new tool is now in the toolbox!!



THE PRODUCTIVITY



IR-4 Scorecard

- 7,300+ food crop tolerances since 1963
- 10,600+ ornamental tolerances since 1977
- Over 300 biopesticide tolerances since 1982
- Since 2001, over 50% of tolerances established by EPA have come from IR-4 petitions



Impact of IR4 through Section 18 Tolerances (1998-2002)

State California Florida Georgia Idaho Michigan Oregon Texas Washington Others Total

Economic Loss Avoidance

- \$1,646,500,000 (56)
- \$ 150,500,000 (20)
- \$ 151,300,000 (12)
- \$ 257,600,000 (61)
- \$ 226,700,000 (25)
- \$ 331,300,000 (66)
- \$ 92,400,000 (13)
- \$1,209,100,000 (74)
- \$1,655,600,000 (376)

\$5,721,000,000 (703)



IR-4: Impact for Brambles



Registrations and Established Tolerances for Brambles through IR-4

- Aim (carfentrazone) herbicide June 04. Previously in WA and OR only
- Benlate (benomyl) fungicide (gone??)
- Casaron (dichlobenil) herbicide
- Solicam (norflurazon) herbicide
- Direx (diuron) herbicide reregistration Aug 01
- Sinbar (terbacil) registration Mar 80 and rereg. June 98
- Lorsban (chlorpyrifos) insecticide TOLERANCE ESTABLISHED for 28 day PHI Aug 91, not currently labeled.



IR-4: Pipeline for Brambles



Bramble Projects in Progress

- Pristine (boscalid + pyraclostrobin) fungicide.
- Diazinon insecticide: reregistration; petition under review at EPA since Feb 01**
- Admire (imidacloprid) insecticide: soil application (CA only), submitted to EPA Dec 02
- Actara (thiamethoxam) insecticide: all data received at IR4 HQ Aug 03



Researchable Projects*

- Provado (imidacloprid): foliar application
- Kenamite (acequinocyl) miticide
- Capture (bifenthrin) insecticide**
- Lorsban (chlorpyrifos) insecticide**
- E2Y45 (experimental) insecticide**
- TetraSan (etoxazole) miticide
- Tanos (famoxadone + cymoxanil) fungicide

- Danitol (fenpropathrin) insecticide
- Akari (fenpyroximate) miticide
- F 1785 (flonicamid) insecticide
- Avaunt (indoxacarb) insecticide
- Mesa (milbemectin) miticide
- Rimon (novaluron) insecticide
- Sanmite (pyridaben) miticide
- Spin-Tor (spinosad) insecticide

*Projects have mfg. approval, but lack prioritization and/or efficacy data.

**Raspberry Crown Borer listed as a target pest.



Turning 'Researchable' projects into 'In-Progress' projects

- Prioritization
 - Food Use Workshop
- Efficacy data
 - Monetary support for researchers to do the work
 - Researchers-Include an extra treatment or two in your plot work
 - Forward data to IR-4:

Mr. Ely Vea, Data Mining Manager 308 Aston Forest Lane Crownsville, MD 21032 Phone: 410-923-4880 Fax: 410-923-4880 E-mail: evvea@comcast.net



Making IR-4 Work for You

- Make Your Needs Known
 - Can't solve a problem unless it is identified. Submit PCR's.
 Contact state IR-4 liaisons, specialists, etc.
 - PCR = http://ir4.rutgers.edu/Docs/FOODRequestForm.htm

• Be Visible

- Have representation at IR-4 Food Use Workshop. This is where projects receive A,B,C rankings.
- 2005 F.U.W. = Sept. 13-15, Marriott, San Diego, CA. See IR-4 website http://ir4.rutgers.edu/

Pruning & Training Brambles

David W. Lockwood Department of Plant Sciences University of Tennessee

Life Cycle

- Perennial Root System
- Biennial Canes
 - Primocane
 - Floricane

Primocanes Originate From:

• Red & Yellow Raspberry –

- Vegetative buds on roots or basal buds on floricanes

• Black Raspberry –

- Tip layers, basal buds on floricanes

- Purple Raspberry
 - Basal buds on floricanes, few tip layers
- Blackberry
 - Basal buds on floricanes

Primocane Year

- Cane grows throughout the summer
- Fruit bud initiation begins in late summer to early fall

Biennial Life Cycle of Canes

• Primocane Year

- Cane grows throughout summer
- Fruit bud initiation occurs in late summer to early fall

- Floricane Year
 - Fruit bud initiation is completed
 - Bloom
 - Fruiting
 - Cane death

Primocane-fruiting types

• Primocane year

- Cane grows early to mid-summer
- Initiates fruit buds
- Fruits in the upper portion of the cane
- Upper portion of cane dies

• Floricane year

- Fruiting occurs on lower portion of cane
- Entire cane dies

Growth Habit of Brambles

- <u>**Thorned</u>** Black Butte, Chickasaw, Choctaw, Illini Hardy, Kiowa, Shawnee</u>
- <u>Thornless</u> Apache, Arapahoe, Black Satin, Chester, Hull, Navaho, Ouachita, Triple Crown
- <u>Erect</u> Apache, Chickasaw, Kiowa, Navaho, Ouachita, Shawnee
- <u>Semi-trailing</u> Chester, Hull, Triple Crown

Why Prune?

- Lessen Pest Problems:
 - cane removal
 - Increase light, air, spray penetration throughout canopy
- Increase yields and quality of fruit
- Ease of management

Pruning Red & Yellow Raspberries



Annual Pruning Sequence – Floricane-Bearing Varieties (established plantings)

- Floricane removal after harvest
- Tip primicanes
- Head laterals
- Thin canes
- Narrow rows
- Remove laterals on lower 12 18" of canes



Floricane Removal

• When:

- After harvest disease
- Winter support
- Why:
 - Lessen carryover of pest problems
 - Increase light in canopy
 - Ease of management

Tipping Primocanes

• Why:

- Stops cane elongation
- Stiffens cane (maintains erect growth habit)
- Induces lateral branching (increases yields)
- When:
 - After primocanes exceeds desired height by 4
 in. for blackberry, 2¹/₂ to 3 in. for raspberry
 - (requires multiple passes through planting)



Tipping Primocanes-Black/Purple Raspberries



Heading Laterals

• Why:

- Increases fruit size
- Increases light penetration into canopy
- Increases ease of harvest
- Eliminates much inferior fruit

• When:

– Late winter to early spring prior to bud break

Yield Components

- Fruits/lateral
- Fruitful laterals/cane
- Canes/foot of row
- Distance between rows

Fruits/Lateral

- Lower laterals have more nodes & higher yield potential (seldom recognized)
- Large diameter canes produces more fruits/lateral
- Increase by more sever heading, reducing # canes/hill
- Increase fruitfulness of lower laterals by removing primocanes in spring

Fruiting Laterals/Cane

- Varies with:
 - Height of tipping (> ht.= > # of nodes, but a lower % of buds break & produce laterals)
- **Cane vigor** (vigorous canes have longer internodal spaces so there will be fewer nodes below the point of tipping
- % of buds that fail to grow
- **# of nodes producing > 1 lateral** (large diameter canes produce more multiple laterals BUT multiple laterals have fewer buds/lateral
Degree of lateral Heading (depends on lateral branch vigor diameter)

- Black raspberry
 - weak, small diameter:
 - strong, large diameter:
- Purple raspberry:
 - Leave 2 to 3 inches longer than black raspberry
- Blackberry:
 - Strong laterals:

12 to 18 inches

2 to 4 inches

14 to 18 inches

Black/Purple Raspberry

•Before Dormant Pruning

1. Black raspberry before winter pruning

•After Dormant Pruning

Black raspberry after winter pruning





Desired Row Characteristics

- Row width:
 - -12 to 18 inches at the base of canes
- Adjust cane population

Primocane Tipping Height

• Blackberry – erect, non-supported 40 - 44" supported 60 - 65" semi-trailing, trellised 6 - 8"

above top wire

20 - 24"

- Black Raspberry -
- Purple Raspberry 24 30"
- **Red & Yellow Raspberry** Do not tip (produces few weak, low-yielding lateral branches)

Pruning Primocane Bearers

- Fall Crop Only:
 - During late winter/early spring mow planting
 - Lessens disease carryover
 - Increases size of fall crop
- Primocane & Floricane Crop:

(optional: remove dead tips after fall harvest) remove entire cane after floricane crop

Primocane Crop Only



Allow Primocanes to grow. Maintain row width 12 – 18 in.

Mow planting to ground in late winter

Advantages of a Single-Cropping System:

- Cane thinning, detailed pruning 7 tying are eliminated
- Cold injury to buds is eliminated
- Winter damage from voles & rabbits is eliminated
- Spur blight, anthracnose, cane blight 7 several other diseases are reduced
- Sap beetle problems are reduced, many other insect problems are eliminated
- Application of fertilizers & pesticides is easier

Primocane Crop Only



Allow Primocanes to grow. Maintain row width 12 – 18 in.

Mow planting to ground in late winter

Alternate Year Harvest

- <u>Field "A"</u>
- Fruit on odd numbered years
- Grow primocanes only in even numbered years

• <u>Field "B"</u>

- Fruit on even numbered years
- Grow primocanes only on odd numbered years

Alternate Year Harvest

- Mow down ¹/₂ of planting each year
- Yield reduction 10 to 15% in blackberries
- 25 to 30% in raspberries
- Reduction in labor & pesticides may offset reduction in income with blackberries

To Support or Not To Support?

- Low head, erect blackberry No
- High head, erect blackberry Yes
- Trailing & Semi-trailing blackberry -Yes
- Black & Purple Raspberry No
- Red & Yellow Raspberry Yes

Function of a Support System

- Hold canes and fruit off the ground (promote better air circulation through planting)
- Lessen Cane Breakage
- Maximize sunlight penetration throughout the canopy
- Ease of management

Bundling Canes & Tying to a Stake



Bundling Canes & Tying to Trellis Wires



Bundling Canes & Tying to Trellis in "Teepee" Design



Fanning Canes on Trellis



Weaving Canes on a Trellis



Semi-Erect Blackberries Dormant Pruning



Trellising Red Raspberries



2-Wire Vertical Trellis



Training Semi-erect Blackberries



Tip primocanes above top trellis wire during summer

Lateral branches form after tipping.

Laterals headed to 12 – 18 in. length. Laterals within 12- 18 of ground removed.







Red Raspberries Trained to a Single-Wire Crossarm Trellis



Crossarm Trellis Floricanes Floricanes Primocanes

Significant Insect Pests of Caneberries and Management Options

> **Douglas G. Pfeiffer** Department of Entomology Virginia Tech, Blacksburg

Southeastern Fruit and Vegetable Conference Savannah GA

Flower/Berry Feeders



Thrips

Biology

Damage

Thrips
Aza-Direct 12.5-42 fl oz/A
Pyrellin EC 1-2 pt/A
Malathion 25 WP 2 lb/A
Just before blossoms open, and when new canes are 1.5-2 feet long

Intro to Pesticides

Aza-Direct
Pyrellin EC
Malathion 25 WP

Tarnished Plant Bug Kills individual drupelets, small fruit When 1 TPB in every two flower clusters



Tarnished Plant Bug



 Prevent flowering weeds
 But do not mow flowering weeds while bramble fruit or blossoms are present

Tarnished Plant Bug Azinphosmethyl 50W 0.25 lb/A Bifenthrin? Asana?

Intro to Pesticides: Azinphosmethyl 50W

Japanese Beetle

- Berry feeder
- Timing makes control difficult
- May need to spray late prebloom
- Lower populations in years following drought



Japanese Beetle Sevin 80S 1 lb/100 gal, 2 lb/A Sevin XLR 2 qt/A Aza-Direct 12.5-42 fl oz/A Surround 95WP 12.5-50 lb/A


Intro to Pesticides:

Sevin 80S
Sevin XLR
Surround 95WP
Kaolin
Organic
PHI
Visible residues

Raspberry Fruitworm Byturus rubi (eastern), B. bakeri (western)





Raspberry Fruitworm

- Small somewhat hairy light brown beetle, about 1/8 inch long
- Pupae overwinter, adults emerge in April, as raspberry leaves unfold
- Females oviposit on or near blossom buds
- Larvae enter blossoms or small fruit
- Larvae drop to ground in July, pupate in soil for winter
- Maintain weed control
- Spray early and late prebloom

Blossom Midge, *Contarinia agrimoniae, C. rubiflorae*No chemical controls established

Foliar Feeders

Leafrollers

- Malathion 8EC, 1 pt/100 gal, 2 pt/A
- Guthion 50W 0.5 lb/100 gal, 1 lb/A
- Brigade WSB 8-16 oz/A
- Asana XL 4.8-9.6 fl oz/A
- Capture 2EC 3.2-6.4 fl oz/A
- Confirm 2F 16 fl oz/A
- Prebloom, when buds breaking or canes 6-8 inches long

Intro to Pesticides:
Brigade WSB 8-16 oz/A
Capture 2EC 3.2-6.4 fl oz/A
Asana XL 4.8-9.6 fl oz/A
Confirm 2F

Raspberry Sawfly Eggs laid May-June Young larvae feed on leaf edges, older larvae skeletonize





Raspberry Sawfly Azinphosmethyl 50W 0.25 lb/100 gal, 0.5 lb/A Prebloom





Blackberry Psyllid



Blackberry Psyllid

Overwinters on conifers Feeds only on blackberry Adults return to blackberry in April Feeding by females starts leaf curl Leaf curl continues with nymphal feeding Blackberry Psyllid
Malathion 8EC 1 pt/100 gal, 2 pt/A
Surround 95WP 12.5-50 lb/A
When adults appear on plants

Mites

Fine grey stippling on upper leaf surfaces
Later webbing, dark blotches on leaves
TSM more common in hot, dry years



Mites

Kelthane 50WSP 1 lb/100 gal, 2 lb/A Acramite 50WS 0.75-1 lb/A Pyrellin EC 1 pt/100 gal, 2 pt/A Savey 50DF 6 oz/A Stylet oil 3-6 qt/100 gal Brigade WSB 8-16 oz/A Capture 2EC 3.2-6.4 fl oz/A



Intro to Pesticides:

Kelthane 50WSP active on motile stages Acramite 50WS Active on motile stages Pyrellin EC active on motile stages Savey 50DF active on eggs Stylet oil active on eggs Repeat applications?

Leafhoppers Malathion 8EC 1 pt/100 gal, 2 pt/A





Aphids

Two species mainly, large raspberry aphid, Amphorophora agathonica, and small raspberry aphid, Aphis rubicola

- Most important as vectors of viruses
- Overwinter as eggs
- Hatch in May

Asexual reproduction during season

Males produced in fall, mating produces eggs

Aphids

- Malathion 8EC 1 pt/100 gal, 2 pt/A
- Azinphosmethyl 50W 0.5 lb/100 gal, 1 lb/A
- Asana XL 4.8-9.6 fl oz/A
- At petal fall
- Chemical control not generally effective at virus vector control
- Use virus-free plants, destroy sick plants
- Don't plant near sick plantings



Raspberry Crown Borer Adult is a moth that mimics yellowjackets



OSU photo

Raspberry Crown Borer Eggs are laid on the undersides of new leaves, with 2-3 eggs per plant. Eggs incubate 3-10 weeks, beginning to hatch in late July (about the first week of September and continuing until early November in the northern part of its range (Canada))



WSU photo

Raspberry Crown Borer

The young larva spins down to the crown, where it overwinters in a hibernaculum.
 In the spring it tunnels into the cambium. Cracks develop at this site, from which reddish brown frass is produced in April.



WSU photo

 Raspberry Crown Borer
 In the second summer, the larva ascends into a cane, girdling it a few inches above the soil surface, and causing it to wilt and break.



WSU photo

Raspberry Crown Borer

- Chemical control: Sniper 2E (4-8 pt /A) may be used to drench the crown area of the plant in either fall or in the spring before buds break. Apply about 1 pt per plant.
- Use will be lost under FQPA.
- Sevin XLR (2 qt/A) or malathion 25WP (2 lb/A) may be applied as a foliar spray
- Cultural control: infested canes and crowns should be removed and destroyed.
- Eliminating nearby wild brambles also reduces infestations.

Rednecked Cane Borer A buprestid beetle, dark gray with coppery pronotum Adults are about 6-7 mm (1/4 inch) long



- Adults are present from May to August, or late April to early June, depending on the region.
- Females lay white spherical eggs on the trunk.
- Larvae exit the egg directly into the plant, never becoming exposed, and so are impervious to sprays.

Young larvae are restricted to the cambium, circling the cane 3-4 times in a close spiral, girdling the primocane, and producing gall-like swellings.



UGA photos

Larvae reach a length of 12 mm, and have a pair of horn-like projections on the posterior end. The larvae are white and legless, with a flattened head (the family is often called flatheadeded borers).

Larvae winter in the cane, and in March create a pupal chamber. The pupa is formed in late April. The pupal period lasts 20-40 days.

When the adult leaves the pupal skin, it remains in the tunnel for about 10 days before chewing a D-shaped emergence hole.
Adults feed on foliage for several days before beginning oviposition.



•Chemical control: After leaf fall, if more than 10% of the primocanes are infested, or if the number of primocanes expected to be pruned off is exceeded, a spray in justified.

•Examine primocanes for adults twice weekly, beginning at the beginning of bloom. Damage is minimized when malathion is applied at intervals of 7-12 days from the time the first beetles appear (early to mid May) until early June (last emergence).

•Wild host removal helpful in itself, also makes chemical control more effective

•Cultural control: Remove galled canes in dormant season or early spring.

•This is most effective if nearby wild hosts are eliminated, and also more effective in open settings (wild brambles in nearby woods provide a source of wild beetles).

Raspberry Cane Borer Adult is a longhorned beetle, black with orange pronotum, ½ inch long



Adults appear in June, and are present until late August. After ovipositing, the female girdles 6 mm above and 6 mm below the egg puncture.
 Shoot tips wilt in early summer.



Raspberry Cane Borer

Chemical control: Just before blossoms open, either malathion 8EC (2 pt/A) or azinphosmethyl 50W (0.5 lb/A) may be applied

Cultural control: Wilting canes or those with girdling should be destroyed. If pruning occurs within a few days of the onset of wilting, only a small amount of additional shoot need be removed.

Bramble Insect Calendar Prebloom – when buds are breaking or 6-8 inch new cane growth Leafrollers, raspberry sawfly, psyllid, raspberry cane borer, TPB, thrips Petal fall (1st cover) Aphids, rednecked cane borer, thrips, leafrollers, psyllid, leafhoppers Second cover (10 days later) Aphids, mites Third cover Japanese beetle, motes, click beetle Post harvest Raspberry crown borer, aphids, mites, leafhoppers

What do we have?
What do we have - Insecticides?
Organophosphates
Carbamates
Botanicals
Pyrethroids
Other natural or "soft" products

What do we have - Insecticides?
Organophosphates

Diazinon (WA,OR, CA only)
Malathion
Guthion, Azinphosmethyl, Sniper

Malathion

- Japanese beetle, leafhoppers, aphids, thrips
- PHI 1d, REI 12 h
- I-4 pt/A (2-4 pt for aphids)

Guthion, Azinphosmethyl, Sniper (Check the label!)

– Sniper 2E (Platte)

- leafhoppers, leafrollers 1 pt/A, PHI 14d
- Raspberry crown borer 4-8 pt/A, PHI 4d

Azinphosmethyl 50W (Micro Flo)

- Foliar leafhopper, leafrollers, aphids, PHI 14d
- Soil raspberry crown borer 2-4 lb/A, PHI 4d (PHI 30 d if > 4 lb/A)

– Guthion Solupak – Raspberry crown borer only!

- 5/8 1 lb/A, up to twice per season
- REI 7 days
- REI U-pick 30 days
- Label through 2005; Defendable? Priority?

What do we have - Insecticides?

Carbamates – Sevin (carbaryl)

Aphids, Japanese beetle, clipper, raspberry fruitworm, leafrollers, etc.
REI 12 h, PHI 7d
1-2 pt/A XLR, 1 ¼ - 2 ½ lb/A 80S

What do we have - Insecticides? Botanicals Azadirachtin (Aza-direct, Ecozin) Japanese beetle, thrips REI 4h, PHI 0d Pyrellin (pyrethrum and rotenone) Thrips, mites REI 48h, PHI 12h (!)

What do we have - Insecticides? Pyrethroids Bifenthrin (Brigade 10WSB, Capture 2EC) REI 12h, PHI 3d) Esfenvalerate (Asana XL, REI 12h, PHI 7d) Leafrollers, mites, root weevils Toxic to predators! Home product Bug-B-Gone - esfenvalerate

What do we have - Insecticides?

Other natural or "soft" products

- Confirm MAC leafrollers
- SpinTor 2SC leafrollers, raspberry fruitworm, raspberry sawfly, thrips
- M-Pede insecticidal soap REI 12h, aphids, mites
- Surround
 - blackberry psyllid, leafhoppers, leafrollers, thrips.
 - REI 4h; fresh up to 3 wks after fruit set
 - **12.5-50 lb/A**
- Bt (Dipel, Javelin, etc.) REI 4h
 JMS Stylet Oil mites, aphids

What do we have - Acaricides?

Kelthane (SLN label for Virginia) Acramite (non-bearing only) Savey (ovicide, very specific) JMS Stylet oil (repeat sprays for eggs) Bifenthrin (Brigade) for mites?

Commercial Bramble Insecticides

- Asana XL REI = 12 h, PHI = 3 d Aza-Direct REI = 4 h, PHI = 7 d
- Azinphosmethyl REI = 48 h, PHI = 14 d
 Bt
- Brigade/Capture REI = 12 h, PHI = 3 d
- **Confirm REI = 4 h, PHI = 14 d**
- Malathion foliar REI = 12 h, PHI = 1 d
- Pyrellin REI = 12 h, PHI = 12 h
- Sevin REI = 12 h, PHI = 7 d
- Sniper REI = 48 h, PHI = 4 d (soil/trunk)
- Surround REI = 4 h, PHI = 0 d
- Acramite REI = 12 h, PHI = nonbearing
- Kelthane REI = 48h, PHI = 1 applic. preharvest, 1 post
- Savey REI = 12 h, PHI = 3 d
- Stylet oil REI = 4 h, PHI = 0 d

Virginia Fruit Web Site

http://www.ento.vt.edu/Fruitfiles/VAFS.html

Visits to Home Page

1997 - 2,649
1998 - 6,175
1999 - 12,409

2000 - 12,760 2001 - 14,795 2002 - 15,151 2003 - 15,168

Total visits to pages:
 1998 – 95,115
 1999 – 200,915
 2000 – 290,909

- 2001 - 497,947 - 2002 - 531,346 - 2003 - 732,121

Virginia Fruit AdVisor Program





 General information on program
 http://www.ento.vt.edu/Fruitfiles/ FruitAdVisor.html

 Virginia Small Fruit Advisor
 http://www.ento.vt.edu/Fruitfiles/ VisorSmall.html

Questions?



Update on Blackberry Production in South Georgia

Gerard Krewer Ext. / Research Horticulturist University of Georgia

South Georgia

- A vast area with mild winters and ferocious summers.
- Plants can grow quickly, but bugs and blights thrive in the subtropical heat and humidity.



What working in South Ga?

- Soil series:
- Loamy sands and sandy loams have produced high yields
- Bedded flatwoods loamy sands have also worked well.



Irrigation Systems

- Overhead-can be used for washing in fertilizer and herbicides
- Drip-lower cost
- Dry fruit
- Problems with rats if drip is not buried



Harvesting Problems

- Sand splashing is a major problem in unmulched or untrellis fields.
- Sand may splash 18 inches or more.
- Results in rapid loss of tooth enamel



Trellis Experiments in S. Ga.

- Different trellises fit different situations
- PYO, Distant Shipping, etc.
- In 2001 we began testing different trellises



Reidsville Trial

- Control
- Post and String
- Post and Wire
- Raspberry V
- Stiles Shift Trellis



Yields

 Table 1. Effect of trellis treatments on the mean yield in lbs. per 10 feet of row for 'Chickasaw' blackberry, 2002-2004

•	200)2 200)3 200)4 <u>3 Ye</u>	<u>ear Mean</u>
Control	22.6	15.5	5.8	14.6	
 Post & String 	29.9	21.9	16	22.6	
 Post & Wire 	20.9	16.3	6.7	14.6	
 RaspberryV 	25.5	13.9	12.4	17.3	
• LSD	8.3	9.5	6.38	8.16	

Post and String

- High yields
- String stretches into a V trellis with time
- Low cost
- More difficult to remove primocanes than with wire



Post and Wire

- Modest yields
- Moderate cost
- Good for distant shipping- easier to pick all the fruit



Raspberry V

- Good yields
- Good separation of primocanes and floricanes
- Easy to pick and prune
- Good PYO



Cultivars

- Distant Shipping
- Arapaho
- Chickasaw????
- Navaho
- You pick and local sales
- Kiowa



What about thorns??

- Good for sites with deer problems.
- Builds character in you-pickers.
- Try latex gloves for the faint of heart.

Pruning

- Don't prune radically in S. Ga. if a cultivar is prone to die back from Bot canker
- Allows disease to enter the canes
- Pinch and summer tip if possible



Dormex

- Cleared only for use in Georgia
- Used to enhance bud break and yield in low chilling winters
- May enhance yields even in high chilling winters



Dormex Response





Dormex

- Best response has been 3% Dormex applied in late Jan.
- Use caution, can cause "flushing" of applicator
- No alcohol the day before or day after
- Use only with enclosed cab tractor.

Blackberry Yield As Influenced by Dormex

Table 3.	Effect of Dormex	on Blackberry	v Yield an	d Fruit Size
----------	------------------	---------------	------------	--------------

								Berry Wt.(g)	
Cultivar	Treat	30 May	6 June	13 June	20 June	27 June	6 July	Total	20 June
Apache	0		119.5 c ^y	790.0 c	1401.3 b	1358.3 a	1153.8 a	4823 b	9.95 a
	3		996.5 a	2417.5 a	1902.5 a	1355.0 a	900.8 ab	7572 a	9.69 ab
	4		606.0 b	1932.5 b	1503.8 ab	1290.0 a	571.3 b	5904 b	8.93 b
Navaho	0	8.3 b	277.0 b	543.8 b	862.5 b	795.0 b	780.0 a	3267 b	6.08 a
	3	182.8 a	694.5 a	1252.5 a	1512.5 a	2013.8 a	527.5 a	6184 a	5.86 a
	4	114.0 ab	575.0 a	1277.5 a	1087.5 b	1707.5 a	705.0 a	5467 a	6.05 a
	LSD	102.6	229.9	418.2	403.3	365.5	472.3	1286	0.73
$y = \mathbf{P} \mathbf{v} $ on \mathbf{h}	vor moor	ha with the ac	nma lattar a	ra not signifi	contly difford	$nt(\mathbf{D} \setminus 05)$	according to t		contian in

y = By cultivar, means with the same letter are not significantly different (P \ge -.05) according to the PDIFF option in PROC MIXED (SAS, 2000) with the Satterthwaite option on the model statement

Some major pests in South Ga.

- Red parasitic algae
- Check with Dr. Phil Brannen
- Control is usually with copper compounds



Thrips

- Major problem in some years with dry periods during bloom.
- Application of insecticides at night may be needed.
- Protect bees.

Gall midges

- Small white "worms" that attack blooms as they open
- Spray at night.
- Often found in combinations with thrips



Viruses

- Try to start with very clean plants
- I would suggest tissue culture or screen house grown



Thank you!

Questions???
Weed Control in Brambles



Wayne Mitchem Orchard and Vineyard Floor Management Dept. of Horticultural Science







Photo courtesy of "Growing Blackberries in NC"

Weed Control is Important

 Weed control is important in establishing and maintaining a vigorous and highly productive blackberry planting. Hoeing, shallow disking and herbicides are recommended. Since blackberries produce shallow fleshy root systems, deep cultivation must be avoided.

- Bramble Fact Sheet, Univ. of Florida

Weed Competition in Spring Planted Raspberries

	1971		1972	
		Avg.		Avg.
Trt.	Canes/plot	Ht.	Canes/plot	Ht.
WF	15	59	71	94
WF 5/28+	14	25*	56	91
WF 6/27+	11*	23*	37 *	74
Weedy	4*	32*	15*	79

H.M. Lawson and J.S. Wiseman. Weed Research, 1976, Vol. 16:155-162.

Weed Competition in Spring Planted Raspberries

_	Fruit Yield Data			
Trt.	Kg/plot	g/cane	g/100 cm cane	
WF	1.28	82	140	
WF 5/28+	0.26*	20*	77*	
WF 6/27+	0.22*	17*	60#	
Weedy	0.06*	15*	41\$	

H.M. Lawson and J.S. Wiseman. Weed Research, 1976, Vol. 16:155-162.

Bramble Ground Cover Management

- 4 ft weed-free band
- Row middles or drive alley
 - Established sod
 - Annual cover crop
 - Native vegetation



Weed-Free/Sod Strip Floor Mgt.

- Weed-free strip
 - Minimizes competition
- Vegetative Alley
 - Minimizes erosion
 - Wind
 - Water
 - Traffic Movement
 - Wet weather



Weed-free Strip – How?

- Mulch
 - Plastic (est. year)
 - Organic
 - Straw
 - Bark
 - Grass clippings



Photo: "Bramble Opportunities" Slide Set, Gina Fernandez



Weed-free Strip – How?

- Mulch Issues
 - Plastic (est. year)
 - Heat
 - Removal/interference with cane development
 - Drip irrigation
 - Organic
 - Costs
 - Labor intensive
 - Annual replacement
 - More suitable for small area?





Weed-free Strip – How?

- Herbicides
 - Injury (POST)
 - Hand removal may be necessary in some instances
 - Cost effective



Photo: "Commercial Bramble Culture", Krewer et.al., UGA.

PRE Herbicide Options in Newly Planted Brambles

- Devrinol 50 DF 4 lb/A
 - Activation within 24 hrs is best
- Oryzalin or Surflan -2 to 4 qt/A
 - Activation within 14 to 21 days
 - Controls annual grasses, pigweed, lambsquarters
 - DO NOT use on tissue culture plants during the first year.

PRE Herbicide Options in Newly Planted Brambles

- Simazine 4F or 90DG 1 qt or 1.1 lb/A
 - Activation within 14 to 21 days
 - Controls ragweed, lambsquarters, pigweed, henbit, prickly lettuce, purslane, and annual grasses
 - DO NOT use on tissue culture plants the first year of planting
- Gallery 75 DF .66 to 1.33 oz
 - Activation within 21 days
 - Controls a number of broadleaf weeds; MG suppression

PRE Herbicide Options Established Brambles

- Solicam 2.5 to 5 lb/A
 - Dormant application
 - Weak on pigweed and lambsquarter
 - Excellent on annual grasses, prickly sida, dogfennel, spurge
 - Suppresses yellow and purple nutsedge
 - Activation within 28 days; Brambles est. 12 mos.
- Oryzalin or Surflan -2 to 4 qt/A
 - Activation within 14 to 21 days
- Simazine 4F or 90DG 2-4 qt or 2.2-4.4 lb/A
 - Even at higher rates the addition of Surflan will be necessary for maximum residual annual grass control.
 - Split application

PRE Herbicide Options Established Brambles

- Sinbar 0.5 to 2 lb/A
 - Established plantings of 1 year or more
 - Apply in spring prior to fruit set
 - Do not apply within 70 days of harvest
 - Do not use on sandy soils with less than 1% OM
 - Activation within 14 days
 - Controls horseweed, pigweed, lambsquarters, annual morningglory, ragweed, Florida pusley, annual grasses
- Casoron 4G 100 lb/A
 - Soil surface application may be applied in January
 - May be applied up until May 1 if incorporated immediately
 - Established plantings (1+ year)
 - Controls ragweed, dandelion, dogfennel, horseweed

POST Herbicide Options in Brambles

- Gramoxone Max 1.5 to 2.7 pt/A
 - NIS @ 0.25 % v/v
 - Contact with new canes will cause injury
 - May tank mix with PRE herbicides
- Glyphosate 11 to 32 oz/A or 1 to 3 pt/A
 - DO NOT ALLOW CONTACT WITH GREEN CANES, BARK OR FOLIAGE
 - Apply as a directed shielded spray

Perennial Weed Control with Glyphosate

Weed Species	% v/v	Timing
Bahiagrass	2	Early Head
Blackberry	1-1.5	Late summer through early Dec.
Smilax	3	5 fully expanded leaves in spring
Nutsedge (y/p)	2-3	Flowering; use half rate and sequential applic. 3-4" tall plants.
Poison ivy/oak	2	Two weeks either side of full bloom (early summer)
Virginia Creeper	1.5-2	Late summer prior leaf color change

POST Herbicide Options in Brambles

- Poast 1.5 to 2.5 pt/A
 - COC @ 1 % v/v
 - 45 day PHI
- Fusilade 12 to 24 oz/A
 - COC @ 1% v/v
 - Nonbearing use only
- Select 6 to 8 oz/A
 - NIS @ 0.25 % v/v
 - Nonbearing use only

Bermudagrass Control

- Poast @ 1.5 pt/A fb 1.0 pt/A
 - Apply when 4" new growth appear
 - Second application when regrowth occurs
- Fusilade @ 1.5 fb 1.0 pt/A
 - Application parameters same as above

Include COC at 1% v/v (1 gal. Per 100 gal of spray solution)



Is Cultivation an Option?

- 1st Year after Planting
 - Shallow cultivation
 - Care must be taken to prevent breakage of emerging primocanes
- Established Plantings
 - Cultivation promotes unwanted suckering
 - SHALLOW disking drive alley is acceptable

Crop Age	Fall	Winter	Spring	Summer
Newly Planted	Glyphosate (preplant)		Oryzalin (Once soil settles after transplanting)	Oryzalin + Paraquat (May or June); Fusilade, Poast, or Select (as needed). Shallow cultivation may be used as well.
	Glyphosate (preplant)		Simazine (half rate) + Oryzalin	Paraquat, Basagran, Fusilade, Poast, or Select (as needed). Shallow cultivation may be used as well.
	Glyphosate (preplant)		Devrinol (Once soil settles after transplanting)	Paraquat, Basagran, or Fusilade, Poast, or Select (as needed). Shallow cultivation may used as well.
	Glyphosate (preplant)		Gallery + Oryzalin	Paraquat, Basagran, Fusilade, Poast, or Select (as needed). Shallow cultivation may be used as well.

Crop Age	Fall	Winter	Spring	Summer
Blackberry and Raspberry Established 1 or more years	Simazine + Paraquat		Sinbar	Paraquat (as needed); Fusilade, Poast, or Select (as needed)
		Simazine + Solicam or Oryzalin + Paraquat		Paraquat (as needed); Fusilade, Poast, or Select (as needed)
	Simazine + Paraquat		Simazine + Oryzalin or Solicam	Paraquat (as needed); Fusilade, Poast, or Select (as needed)
	Paraquat	Casoron		Paraquat (as needed); Fusilade, Poast, or Select (as needed)

Contact Info

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