Rust and Other Important Diseases of Southern Highbush Blueberry

2023 FBGA Fall Conference and Show

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Overview

Today's topics to review

- Disease happenings from the PDC
- Doug's grower survey results
  - Important disease issues
- Rust management difficulties
  - What fungicides are being used successfully?
- Leaf diseases evergreen vs deciduous
  - Extended season, more apps
- Anthracnose
  - A brief review

2022-2023 PDC Blueberry Data

166 samples through 10/3/23

County, State	No.	County, State	No.
ALACHUA, FL	222	Clinch, GA	28
PASCO, FL	83	Hardin, TX	27
LAKE, FL	43	Bacon, GA	25
POLK, FL	38	HARDEE, FL	21
MARION, FL	38	Ware, GA	12
MADISON, FL	36	Pender, NC	7
HIGHLANDS, FL	31	NASSAU, FL	7
CLAY, FL	30	MIAMI-DADE, FL	7
ORANGE, FL	30	GLADES, FL	3
DESOTO, FL	29	HILLSBOROUGH, FL	3
		BREVARD, FL	1

2022-2023 PDC Blueberry Data

Through 10/3/23

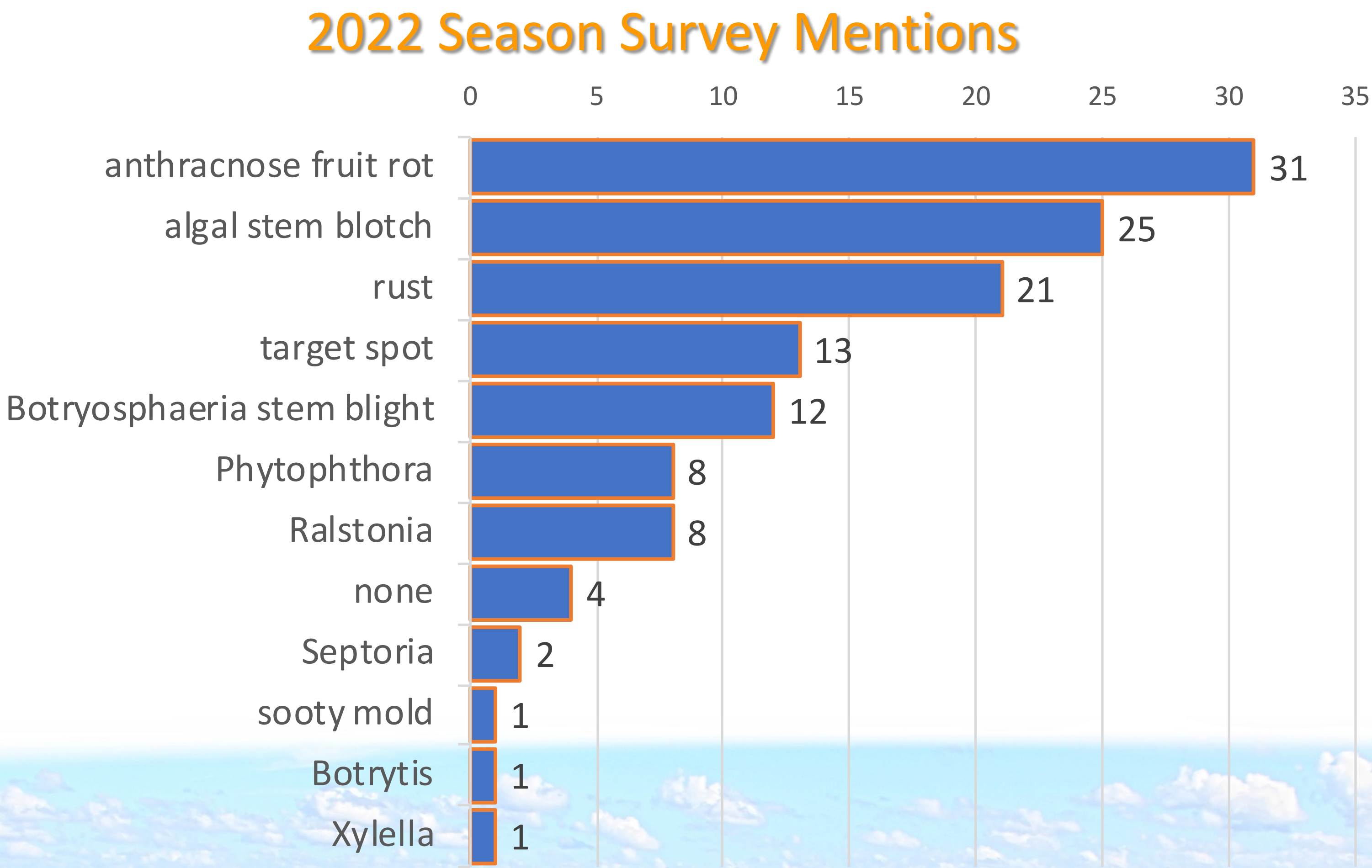
Variety	No.	Variety	No.	Variety	No.
311	2	GeorgiaDawn	10	Patricia	4
12-279	7	Indigocrisp	6	Preston	10
17-142	20	Jewels	1	Rabbiteye	3
Abundance	5	KeeCrisp	24	SanJoaquin	3
Albus	3	Kestrel	10	Sentinel	31
Arcadia	59	Kira	2	Stellar	13
Avanti	48	Legacy	15	Suziblue	16
Chickadee	4	Mageia	3	SweetCrisp	5
Collosus	8	Meadowlark	6	Vireo	8
Emerald	17	Oneal	7	Winterbelle	7
Farthing	78	Optimus	24	WinterSweet	4

2022-2023 PDC Blueberry Data

Through 10/3/23

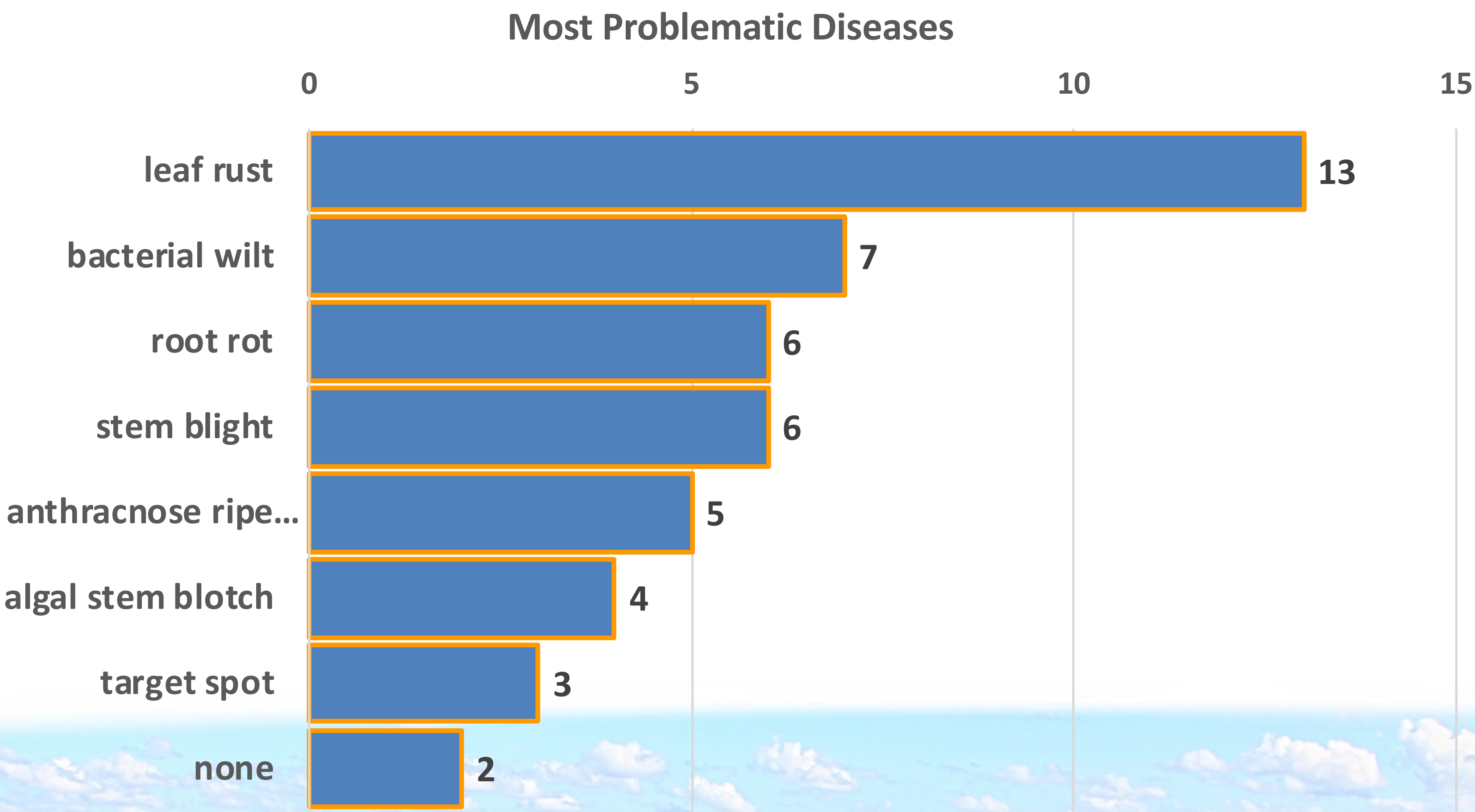
Abiotic issue		Disease		Arthropod pests	
No Pathogen Found	123	Botryosphaeria Stem Blight	115	Thrips	6
Abiotic Problem	32	Phytophthora crown and root rot	81	Mites	4
Oedema	15	Anthracnose	77	Blueberry bud mite	4
Girdling Roots	9	Phomopsis twig blight/leaf spot	16		
		Phyllosticta leaf spot	15		
		Pestalotia leaf spot	14		
		Cercospora leaf spot	13		
		Pythium root rot	12		
		Target Spot	12		
		Gray Mold	12		
		Septoria leaf spot	8		
		leaf rust	8		
		Armillaria root rot	8		
		Bacterial wilt of blueberry	7		
		Algal stem blotch	6		
		Bot canker	5		
		Blueberry red ringspot	5		
		Cylindrocladium Blight	3		

Grower Disease Issues



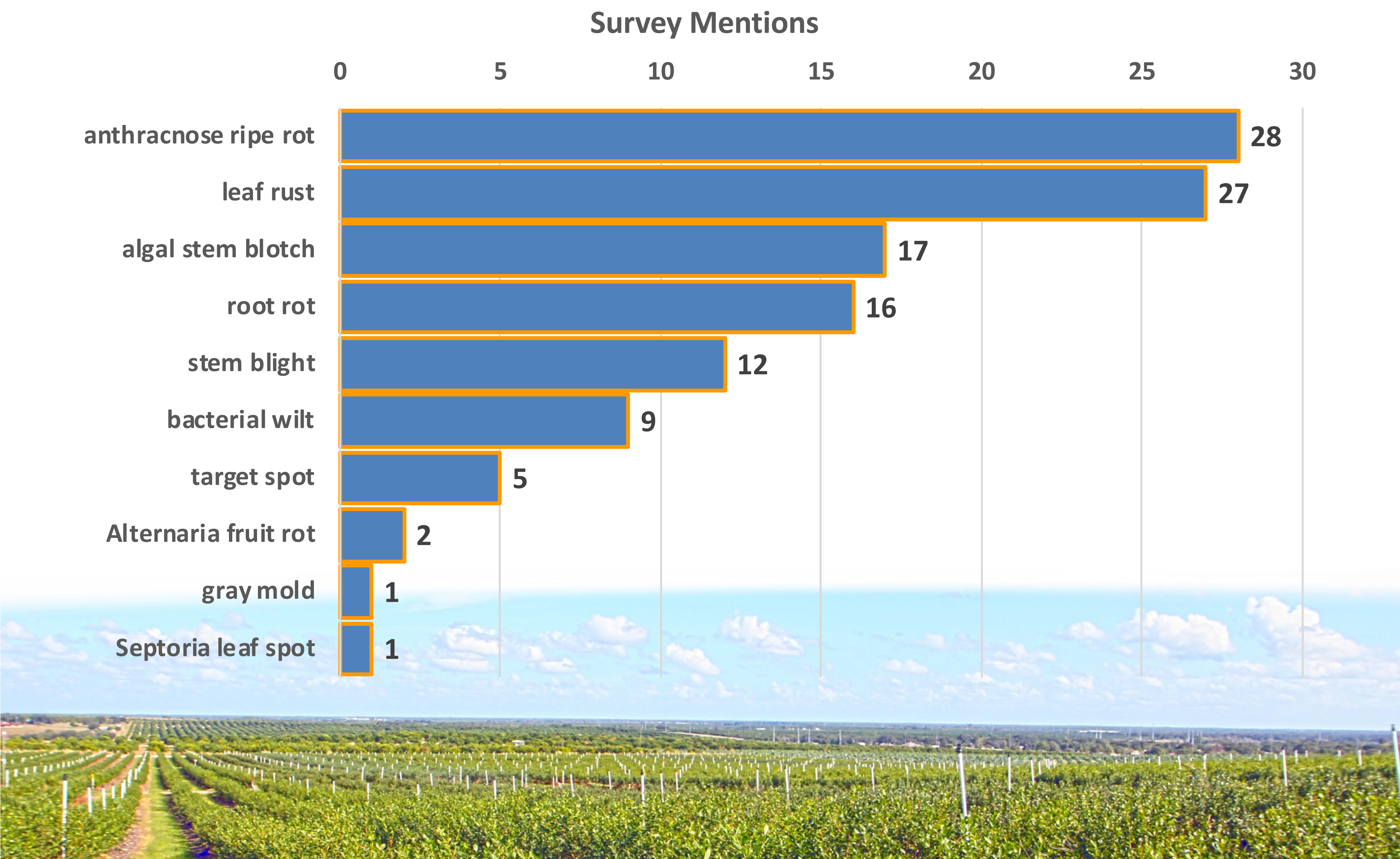
Grower Disease Issues

2023 Season Survey Results



Grower Disease Issues

2023 Season Survey Results



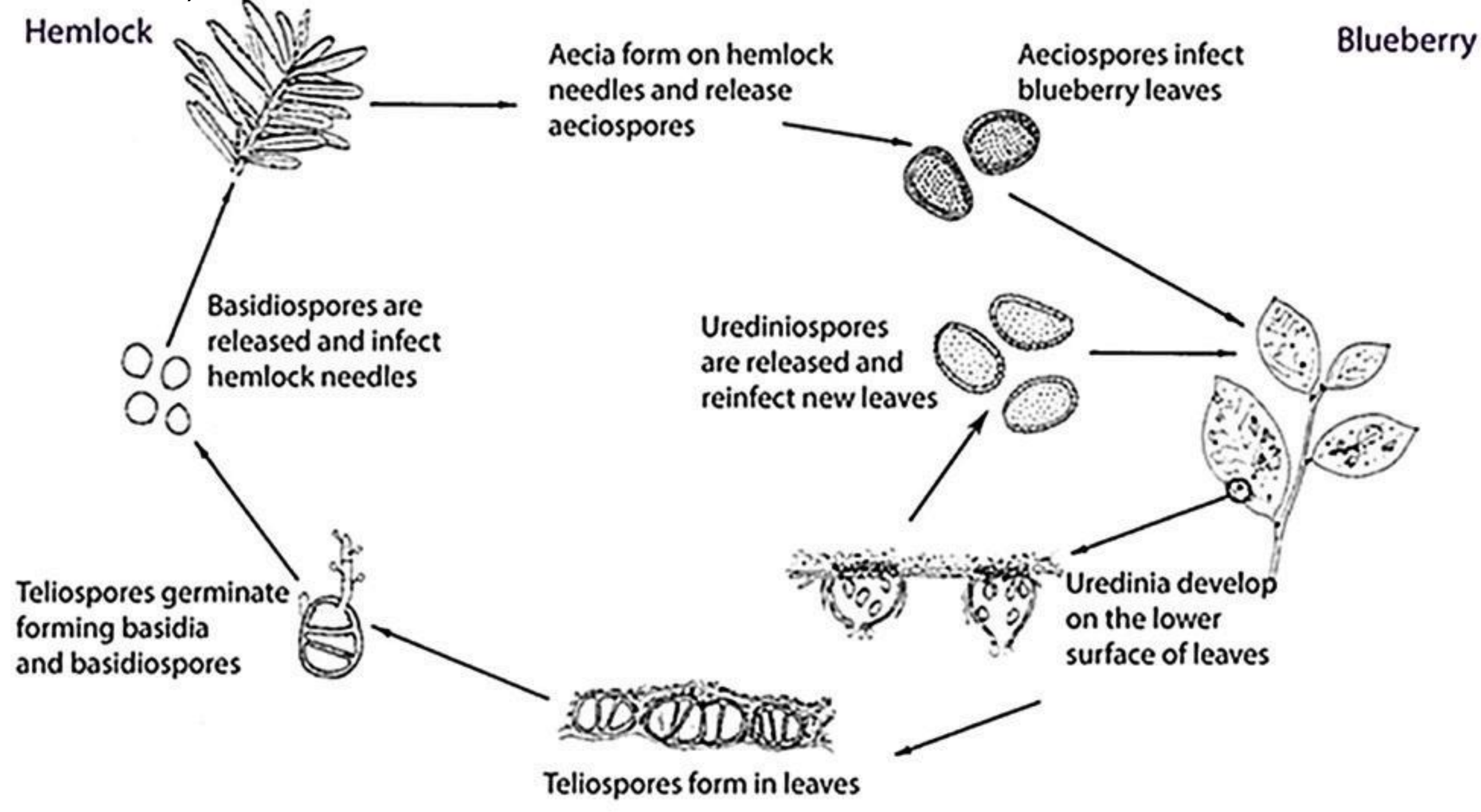
2023 Grower Survey

Top 5 Disease problems/causal agent

Disease	Pathogen	Top5
anthracnose ripe rot	*Colletotrichum gloeosporioides*	28
leaf rust	*Thekopsora mimimum*	27
algal stem blotch	*Cephaleuros virescens*	17
root rot	*Phytophthora cinnamomi*	16
stem blight	*Botryosphaeria spp.*	12
bacterial wilt	*Ralstonia solanacearum*	9
target spot	*Corynespora cassiicola*	5
Alternaria fruit rot	*Alternaria spp.*	2
gray mold	*Botrytis cinerea*	1
Septoria leaf spot	*Septoria albopunctata*	1

Rust Lifecycle

(not known to occur in Florida)
eastern hemlock and Japanese hemlock
Tsuga canadensis, T. diversifolia



2023 Grower Survey

- 63% of Growers responded they had not experienced rust control failures (37% did)

Fungicide	Mentions
Bravo	12
copper	11
Proline	11
Tilt	11
Abound	9
Quash	9
Captan	2
Oxidate	1
Pristine	1

Variety	Mentions
Jewel	2
Kestrel	2
Ventura	2
Optimus	1

2023 Grower Survey

- Quash and copper products varied between respondents reporting failure vs not

Fungicide	Yes failures	%		Fungicide	No failures	%
Quash	8	21		copper	6	22
Bravo	7	18		Bravo	5	19
Proline	7	18		Proline	4	15
Tilt	6	15		Tilt	4	15
Abound	5	13		Abound	3	11
copper	5	13		Captan	2	7
				Pristine	1	4
				Quash	1	4

Quash?

- Southeast Guide (VG)
- UF IPM (4 of 5)

Petal fall until one month after bloom, cont.						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Blueberry rust, cont.	**metconazole** *FRAC 3* (Quash)	2.5 oz	VG	12 hrs	7 days	May be applied by ground (min. 20 GPA) or air (min 10 GPA). Do not apply more than twice in a row, or more than 7.5 oz per season, or more than three times per season. Supplemental label for bushberries. A tank mix with captan is recommended for resistance management and to provide Botrytis suppression.
	prothioconazole *FRAC 3* (Proline 480 SC)	5.7 fl oz	E	12 hrs	7 days	Apply up to two applications per year on a 7-10 day schedule. A tank mix with captan is recommended for resistance management and to provide Botrytis suppression.
	propiconazole *FRAC 3* (Tilt, Bumper 41.8 EC, PropiMax EC)	6.0 fl oz	G	12 hrs	30 days	May be applied by either ground or aerial application (see label). Do not apply more than 30 fl oz per acre per season. More effective when allowed to dry ahead of a rain. A tank mix with captan is recommended for resistance management and to provide Botrytis suppression.
Phytophthora root rot	**potassium phosphite** *FRAC P07* (ProPhyt and generic formulations)	4 pt	VG	4 hrs	0 hrs	Apply as a foliar spray for Phytophthora and Pythium after leaf emergence. Also effective against Septoria and Anthracnose leaf spots. **Do not tank mix with copper and foliar fertilizers, and do not apply in acidic water or add acidifying agents, as foliage/fruit damage could be a result. When tank-** … **t the mix on a** … **oxicity does** … ites for export … our purchaser

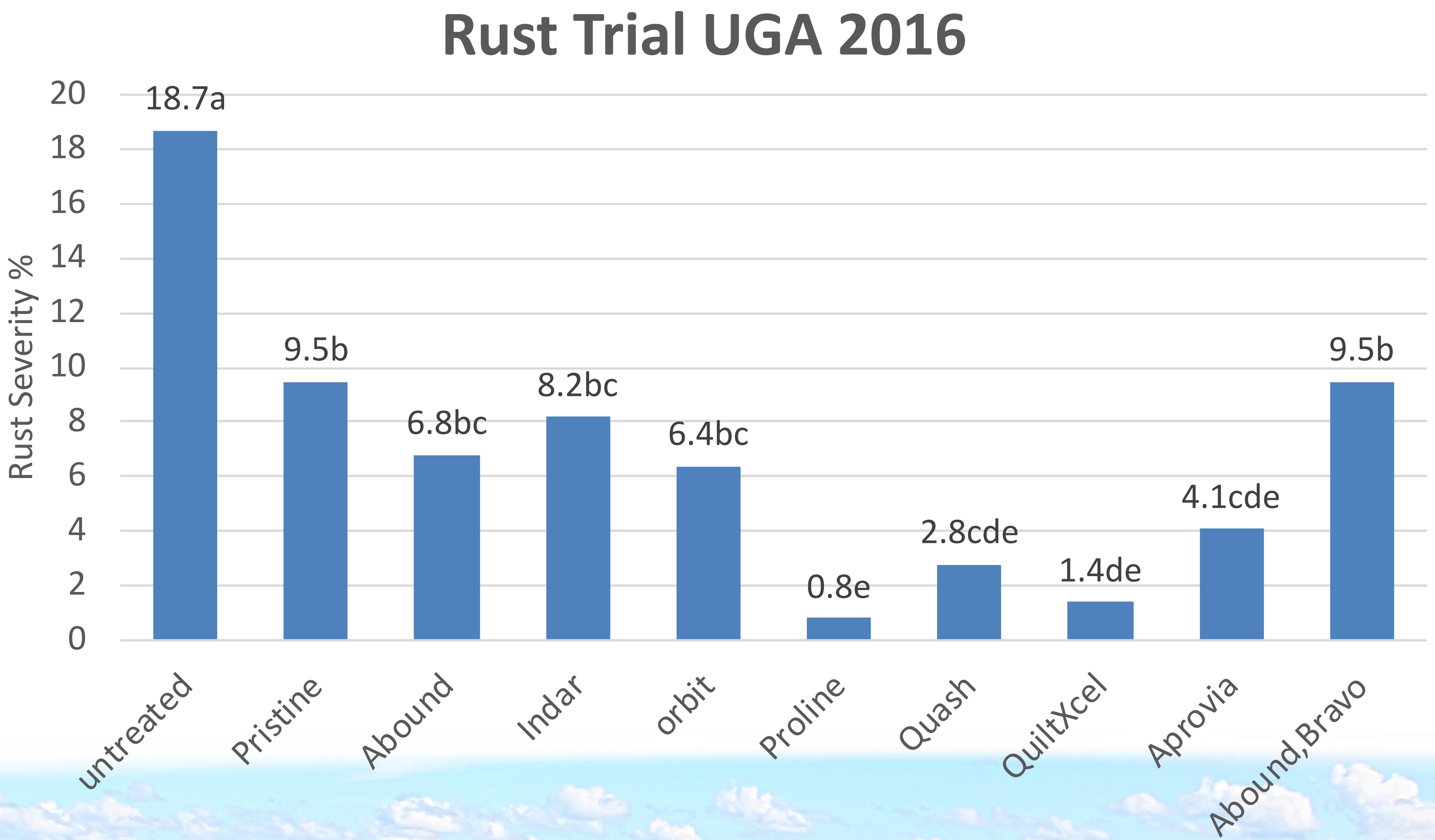
[7+9]								
Fosetyl-Al (Aliette® WDG) [33]	+++	NA	NA	+	+	++++	+++	NA
Mefenoxam (Ridomil Gold®) [4]	+++	NA	NA	NA	NA	NA	NA	NA
Metconazole (Quash®) [3]	NA	???	???	++++	???	++++	++++	++++
Mono- and dipotassium salts of phosphorous acid (K-Phite®) [33]	+++	NA	NA	NA	NA	++++	++++	NA
Potassium phosphite (ProPhyt®) [33]	+++	NA	NA	NA	NA	++++	++++	NA
Propiconazole (Tilt®, Bumper®, PropiMax® [3]	NA	NA	NA	NA	NA	++++	???	+++
Prothioconazole (Proline®) [3]	NA	NA	NA	???	???	++++	???	++++

Relative rust efficacy

What works 2023

- Excellent:
  - Proline prothioconazole (DMI),
  - Quilt Xcel azoxystrobin and propiconazole (QoI+DMI)
  - Propulse fluopyram and prothioconazole (DMI+SDHI)
- Very Good:
  - Quash? (DMI)
- Good:
  - Indar (DMI), Tilt (DMI), Bravo (multi), Abound (QoI), Aprovia (benzovindiflupyr SDHI)
- Fair:
  - Pristine (QoI+SDHI), Copper, Captan

Blueberry Efficacy Data



Applications made every 2 weeks, incidence was greater than 94%

Plant Disease Management Reports 11:SMF019

When to spray

- Before disease becomes severe!
  - Scout, spraying earlier in disease epidemic is more effective
  - Start looking in Sept. for evergreen, postharvest for deciduous
    - Inner canopy, more susceptible varieties, poor air movement, defoliation, orange spores
  - Use Bravo early before bloom (40+ day PHI) 3-4 apps
  - Indar and Tilt (30 day PHI) 4 apps
  - Proline and Quash (7 day PHI) 2 and 3 apps
  - Abound (0 day PHI) 3-7 apps
  - Aprovia (1 day PHI) 2 apps

Leaf diseases deciduous

	January	February	March	April	May	June	July	August	September	October	November	December
	Bloom (1)											
			Harvest (2)									
						Post-harvest (3)						
Phomopsis	■	■	■	■	■							
Pristine, Switch, Abound, Quash, Quilt Xcel												
Septoria			■	■	■					■	■	■
Orbit, Indar, Quash, Quilt Xcel, Proline,												
Luna Tranquility, Abound, Switch, Pristine, Bravo												
Rust					■	■			■	■	■	
Orbit, Indar, Quash, Proline, Pristine, Bravo												
Anthracnose						■	■	■	■	■		
Indar, Orbit, Quash, Quilt Xcel, Proline,												
Luna Tranquility, Abound (tank mixed with captan),												
Pristine, Switch, captan, Bravo												
Target Spot							■	■				
Indar, Orbit, Quash, Quilt Xcel, Proline,												
Luna Tranquility, Abound, Pristine, Switch, captan,												
Bravo												
Phyllosticta							■	■	■	■		
Orbit, Quash, Tilt, Pristine												

(1) February through March for North-Central, January through March for Central and South-Central in most years. Check the preharvest interval of all products.

(2) April through May for North-Central, March through May for Central and South-Central in most years. Check the preharvest interval of all products.

(3) June through December for all regions in most years

Prices will vary

- Example calendar spray deciduous

1-Jun	Bravo ($15 to $20/acre)
15-Jun	Indar ($17/acre) or Proline ($30/acre)
29-Jun	Bravo ($15 to $20/acre)
13-Jul	Ridomil or phytes for Phytophtora
27-Jul	Copper for algal stem blotch
10-Aug	Quilt Xcel ($19/acre) target spot, anthracnose
24-Aug	Copper for algal stem blotch
7-Sep	Aprovia ($60/acre)? ← only lowbush!
21-Sep	Copper for algal stem blotch
5-Oct	Tilt ($6/acre)
19-Oct	Abound ($9/acre)+Captan ($7.50)

Leaf diseases evergreen

	January	February	March	April	May	June	July	August	September	October	November	December
	Bloom (1)											
			Harvest (2)									
						Post-harvest (3)						
Phomopsis												
Pristine, Switch, Abound, Quash, Quilt Xcel												
Septoria												
Orbit, Indar, Quash, Quilt Xcel, Proline,												
Luna Tranquility, Abound, Switch, Pristine, Bravo												
Rust												
Orbit, Indar, Quash, Proline, Pristine, Bravo												
Anthracnose												
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Bravo												
Phyllosticta												
Orbit, Quash, Tilt, Pristine												

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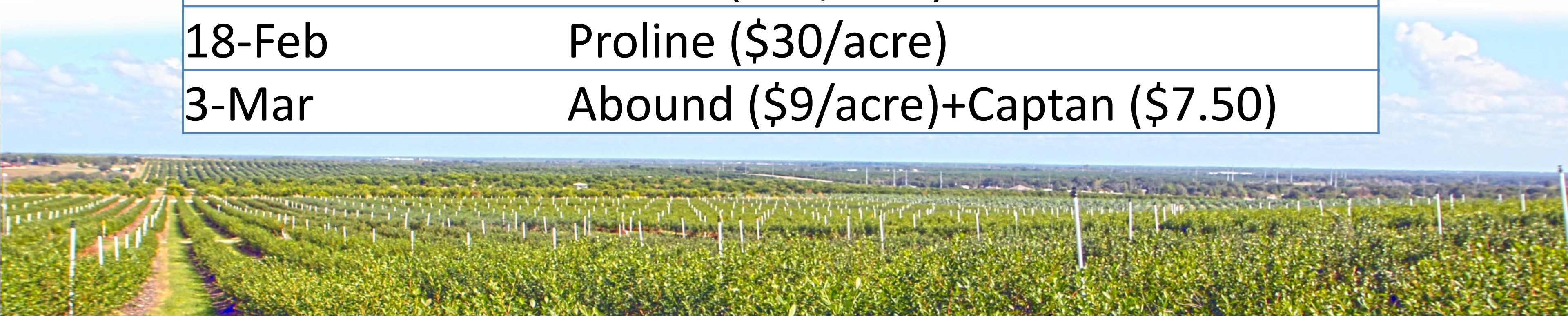
(2) April through May for North-Central, March through May for Central and South-Central in most years. Check the preharvest interval of all products.

(3) June through December for all regions in most years

Prices will vary

- Example calendar spray evergreen

15-Oct	Bravo ($15 to $20/acre)	
29-Oct	Indar ($17/acre)	
12-Nov	Bravo ($15 to $20/acre)	
26-Nov	Tilt ($6/acre)	
10-Dec	Bravo ($15 to $20/acre)	
24-Dec	Proline ($30/acre)	
7-Jan	Quilt Xcel ($19/acre)	
21-Jan	Aprovia ($60/acre)	only lowbush!
4-Feb	Quash ($25/acre)	
18-Feb	Proline ($30/acre)	
3-Mar	Abound ($9/acre)+Captan ($7.50)	



Early defoliation reduces yield

RESEARCH REPORTS

Early and Mid-fall Defoliation Reduces Flower Bud Number and Yield of Southern Highbush Blueberry

J.G. Williamson and
E.P. Miller

ADDITIONAL INDEX WORDS. *Vaccinium corymbosum*, *V. ashei*, flower bud initiation, fungal leaf spot diseases

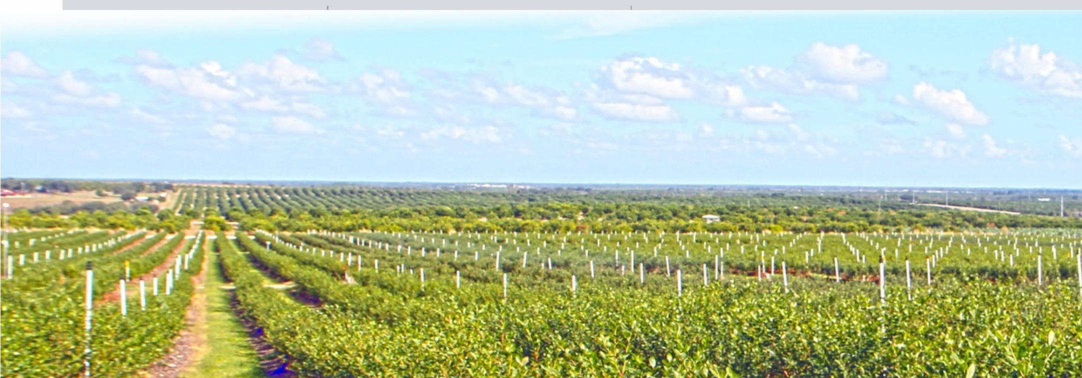
SUMMARY. Three experiments were conducted in north-central Florida to determine the effects of fall defoliation on flower bud initiation and yield of southern highbush (SHB) blueberry (*Vaccinium corymbosum* hybrid). In 1998, randomly selected upright shoots of mature, field-grown 'Misty' and 'Sharpblue' plants were hand-defoliated at monthly intervals beginning 4 Sept. and ending 7 Dec. In 1999, a similar study was conducted using different plants of the same cultivars. Representative shoots were defoliated at monthly intervals

and October defoliations of 'Star' reduced yields or delayed fruit ripening. Collectively, these experiments demonstrate the importance of maintaining healthy foliage through October in the lower southeastern United States for adequate flower bud initiation and high yields of SHB blueberry the following spring.

Florida's long, humid, growing seasons with frequent summer rains are conducive to disease development on blueberry by a number of fungal leaf spot diseases including septoria leaf spot (*Septoria albopunctata*), phyllosticta leaf spot (*Phyllosticta vaccinii*), and blueberry leaf rust (*Pucciniastrum vaccinii*). When uncontrolled, these leaf spot diseases often cause partial or complete defoliation of SHB blueberries by mid-fall (4 to 8 weeks before natural leaf senescence and abscission) (Williamson and Lyrene, 1995). Flower bud induction in lowbush (*V. angustifolium*) (Hall and Luwig, 1961), highbush (*V. corymbosum*) (Hall, et al., 1963) and rabbiteye (RE) (*V. ashei*) (Darnell, 1991) is initiated during short photoperiods. In Florida, Lyrene (1992) concluded that early fall defoliation of 'Aliceblue' RE blueberry reduced flower bud induction either by eliminating photoreceptors, or by lowering carbohydrate reserves, during critical periods. While the ef-

growth of new upright shoots during mid to late summer. Randomly selected upright shoots were hand defoliated on 4 Sept., 2 Oct., 6 Nov., or 7 Dec. Control shoots were not defoliated. Natural defoliation of control shoots occurred during late December. Each defoliation treatment was replicated 10 times in a randomized complete block design. Blocks consisted of individual plants that contained one replicate (shoot) of each treatment. Since the cultivars were in separate rows, each cultivar was considered a separate experiment and no comparisons were made between cultivars. Flower buds were counted during Jan. 1999, and expressed as number of buds per length of shoot. Fruit were harvested at maturity during Spring 1999. Fruit number, and mean and total fresh weights were determined for all fruit from each shoot.

1999 FIELD EXPERIMENTS. Two experiments ('Misty' and 'Sharpblue') were conducted in a commercial blueberry planting in north-central Florida using different plants of the same cultivars as described for 1998. The plants had been in the field 8 years and averaged about 1.5 m tall. All plants were topped with a mechanical hedger about mid-June as described for the 1998 experiment. Randomly selected upright shoots were selected and hand defoliated on 14 Sept., 15 Oct., 15 Nov., or 15 Dec. Additional shoots



HORTSCIENCE 27(7):783-785. 1992.

Early Defoliation Reduces Flower Bud Counts on Rabbiteye Blueberry

Paul M. Lyrene
University of Florida, Fruit Crops Department, 1137 Fifield Hall, Gainesville, FL 32611

Additional index words. *Vaccinium ashei*, flower bud set

Abstract. **Vigorous, upright shoots on mature *V. ashei* Reade cv. Aliceblue plants growing in a commercial field planting were used to study the effects of premature defoliation on flower bud formation. Three treatments (total shoot defoliation, alternate-node defoliation, and no defoliation) were applied on each of three dates (20 Aug., 17 Sept., and 15 Oct. 1987). For the August defoliation, the number of flower buds present per shoot on 6 Jan. of the following year averaged 1.3 for shoots that were totally defoliated, 3.7 for shoots on which alternate nodes had been defoliated, and 4.2 for control (nondefoliated) shoots. Shoots treated on 17 Sept. averaged 2.6 buds per shoot for total defoliation, 4.1 for alternate-node defoliation, and 4.8 for controls. Defoliation on 15 Oct. did not reduce flower bud formation. Reduction in flower bud formation due to defoliation was localized at the defoliated nodes. For shoots on which alternate nodes were defoliated on 20 Aug., 59.8% of the apical five nodes that were not defoliated produced flower buds compared with 1.4% of the defoliated nodes.**

Mature rabbiteye blueberry plants in North Florida often are partially defoliated months before the first killing freeze, which normally occurs in late November. Defoliation is most extensive on plants that have not been pruned, are being fertilized at low rates, or are growing on marginal soils. Florida's long growing season, frequent summer rains, and long periods of high humidity are conducive to defoliation by fungal pathogens. Rabbiteye cultivars vary in susceptibility to premature autumn defoliation.

Observations over several years of many rabbiteye clones in test blocks at the Univ. of Florida Horticulture Unit in Gainesville suggested that premature defoliation was as-

curred by 20 Aug. on the shoots used in the experiment.

The nine shoots in each block were randomly assigned to three defoliation dates, each of which had three treatments: 1) a control, in which no leaves were removed; 2) alternate-node defoliation, in which every other leaf was removed; and 3) total shoot defoliation. In the alternate-node defoliation, the basal node on the last growth flush of the shoot was always defoliated, and alternate-node defoliation progressed toward the apex, so that the terminal node was either defoliated or not, depending on how many nodes were in the growth flush. Care was taken in defoliation that the axillary buds were

EDIS Resources

- Leaf disease guide
- Diagnostic key
- Rarely just one!

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UF/IFAS PEER REVIEWED PP348

Florida Blueberry Leaf Disease Guide[1]

Douglas A. Phillips, Norma C. Flor, and Philip F. Harmon[2]

This publication is intended for Florida blueberry growers to use as a diagnostic field guide in the identification and management of common leaf diseases on southern highbush blueberry (SHB). Management recommendations
ations and horticultural inputs
se severity.

berry (SHB) cultivars are com-
hout much of Florida, in both
n production systems. Growers in
hould strive to keep leaves healthy
rentiation in fall to ensure opti-
evergreen production, it is critical
ar's foliage through winter months
duction the following season. In
be damaged by many factors, such
ions, chemical applications, insects,

s basic information to assist grow-
e likely cause (fungal, viral, algal,
ptoms, 2) when specific leaf spots
aracteristic symptoms of common
me of the available management
can be definitively diagnosed by
ptoms can vary over time and on

different blueberry cultivars. Symptoms with different causes can have similar appearances, and more than one disease can occur on the same leaf. Growers should consult UF/IFAS Extension or use a lab diagnostic service. Blueberry disease samples can be sent to the UF/IFAS Plant Diagnostic Center (plantpath.ifas.ufl.edu/extension/plant-diagnostic-center) or another diagnostic lab for accurate identification of the problem.

Several leaf diseases affect SHB in Florida and have the potential to defoliate bushes. For fungal leaf diseases, growers have many effective chemical management options; however, proper product selection and timing of application depends on correct disease diagnosis. Because fungicides are only effective for fungal diseases, differentiating between symptoms caused by fungi and other factors can help prevent unnecessary fungicide use and costs.

The first step in diagnosing the cause of leaf symptoms in blueberries is to determine if the cause is an abiotic factor (e.g., environmental conditions such as freeze or drought stress, nutrient deficiency or toxicity, herbicide damage, mechanical damage, etc.) or a biotic factor (e.g., plant pathogens). Abiotic and biotic factors are not mutually exclusive; in fact, some abiotic factors can increase biotic susceptibility. A University of Florida blueberry scouting guide to be released in the future will contain images of

e of a series of the Plant Pathology Department, UF/IFAS Extension. Original publication date May 2019. Visit the EDIS
ufl.edu for the currently supported version of this publication.

ry Extension coordinator, Horticultural Sciences Department; Norma C. Flor, postdoctoral researcher, Plant Pathology
larmon, professor, Plant Pathology Department; UF/IFAS Extension, Gainesville, FL 32611.

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HS1156

2017 Florida Blueberry Integrated Pest Management Guide[1]

Jeffrey G. Williamson, Philip F. Harmon, Oscar E. Liburd, and Peter Dittmar[2]

This publication was adapted for Florida from the *Southeast Regional Blueberry Integrated Management Guide*, available at http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2016/2016BlueberrySprayGuideFINAL.pdf. Thus, major contributions were made by the original editors: Hannah Burrack (commodity editor, N.C. State University); section editors, Phil Brannen (pathology, University of Georgia), Bill Cline (pathology, N.C. State University), Hannah Burrack (entomology, N.C. State University), Frank Hale (entomology, University of Tennessee), Dan Horton and Ash Sial (entomology, University of Georgia), Mark Czarnota (weed science, University of Georgia), Katie Jennings (weed science, N.C. State University), David Lockwood (vertebrate management, University of Tennessee), Bob Bellinger (pesticide stewardship and safety, Clemson University); and senior editors, Phil Brannen (University of Georgia) and Powell Smith (Clemson University).

Additional contributions by Allen Straw (Virginia Tech University), Scott Nesmith and Harald Scherm (University of Georgia), Steve Bost (University of Tennessee), Phil

Recommendations are based on information from the manufacturers' labels and performance data from research and Extension field tests.

Because environmental conditions and grower application methods vary widely, suggested use does not imply that performance of the pesticide will always conform to the safety and pest control standards indicated by experimental data.

This publication is intended for use only as a guide. Specific rates and application methods are on the pesticide label, and these are subject to change at any time. Always refer to and read the pesticide label before making any application! The pesticide label supersedes any information contained in this guide, and it is the legal document referenced for application standards.

Pesticide Emergencies

Poisonings: 1-800-222-1222

Managing foliar fungal

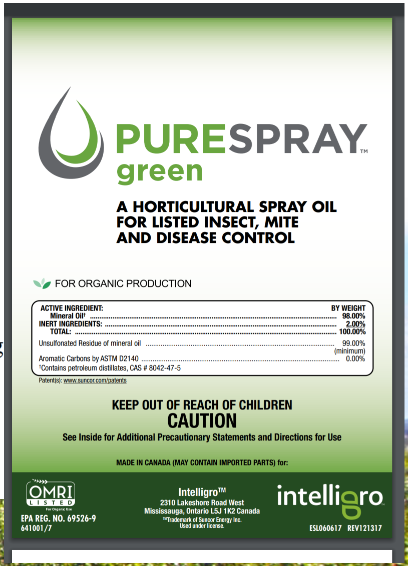
- Avoid overhead irrigation
- Use fungicide applications early in the disease progress
- Do not apply more than the labels allow for any one active ingredient for the season
- Rotate and tank mix products to cover all the bases

Organic Options

- Copper fungicides
  - Copper hydroxide
- Horticultural oil
  - Purespray Green

Treatment and amount/A	Application timing[z]	Blueberry leaf rust Incidence (%)[y]	Blueberry leaf rust Severity (spots/leaf)[y]
Untreated control	----	95.9 a	7.7 ab
Double Nickel LC 2 qt	1-8	95.2 a	9.6 a
Serenade Opti 20 oz	1-8	93.6 a	7.4 ab
OSO 5% SC 6.5 fl oz	1-8	94.3 a	7.4 ab
LifeGard WG 3.4 oz	1-8	92.8 a	7.1 ab
EcoSwing 2 pt	1-8	95.8 a	6.9 b
TimorexACT 17 fl oz	1-8	92.8 a	6.7 bc
ThymeGuard 1.5 qt	1-8	91.3 a	6.4 bc
PureSprayGreen 1.5 gal	1-8	82.6 b	4.2 c

[z]Treatments were applied on (1) 13 Mar, (2) 20 Mar, (3) 27 Mar, (4) 5 Apr, (5) 12 Apr, (6) 20 Apr, (7) 27 Apr, and (8) 4 May.
[y]Recorded for~50 leaves per plot on average. Means in each column followed by the same letter are not significantly different according least significant difference test (LSD)(α=0.05).



Host plant resistance

- Collaborative effort with breeding program
  - Primary objectives
    - Characterize the BB rust that we have in Florida
    - Compare rust from different varieties, parts of the state, times of year, etc.
    - Develop a screen to use in the breeding program to identify and select for sources of resistance within the breeding program genetics
    - Characterize the sources of resistance we find

Anthracnose review

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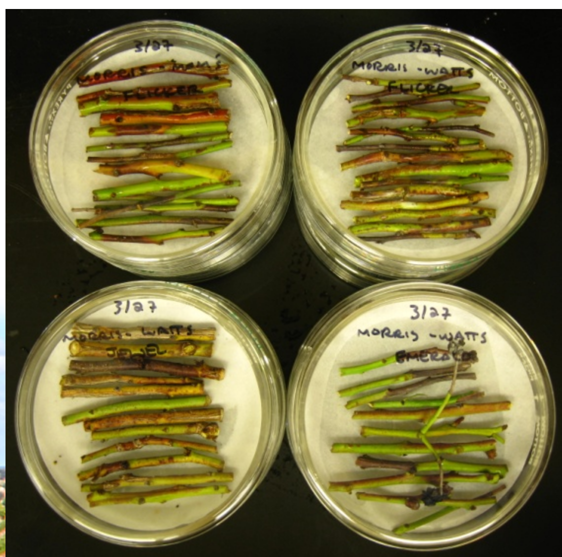
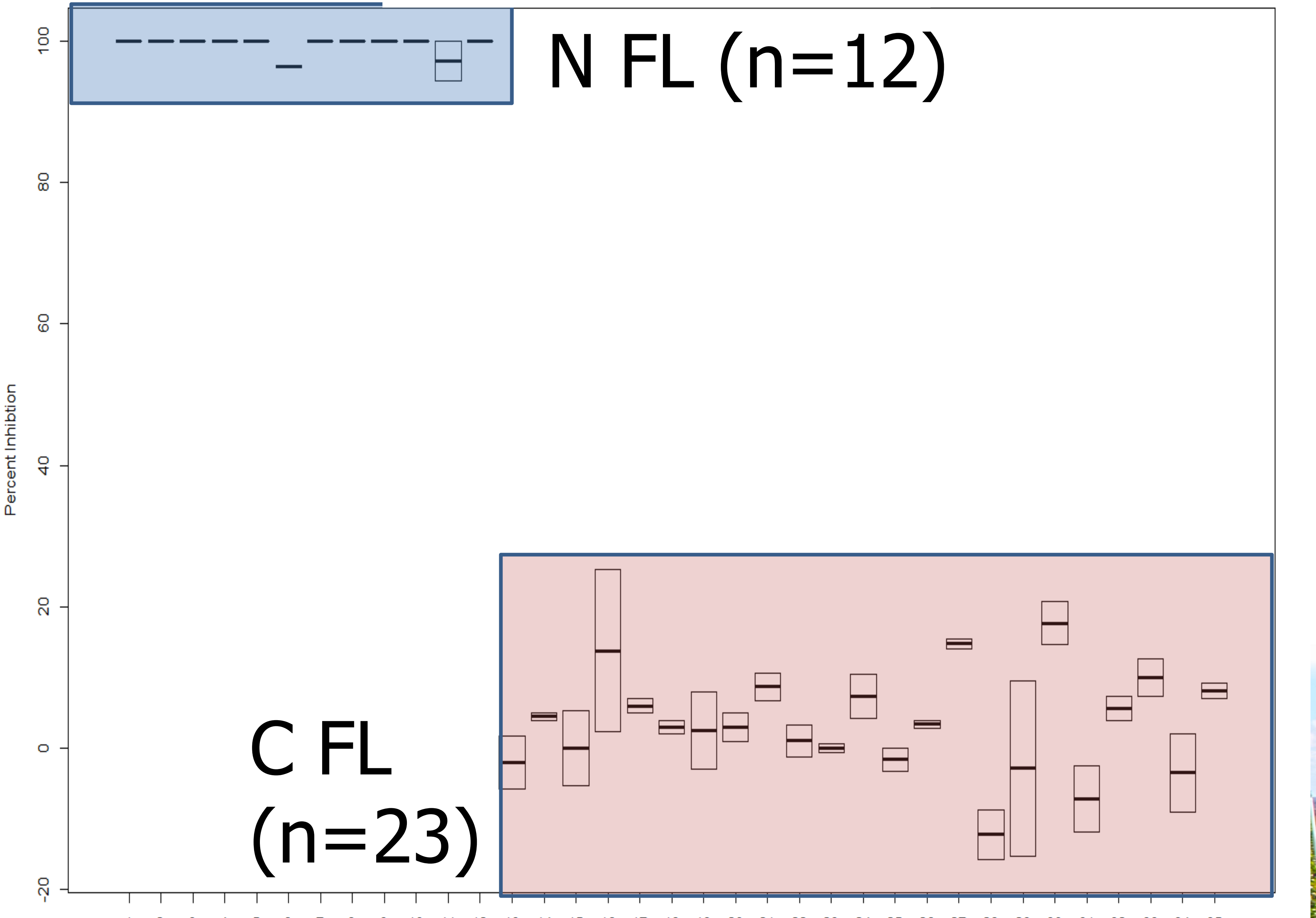
- Can infect:
  - Blueberry: Stem, Leaf, Berry
  - Cultivars: Flicker, Scintilla, Jewel, Emerald, Kestrel, Farthing, Meadow Lark
  - Locations: 2 North Florida farms (N1, N2), 2 Central Florida farms (C1, C2)



2015 inhibition



Managing anthracnose

- Do not use applications of only Abound, Cabrio, or Pristine on Flicker post harvest
- Rotate or tank mix DMI fungicides with compatible contact fungicides
- Do not apply more than the labels allow for any one active ingredient for the season
- Change between products with different active ingredients

Fungicides to look into

- DMI fungicides include products:
  - Tilt and Orbit, Indar, Quash, a new product Proline
- Contact fungicides include:
  - Bravo, Captan, Kocide, Omega, and Ziram

- From what I’ve seen, Flicker will require frequent rotations of these fungicides when rains are regular and disease is likely

Non-fungicide options

- Overhead irrigation has been associated with greater disease severity—drip less so
- Sanitation
  - use sanitizer on shears when pruning Flicker
  - remove diseased plant material from the field and compost, bury, or burn it as appropriate
  - plant varieties other than Flicker

Any Questions?

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