HS 1156

UF UNIVERSITY of FLORIDA
IFAS Extension

Florida Blueberry Integrated Pest Management Guide[1]

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This publication was adapted for Florida from the Southeast Regional Blueberry Integrated Management Guide, available here: http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2006/12Jan06BlueberrySprayGuide.pdf. Thus, major contributions were made by the original editors: Gerard Krewer, Phil Brannen, Mark Czarnota, Dan Horton, Paul Guillebeau, and Paul Sumner (University of Georgia); Bill Cline (North Carolina State University); Frank Hale and David Lockwood (University of Tennessee); Hannah Barrack, Katie Jennings, Wayne Mitchem and David Monks (North Carolina State University); and Powell Smith and Bob Bellinger (Clemson University).

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Recommendations are based on information from the manufacturer's label 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 applications 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

This number automatically connects you with a local Poison Control Center from anywhere in the United States.

1. This document is HS 1156, one of a series of the Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date March 2008. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.

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Pesticide spills or other emergencies:

800-424-9300 (24 hours) CHEMTREK. Be prepared – www.chemtrek.com now for a listing of the information you will be asked to provide in a chemical spill emergency.

Spills on public roads **(In many cases you can call CHEMTREK at 1-800-424-9300 or 911.)**

State Agency Phone Number:

Florida Hazardous Material Planning Section

Cell: call *FDCA 1-800 320-0519 or 911

Environmental emergencies (contamination of waterways, fish kills, bird kills, etc.)

State Agency Phone Number

Florida Department of Community Affairs

Response Team 1-800 320-0519

Pesticide Safety and Label Interpretation Resources

- Federal Regulations Affecting Use of Pesticides http://edis.ifas.ufl.edu/PI168
- Interpreting Pesticide Label Wording
- http://edis.ifas.ufl.edu/PI071

Toxicity of Pesticides http://edis.ifas.ufl.edu/PI008

Sprayer Calibration

Sprayer calibration is very important. Sprayers should be calibrated often to guard against using excess pesticides due to nozzle wear, speed increases, etc. Failing to calibrate often costs money, may cause crop damage and is unsafe.

- Calibration of Herbicide Applicators http://edis.ifas.ufl.edu/WG013
- Calibration of Airblast Sprayers http://edis.ifas.ufl.edu/AE238
- Pesticide Calibration Formulas and Information http://edis.ifas.ufl.edu/WG067

Blueberry Integrated Management Guide (Insect and Disease Control)

Establishment

Root rots – various root rots of blueberry can be particularly problematic immediately after transplanting and until plants are well established. Even in well-drained soils, root rots have been observed in bark-amended beds, and root rots are particularly damaging in high-density bark beds, even when using new bark. Though cost is an issue, replanting into old bark (high-density plantings) is not a good practice; disease-causing organisms build up in the bark, and they can make reestablishment very difficult. It is recommended that phosphite-containing materials (Aliette®, ProPhyt®, AgriFos®, etc.) be used in non-bearing plants after establishment (for bedded and high-density bark plantings). These materials are applied to leaves, and therefore leaf tissue must be fully expanded in order for plants to take them up. In the initial year of planting, a minimum of four applications (spaced approximately one month apart) would be advisable. In general, phosphite materials are acidic, and they should not be applied with acidifiers or acidic water (pH < 6).

Excessive application or application intervals shorter than those dictated by label will injure plants . These phosphite materials also suppress Septoria leaf spot and anthracnose, major foliar diseases of young plants. Some of the phosphonate materials are labeled for use as drenches or chemigation, but information on the success of these methods in southern blueberry production is limited.

In high-density bark beds, use of Ridomil Gold® EC will also provide good control of Pythium and Phytophthora root rots; use of Ridomil Gold® EC in field plantings is very expensive and difficult, since the product has to be taken up by the roots for activity. Where possible, rotation of Ridomil Gold® EC and phosphites is a good resistance-management practice. Do not exceed label recommendations.

Dormant (before flower or leaf buds break)

Blueberry gall midge – The blueberry gall midge is a tiny fly whose larvae feed on vegetative and floral buds. On rabbiteye cultivars, the blueberry gall midge occurs frequently, but it normally only causes economic levels of damage on susceptible cultivars. Blueberry gall midge can become a major problem on some rabbiteye cultivars. Feeding injury destroys floral and vegetative buds before the bud scales open in the spring. In southern highbush blueberries (SHB), infestation of blueberry gall midge occurs less frequently than on rabbiteye, but SHB may show symptoms on new growth. Gall midges lay eggs on warm winter days and at any time during the growing season when the plants are making new flushes of growth. For control, apply diazinon as needed for gall midge between flower bud stages 1 and 2, when the most mature buds first show slight separation of scales. Repeat sprays during warm spells if necessary. Separation of bud scales may occur as early as 15 December in north Florida. In rabbiteye, 'Premier' is often particularly attractive to the gall midge, and it is a good sentinel variety to monitor. Gall midge sprays also suppress pre-bloom thrips population.

Flower thrips. These are small insects (1/16 of an inch in length) with yellowish to orange coloration and fringed wings. Flower thrips damage blueberry flowers in two ways. Larvae and adults feed on all parts of the flowers including ovaries, styles, petals, and developing fruit. This feeding damage can reduce the quality and quantity of the fruit produced. Females cause damage to the fruit when they lay their eggs inside flower tissues. The newly hatched larvae bore holes in the flower tissues when they emerge. White, blue and yellow sticky traps can be used for monitoring thrips. White traps are preferred over blue and yellow because the thrips show up best against a light background, and because the white traps do not attract as many beneficial insects as yellow traps. Another technique for monitoring thrips involves gently tapping the flowers and allowing the thrips to fall onto a white sheet of paper below for counting. An Economic Injury Level (EIL), the lowest number of thrips that can cause economic damage in blueberries, has been developed for two popular rabbiteye cultivars, 'Tiftblue' and 'Climax'. During bloom, when thrips numbers reach approximately 68 thrips per trap for 'Tifblue' and 75 thrips per trap for 'Climax' in one week, insecticide applications should be considered. We recommend that growers use Spinosad (SpinTor® 2 SC) at the 6 oz per acre rate or Delegate™ WG at 4 oz per acre to manage flower thrips populations in southern blueberries (Rabbiteye and southern highbush).

Blueberry bud mite – The blueberry bud mite is an eriophyid mite so tiny (1/125 inch long) that it cannot be seen without magnification. Blueberry bud mite is an occasional pest in well-established blueberries in Florida. Bud mite injury is often confused with frost damage and may become more visible in late spring. In early spring, infested plants exhibit stunted, succulent, fleshy, closely packed, reddish rosetted buds, which may dry up and often fail to open. Bloom on infested plants is reduced. Affected berries are small, roughened and may have small reddish pimples or blisters on the fruit surface. Sanitation by aggressive, timely pruning of infested branches can be helpful. Mechanical topping (mowing off old fruiting twigs) immediately after harvest greatly reduces bud mite incidence the following year. Never propagate from bushes that may be infested with blueberry bud mite. Horticultural oil applications immediately after harvest will aid in control.

Imported fire ants – Ant baits employed in early spring as a broadcast treatment usually eliminate most but not all fire ant mounds within treated areas. Under high ant pressure, treating a second time in the fall will provide better fire ant control. Most ant baits are slow acting; they require up to eight weeks to control active mounds. Worker ants must be attracted to baits so that they will carry the baits back to their colonies. Most ant baits interfere with reproduction, which causes a gradual die-off of colonies. Extinguish® Professional Fire Ant Bait (0.5% methoprene) is labeled for use on all crop land sites. It is effective but somewhat slower acting than Esteem® Ant Bait (0.5% pyriproxyfen).

Ant baits work best when the soil is moist, but not wet. Active ant foraging is essential. Ideally, temperatures should be warm and sunny. Avoid application of ant baits when conditions are expected

to be cold, overcast, rainy or very hot. **Individual mound treatments are most effective when used as-needed for the occasional colony that survives broadcast treatments.** Mound treatments using insecticide baits should be applied in a circle 3 to 4 feet from the mound. Do not disturb mounds or place bait directly on top of mounds.

Mummy berry – Mummy berry is currently not identified as an important disease of southern highbush blueberry in Florida. The disease is a major issue in production areas north of Florida. Florida growers concerned about potential mummy berry problems are encouraged to contact county Extension for diagnostic confirmation and additional information.

Phytophthora root rot – Root rot is generally a problem of low, poorly drained sites. To avoid root rot, provide for adequate drainage by constructing raised beds *before planting.* Site selection and/or proper bedding operations are essential cultural practices for control of this disease. Treatment with fungicides is not effective for reversing root rot damage on plants with severe symptoms. Preventative treatments in pine bark beds and poorly drained sites may be warranted, since the beds are often saturated with water through either irrigation or rainfall.

Commonly recognized stages of flower bud development for southern highbush blueberry

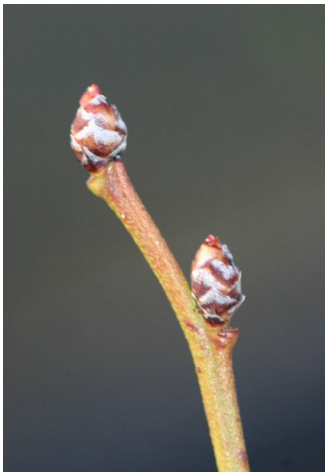

Figure 1. Flower bud stage 1 Credits: Jeff Williamson and Paul Lyrene, University of Florida

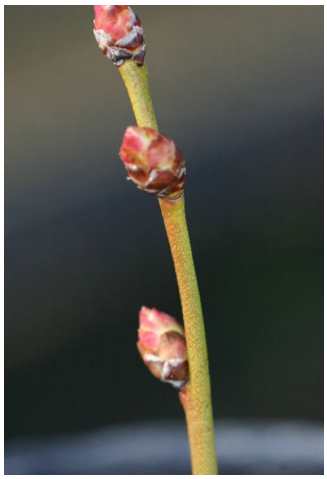

Figure 2. Flower bud stage 2 Credits: Jeff Williamson and Paul Lyrene, University of Florida

Figure 3. Flower bud stage 5 Credits: Mark Langstroth, Michigan State University

Figure 6. Flower bud stage 6 Credits: Jeff Williamson and Paul Lyrene, University of Florida

Figure 4. Flower bud stage 4 Credits: Mark Langstroth, Michigan State University

Figure 5. Flower bud stage 5 Credits: Mark Langstroth, Michigan State University

Figure 7. Flower bud stage 7 Credits: Jeff Williamson and Paul Lyrene, University of Florida

Table 1. Management Strategies for Pest and Disease Problems of Dormant Blueberry Plants

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Phytophtora root rot	mefenoxam (Ridomil Gold 4EC)	3.6 pt	++++	48 hrs	0 days	**Established plantings:** Apply 1/4 pt/1000 linear feet of row (3.6 pints per acre broadcast basis) in a 3-foot band over the row before the plants start growth in the spring. **New plantings:** Apply 3.6 pints per acre (broadcast rate) at or after the time of planting. An 18-inch band over the row is recommended. Do not apply more than 0.9 gallon per acre broadcast during the 12 months before plants bear harvestable fruit, or illegal residues may result. For both new and established plantings, one additional application may be made to coincide with periods most favorable for root rot development.
Scale	Superior Oil (70 second) **Pre-bloom use only.**	2 gal/100 gal water/acre or 2 fl ozs/1 gal of water	+++++	4 hrs	12 hrs (no later than delayed dormant)	Oil may be applied dormant or delayed dormant. Apply as needed for scale infestations. Do not apply oil when temperatures are expected to be higher than 85° F or lower than 40° F within 24 hours. Do not use within 14 days of lime-sulfur.
Imported fire ants	malathion (Malathion 57EC)	1 pt	++	12 hrs	1 day	Malathion is a modestly effective foliar rescue treatment. **May be applied to plants** one day before harvest to discourage ants from foraging on the plants. This is a stopgap treatment to get ants off the plants. Rely on aggressive post-harvest imported fire ant controls to suppress these pests in blueberries.

Table 1. Management Strategies for Pest and Disease Problems of Dormant Blueberry Plants

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	diazinon. (Diazinon AG 500)	1 pt/100 gal	++++	24 hrs	7 days	Mound drench. Slowly apply 1 gallon of diluted mixture over and 6 inches around each mound. Apply gently to avoid disturbing ants.
	pyriproxyfen (Esteem Ant Bait)	1.5–2.0 lbs (2–4 tbsp/mound)	++++	12 hrs	24 hrs	Esteem Ant Bait should be applied during the spring, and if needed, again in the fall. Apply on sunny days when the soil temperature is at least 60° F, and the soil is moist. Baits are slow-acting but effective. Allow 4 weeks to work. Do not make other imported fire ant treatments for 7–10 days. May need to reapply if heavy, flooding rains occur within 7 days.
	methoprene (Extinguish Professional Fire Ant Bait 0.5 %)	1–1.5 lb (3–5 tbsp/ 1000 sq ft) (3–5 tbsp/mound)	+++	4 hrs	0 days	Extinguish Professional Fire Ant Bait (0.5% methoprene) is legal for use on crop land. **Caution: Extinguish baits with methoprene plus hydramethylnon are not labeled for use on crop land.** Application during the heat of the day or when rain is expected within 6 hours of application will reduce the effectiveness of this product. In areas of heavy infestation, repeat applications may be necessary 10–12 weeks after the initial application.
Gall midge	diazinon (Diazinon AG500)	1 pt	**++++**	24 hrs	7 days	Diazinon is the material of choice for early gall midge sprays. Do not apply diazinon within 5 days of bloom because its residues may injure pollinators.

Table 1. Management Strategies for Pest and Disease Problems of Dormant Blueberry Plants

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	spinosad (SpinTor 2SC)	6 oz	+++	4 hrs	3 days	SpinTor is the material of choice near bloom, and should be applied as-needed just before bloom for gall midge and/or thrips. SpinTor is quite toxic to bees until it is thoroughly dry (3 hrs), but thereafter it is relatively non-toxic to bees. SpinTor 2SC should be applied in early morning or late evening during bloom.
	malathion (Malathion 57EC)	2 pt	++++	12 hrs	1 day	Malathion may be applied for gall midge at stage 1 to 2 of bud development. Do not apply malathion within 24 hours of bloom.

Table 2. Management Strategies for Pest and Disease Problems in Blueberry Plants from Pre-bloom through Green Tip (Leaf Buds) and Pink Bud (Flower Buds)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Flower thrips – Flower thrips can be very damaging to flower buds and blooms. Thrip numbers typically increase dramatically as corollas open and bloom progresses. Determining when or if blueberries should be treated for thrips is difficult. Treatment thresholds, thrip counts that indicate the need for an insecticide application, do not presently exist. Blueberries are a pollination sensitive crop, and careless use of insecticides and subsequent bee kill can easily impair pollination and ruin fruit set. Insecticides should not be applied during bloom. Some very provisional thrips treatment threshold concepts follow. (1) Begin sampling bloom clusters for thrips at stage 3. Place flower bud clusters in sealed plastic bags and incubate them in a warm room or on a windowsill. Less than 2 thrips per individual bloom during stage 3 is probably insignificant. However, 6 thrips per bloom is almost certain to destroy a flower. (2) If thrips are found in blooms at stage 3, begin sampling two to three times a week. Take a minimum of five bags of bloom clusters per block each time. If more than 2 thrips per individual bloom are found, and if the numbers are increasing, apply an insecticide. Diazinon is the material of choice until 5 days pre-bloom. From five days pre-bloom until first bloom, the material of choice is SpinTor.						

Table 2. Management Strategies for Pest and Disease Problems in Blueberry Plants from Pre-bloom through Green Tip (Leaf Buds) and Pink Bud (Flower Buds)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Phomopsis cane and twig blight	pyraclostrobin + boscalid (Pristine WG)	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.
Gall midge	diazinon (Diazinon AG 500)	1 pt	++++	24 hrs	7 days	Do not apply within 5 days of bloom.
	spinosad (SpinTor 2SC)	6 oz	+++	4 hrs	3 days	SpinTor 2SC may be applied as-needed just before bloom for gall midge and/or thrips. SpinTor 2SC is quite toxic to bees until it is thoroughly dry (3 hours), but thereafter it is relatively non-toxic to bees. SpinTor 2SC should be applied in early morning or late evening during bloom.
	spinosad (Entrust 80%)	1.25–2 oz	+++	4 hrs	3 days	Bloom (organic formulation of Spinosad) may be applied as-needed just before bloom for gall midge and/or thrips. Entrust is quite toxic to bees until it is thoroughly dry (3 hours), but thereafter it is relatively non-toxic to bees. Entrust should be applied in early morning or late evening during bloom.
	malathion (Malathion 57EC)	2 pt	+++	12 hrs	1 day	

Table 3. Management Strategies for Pest and Disease Problems in Blueberry Plants from 10 to 20% Bloom until 80 to 90% Bloom

Do not use insecticides during bloom **– Spraying with insecticides may kill or repel wild bees, and honey bees are needed for adequate pollination and fruit set.**						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments**
Flower thrips	spinosad (SpinTor 2SC)	6 oz	+++	4 hrs	3 days	Insecticide applications during bloom are typically very damaging to pollinators. SpinTor is toxic to bees exposed to treatment for 3 hours following treatment. Do not apply SpinTor to blooming, pollen-shedding or nectar-producing parts of plants if bees are foraging on the plants during this period. Thus, flower thrips may be sprayed in the late evening or early morning before bees are active (to minimize risk to bees). Do not apply SpinTor more than 3 times in a 30-day period.
	spinosad (Entrust 80%)	1.25–2 oz	+++	4 hrs	3 days	Entrust is quite toxic to bees until it is thoroughly dry (3 hours) but thereafter it is relatively non-toxic to bees. Entrust should be applied in early morning or late evening during bloom.
	Delgate WG	3–6 oz	++++	4 hrs	3 days	Delegate is quite toxic to bees until it is thoroughly dry (3 hours) but thereafter it is relatively non-toxic to bees. Delegate should be applied in early morning or late evening during bloom.
Botrytis flower blight	cyprodinil + fludioxonil (Switch 62.5WG)	11–14 oz	+++++	12 hrs	0 days	Make the first application during early bloom. Subsequent applications should be made every 7–10 days during bloom. Do not apply more than 56 oz. of product per acre per year. Make no more than two sequential applications before using another fungicide with a different mode of action.

Table 3. Management Strategies for Pest and Disease Problems in Blueberry Plants from 10 to 20% Bloom until 80 to 90% Bloom

Do not use insecticides during bloom **– Spraying with insecticides may kill or repel wild bees, and honey bees are needed for adequate pollination and fruit set.**						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments**
	fenhexamid (Elevate 50WDG)	1.5 lb	+++++	12 hrs	0 days	Begin application at 10% bloom. Applications should be made every seven days when conditions favor disease. Do not make more than two consecutive applications without switching to a fungicide with a different mode of action. Do not apply more than 6.0 lb product per acre per year.
	captan + fenhexamid (CaptEvate 68WDG)	3.5–4.7 lb	+++++	72 hrs	0 days	CaptEvate is a combination product of captan plus Elevate. Do not make more than two consecutive applications before switching to a fungicide with a different mode of action. Do not apply more than 21.0 lb/acre/season.
	pyraclostrobin + boscalid (Pristine WG)	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.
	ziram (Ziram 76DF)	3 lb	++	48 hrs	~30 days	Do not apply later than 3 weeks after full bloom.
	captan (Captan 50WP)	5 lb	++	72 hrs	0 days	Do not apply more than 70 lb per acre per crop year.
	captan (Captec 4L)	2 qt	++	72 hrs	0 days	Do not apply more than 35 quarts per acre per crop year.
Cranberry fruitworm – Scout fields for cranberry fruitworm to determine if and when spraying is needed. Check for fruitworm twice a week from full bloom until 4 weeks after petal fall. Examine fruit clusters for tiny, pin-sized holes in berries, with frass and premature ripening in more mature fruit. Break berries open to look for pale green larvae and damage. Early varieties such as 'Climax' are normally infested first. Infestations should be caught in the first or second berry in a cluster for sprays to give the needed control of this pest.						

Table 3. Management Strategies for Pest and Disease Problems in Blueberry Plants from 10 to 20% Bloom until 80 to 90% Bloom

Do not use insecticides during bloom **– Spraying with insecticides may kill or repel wild bees, and honey bees are needed for adequate pollination and fruit set.**						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments**
Ripe (anthracnose) and/or Alternaria rots	azoxystrobin (Abound)	6.2–15.4 fl oz	+++++	4 hrs	0 days	Subsequent applications can be made at 7- to14-day intervals. Do not apply more than two sequential applications before switching to a fungicide with another mode of action (e.g. Captan). Do not apply more than 1.44 quarts per acre per season.
	cyprodinil + fludioxonil (Switch 62.5WG)	11–14 oz	+++++	12 hrs	0 days	Applications can be made on a 7- to 10-day interval when conditions warrant. Do not apply more than 56 oz of product per acre per year. Make no more than two sequential applications before using another fungicide with a different mode of action.
	pyraclostrobin (Cabrio EG)	14 oz	++++	24 hrs	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 per acre per crop year.
	pyraclostrobin + boscalid (Pristine WG)	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.
	ziram (Ziram 76DF)	3 lb	++	48 hrs	~30 days	Do not apply later than 3 weeks after full bloom.
	captan (Captan 50WP)	5 lb	+++	72 hrs	0 days	Do not apply more than 70 lb per acre per crop year.
	captan (Captec 4L)	2 qt	+++	72 hrs	0 days	Do not apply more than 35 quarts per crop year.

Table 4. Management Stratetgies for Pest and Disease Problems in Blueberry Plants from Petal Fall Until One Month After Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Cranberry fruitworm, cherry fruitworm, plum curculio – Review field histories and scout fields for fruitworms and plum curculio to determine if and when spraying is needed. In some southeastern production areas (GA), plum curculio has not been found to be a pest of rabbiteye blueberries. Fields with a history of infestation should be sprayed at least twice on a 7-14 day interval, beginning immediately after bloom. Check for fruitworms twice a week from full bloom until 4 weeks after petal fall. Examine fruit clusters for tiny pin-sized holes in berries, with frass and premature ripening in more mature fruit. Break berries open to look for larvae and damage. Early varieties are normally infested first. Control will be best when these insects are sprayed early in the infestation period. **Septoria and anthracnose leaf spots** – Septoria and anthracnose leaf spot pathogens can cause premature defoliation, resulting in poor bud development and subsequent loss of yield. Fungicide timing for leaf spots varies across the state and by specific disease. Septoria can occur prior to harvest through late spring. Anthracnose leaf spots generally start post harvest and persist through summer.						
Ripe (anthracnose) and/or Alternaria rots	azoxystrobin (Abound)	6.2–15.4 fl oz	+++++	4 hrs	0 days	Subsequent applications can be made at 7- to 14-day intervals. Do not apply more than two sequential applications before switching to a fungicide with another mode of action (e.g. Captan). Do not apply more than 1.44 quarts per acre per season.
	cyprodinil + fludioxonil (Switch 62.5WG)	11–14 oz	+++++	12 hrs	0 days	Applications can be made at 7- to 10-day intervals when conditions warrant. Do not apply more than 56 oz of product per acre per year. Make no more than two sequential applications before using another fungicide with a different mode of action.
	pyraclostrobin (Cabrio EG)	14 oz	++++	24 hrs	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 per acre per crop year.

Table 4. Management Stratetgies for Pest and Disease Problems in Blueberry Plants from Petal Fall Until One Month After Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Phytophthora root rot	fosetyl-Al (Aliette WDG)	5 lb	+++	12 hrs	0 days	Apply Aliette as a foliar spray after leaves have emerged Subsequent applications can be made at 14- to 21-day intervals. Do not exceed 4 applications per acre per year. **Do not tank mix with copper and foliar fertilizers, and do not apply in acidic water or add acidifying agents because these practices could damage foliage and fruit.** When tank-mixing this product with others, test the mix on a small area to make sure that phytotoxicity does not occur.
	potassium phosphite (Prophyt)	4 pints	++++	4 hrs	0 hrs	Apply as a foliar spray for Phytophthora and Pythium after leaves have emerged. 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 because these practices could damage foliage and fruit.** When tank-mixing this product with others, test the mix on a small area to make sure that phytotoxicity does not occur.

Table 4. Management Stratetgies for Pest and Disease Problems in Blueberry Plants from Petal Fall Until One Month After Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	mono- and di-potassium salts of phosphorous acid (Agri-Fos)	2.5 quarts	++++	4 hrs	0 hrs	Apply as a foliar spray for Phytophthora and Pythium after leaves have emerged. PersonNameAlso 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 because these practices could damage foliage and fruit.** When tank-mixing this product with others, test the mix on a small area to make sure that phytotoxicity does not occur.
Ripe (anthracnose) and/or Alternaria rots	pyraclostrobin + boscalid (Pristine WG)	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.
	ziram (Ziram 76DF)	3 lb	++	48 hrs	~30 days	Do not apply later than 3 weeks after full bloom.
Cranberry fruitworm	malathion (Malathion 57EC)	2.8–3.2 pt	+++	12 hrs	1 day	Spray fruitworms when 1 bush in 5 has infested fruit clusters.
	esfenvalerate (Asana XL 0.66 EC)	4.8–9.6 fl oz	++++	12 hrs	14 days	Some users may be allergic to Asana; discontinue use if skin or eyes become inflamed.
	esfenvalerate (Adjourn 0.66 EC)	4.8–9.6 fl.oz.	++++	12 hrs	14 days	Some users may be allergic to Adjourn; discontinue use if skin or eyes become inflamed.
	phosmet (Imidan 70WP)	1.3 lbs	+++++	24 hrs	3 days	Imidan, applied for blueberry maggot, provides excellent control of fruitworms.

Table 4. Management Stratetgies for Pest and Disease Problems in Blueberry Plants from Petal Fall Until One Month After Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	phomet (imidan 70W)	1.3 lb	+++++ (for fruitworms) ++++++++ (for plum curculio)	24 hrs	3 days	Imidan produces 7–10 days residual control. Begin spraying after petel fall.
	carbaryl (Sevin 80WSP)	1.875–2.5 lb	+++ (for fruitworms)	12 hrs	7 days	Sevin gives only moderate control of fruitworms
	tebufenozide (Confirm 2F)	16 fl oz	+++++ (for fruitworms)	4 hrs	14 days	Confirm gives very good control for cranberry fruitworms. Confirm needs to be ingested to be effective; therefore, timing is critical. Apply Confirm while fruitworms are still small. Confirm conserves natural enemies.

Table 5. Management Strategies for Pest and Disease Problems in Pre-harvest Blueberries

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Alternaria and ripe rots	azoxystrobin (Abound)	6.2–15.4 fl oz	+++++	4 hrs	0 days	Subsequent applications can be made at 7- to14-day intervals. Do not apply more than two sequential applications before switching to a fungicide with another mode of action (e.g. Captan). Do not apply more than 1.44 quarts per acre per season.
	cyprodinil + fludioxonil (Switch 62.5WG)	11–14 oz	+++++	12 hrs	0 days	Applications can be made at 7- to10-day intervals when conditions warrant. Do not apply more than 56 oz. of product per acre per year. Make no more than two sequential applications before using another fungicide with a different mode of action.

Table 5. Management Strategies for Pest and Disease Problems in Pre-harvest Blueberries

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	pryraclostrobin (Cabrio EG)	14 oz	++++	24 hrs	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 per acre per crop year.
	pyraclostrobin + boscalid (Pristine WG)	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.

Table 6. Management Strategies for Pest and Disease Problems in Harvest Blueberries

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI t	PHI	Comments
Blueberry maggot fly (BBMs) – Blueberry maggot is only a problem for growers north of the Lake City and Live Oak area. Growers in Gainesville and south of Gainesville should not experience a problem with blueberry maggot. Blueberry maggot is a late-season pest. If berries are infested with BBM, a whitish maggot will appear in the fruit at harvesting. The adult fly that lays the eggs can be monitored by hanging yellow, sticky traps (baited with ammonium acetate), at least one per cultivar. Trap catches indicate when adults are present. **Traps should be hung in the planting by early May.** See your county agent for ID pictures and further reference. **If your planting has a history of BBM infestation, spray as soon as adults are trapped**. Once spraying for BBM begins it is very important to **spray every 7–14 days until all the fruit has been harvested.** Materials and spray intervals are listed below. All gowers in Florida who are shipping blueberries to Canada or the United Kingdom must comply with appropriate guidelines for scouting, spraying and post-harvest inspection of berries, including a protocol for cooking samples of harvested fruit to test for the presence of the maggot in berries. The Canadian protocol states that blueberries must be certified maggot-free to enter Canada. **Fruit rots** – Fungicides alone do not provide adequate control; proper harvesting and handling is essential. Pre- and post-harvest rots can be greatly reduced by timely, complete harvest of all ripe fruit on the bush, followed by rapid post-harvest cooling. For hand-harvested highbush and southern highbush cultivars, harvest all ripe berries on the bush every 7 days or less. Rabbiteye cultivars should be clean-harvested every 10-14 days. Post-harvest cooling is critical and is best accomplished through the use of partial-vacuum or forced-air systems that use fans to pull cold air through stacks of palletized fruit.						

Table 6. Management Strategies for Pest and Disease Problems in Harvest Blueberries

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI t	PHI	Comments
Blueberry maggot	phosmet (Imidan 70W)	1.3 lb	++++	24 hrs	3 days	**Imidan is the material of choice.** BBM sprays should protect berries from the start of egg lay until the last berries are harvested. Imidan provides 10–14 days residual control. Do not apply more than 2 times per season.
	carbaryl (Sevin 80S)	1.875–2.5 lb	+++	12 hrs	7 days	BBM sprays should protect berries from the start of egg lay until the last berries are harvested. Sevin provides 5–7 days residual effectiveness.
	malathion (Malathion 57EC)	1.5 pt	+++	12 hrs	1 day	BBM sprays should protect berries from the start of egg lay until the last berries are harvested. Malathion provides 5–7 days residual control.
	diazinon (Diazinon AG500)	1 pt/100 gal	++++	24 hrs	7 days	Allow 14 days between applications.

Table 7. Management Strategies for Pest and Disease Problems in Post-harvest

Pest/Problem	Management Options	Amount of formulation per acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments

Table 7. Management Strategies for Pest and Disease Problems in Post-harvest

Pest/Problem	Management Options	Amount of formulation per acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Blueberry bud mites – This is an occasional pest of blueberries in Florida. Use high volume (300 gallons per acre), high pressure (200 psi) applications of a post-harvest insecticide/miticide and horticultural oils. **In blocks infested with blueberry bud mite, make two post-harvest applications of endosulfan.** Pruning and removing or destroying old blueberry canes can help reduce bud mite populations. Summer topping or hedging immediately after harvest is a common practice used to manage bush height; this practice also greatly reduces bud mite by removing old, infested fruiting twigs. **Imported fire ants** – Imported fire ants can be very important pests in orchards, vineyards or fields. Ant baits employed after harvest into fall as a broadcast treatment should eliminate most, but seldom all, fire ant mounds within treated areas. Under high pressure, use a dormant, or early spring broadcast application in addition to the post-harvest application to get better fire ant control. Ant baits are slow acting; they require up to eight weeks to control active mounds. Worker ants must be attracted to baits so that they will carry the baits back to their colonies. Most ant baits interfere with reproduction, which causes a gradual die-off of colonies. PersonNameExtinguish Professional Fire Ant Bait (0.5% methoprene) is labeled for use on all crop land sites. It is effective, but somewhat slower acting than Esteem Ant Bait (0.5% pyriproxyfen). Ant baits work best when soil is moist but not wet. Active ant foraging is essential. Ideally, temperatures should be warm and sunny. Avoid application of ant baits when conditions are expected to be cold, overcast, rainy or very hot. **Individual mound treatments are most effective when used as-needed for the occasional colony that survives broadcast treatments.** Mound treatments using insecticide baits should be applied in a circle 3 to 4 feet from the mound. Do not disturb mounds or place bait directly on top of mounds. **Blueberry bud mite** – Blueberry bud mite is a tiny eriophyid mite, best visible with a dissecting microscope. In early-ripening cultivars, sanitation, in the form of post-harvest hedging, cutting back into one- and two-year-old wood, should be the primary management response for blueberry-bud-mite-infested blocks. Post-harvest application(s) of endosulfan may be helpful to augment this critical cultural practice.						
Blueberry bud mite	endosulfan (Thionex 3EC)	2qt/300 gal	++++	24 hrs	Post-harvest only	Blueberry bud mite infestations are very site specific and only affect certain varieties. Bud mites may be spread via propagation. A post-harvest application, followed by another in August, is the general recommendation. Consult with an entomologist to insure proper timing of these applications. Do not apply more than 4 quarts of endosulfan 3EC per acre per year **(for postharvest use only).**
	endosulfan (Endosulfan 3EC)	2 qt/300 gal	++++	24 hrs	Post-harvest only	
	horticultural oil (JMS Stylet Oil)	3–6 qt/100 gal	++	4 hrs	0 days	Blueberry bud mite cant be readily seen, and by the time symptoms are observed in the spring, the mites are too deep for effective treatment.
	horticultural oil (Stoller Golden Pest Spray Oil)	2 gal (low volume) application or 2 gal/100 gal (dilute spray)	++	4 hrs	0 days	

Table 7. Management Strategies for Pest and Disease Problems in Post-harvest

Pest/Problem	Management Options	Amount of formulation per acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Yellownecked caterpillars,	malathion (Malathion 57EC)	1.5 pt	+++	12 hrs	1 days	Foliage feeding caterpillars become more difficult to control as they mature.
azalea caterpillar	*Bacillus thuringiensis* [BT] (Dipel DF)	0.5–1.0 lb	++	4 hrs	0 days	Dipel is an effective microbial insecticide. However, it should be applied to small, early-stage caterpillars.
	tebufenozide (Confirm 2F)	4–8 fl oz	++++	4 hrs	14 days	Confirm is very effective if applied to small, early-stage caterpillars.
	esfenvalerate (Asana 0.66 EC)	4.8–16 oz	++++	12 hrs	14 days	Esfenvalerate should be used as a salvage treatment for large caterpillars. It is very effective, but if used often, it encourages scale and mite buildup.
	esfenvalerate (Adjourn 0.66 EC)	4.8–9.6 fl.oz.	++++	12 hrs	14 days	Some users may be allergic to Adjourn; discontinue use if skin or eyes become inflamed.
Imported fire ants	malathion (Malathion 57EC)	1 pt	++	12 hrs	1 day	Malathion is a modestly effective foliar rescue treatment. May be applied to plants one day before harvest to discourage ants from foraging on the plants. This is a stopgap treatment to get ants off the plants. Rely on aggressive post-harvest imported fire ant controls to suppress these pests in blueberries.
	diazinon. (Diazinon AG 500)	1 pt/100 gal	++++	24 hrs	7 days	Mound drench. Slowly apply 1 gallon of diluted mixture over and 6 inches around each mound. Apply gently to avoid disturbing ants.
	pyriproxyfen (Esteem Ant Bait)	1.5–2.0 lbs (2–4 tbsp/mound)	++++	12 hrs	24 hrs	Esteem Ant Bait should be applied during the spring, and, if needed, again in the fall. Apply on sunny days when the soil temperature is at least 60F, and the soil is moist. Baits are slow acting but effective. Allow 4 weeks to work. Do not make other imported fire ant treatments for 7–10 days. May need to reapply if heavy, flooding rains occur within 7 days.

Table 7. Management Strategies for Pest and Disease Problems in Post-harvest

Pest/Problem	Management Options	Amount of formulation per acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	methoprene (Extinguish Professional Fire Ant Bait 0.5 %)	1–1.5 lb (3–5 tbsp/ 1000 sq ft) (3–5 tbsp/mound)	+++	4 hrs	0 days	Extinguish Professional Fire Ant Bait (0.5% methoprene) is legal for use on crop land. **Caution: Extinguish baits with methoprene plus hydramethylnon are not labeled for use on crop land.** Application during the heat of the day or when rain is expected within 6 hours of application will reduce the effectiveness of this product. In areas of heavy infestation, repeat applications may be necessary 10–12 weeks after the initial application.
Flea beetles	carbaryl (Sevin 80S)	1–2 lb	+++	12 hrs	7 days	Sevin is also effective against small to medium-sized caterpillars.
	diazinon (Diazinon AG500)	1 pt/100 gal	++++	24 hrs	7 days	Diazinon is also effective against small to medium-sized caterpillars.

Table 8. Late-Season and After-Harvest Blueberry Foliage Management

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
During fruit maturation and/or immediately following harvest, fungicide applications may be warranted for control of leaf spot and suppression of dieback diseases and root rots. Start applications as soon as leaf spots are first observed. **Dieback diseases of southern highbush varieties** – Most southern highbush varieties are hedged immediately after harvest. Hedging cuts can serve as an entry point for many stem pathogens. At the end of each day of hedging, application of broad-spectrum fungicides such as Pristine is recommended to help reduce infection. **Blueberry rust –** Rust is a problem in all Florida production areas. On susceptible varieties, rust can prematurely defoliate plants. Where leaves are not dropped in winter, rust can carry over on the previous year's foliage and can cause rust problems in early spring as well. **Bravo WeatherStik is labeled for control of both rust and Septoria leaf spots; this chlorothalonil product makes an excellent rotation partner for the strobilurin-containing products, Cabrio and Pristine. However, Bravo WeatherStik can only be used after harvest because chlorothalonil will damage fruit.**						

Table 8. Late-Season and After-Harvest Blueberry Foliage Management

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Septoria and Anthracnose leaf spots and Phytophthora root rot	Fosetyl-Al (Aliette WDG)	5 lb	++++	12 hrs	12 hrs	Apply PersonNameAliette as a foliar spray for Phytophthora and Pythium root rots and Septoria leaf spot. Subsequent applications can be made at 14- 21-day intervals. Two or three fungicide applications following harvest are generally sufficient to prevent major outbreaks of Septoria leaf spot. Assuming that hedging is conducted immediately following harvest, this is a good time to consider an application. Do not exceed 4 applications per acre per year. **Do not tank mix with copper and foliar fertilizers, and do not apply in acidic water or add acidifying agents because these practices could damage fruit or foliage.** When tank-mixing this product with others, test the mix on a small area to make sure that phytotoxicity does not occur.
	potassium phosphite (Prophyt)	4 pints	++++	4 hrs	0 hrs	Apply as a foliar spray for Phytophthora and Pythium. PersonNameAlso 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 because these practices could damage fruit or foliage.** When tank-mixing this product with others, test the mix on a small area to make sure that phytotoxicity does not occur.

Table 8. Late-Season and After-Harvest Blueberry Foliage Management

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	mono- and di-potassium salts of phosphorous acid (Agri-Fos)	2.5 quarts	++++	4 hrs	0 hrs	Apply as a foliar spray for Phytophthora and Pythium. PersonNameAlso 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 because these practices could damage fruit or foliage.** When tank-mixing this product with others, test the mix on a small area to make sure that phytotoxicity does not occur.
Septoria and anthracnose leaf spots only	azoxystrobin (Abound)	6.2–15.4 fl oz	++++	4 hrs	0 days	Subsequent applications can be made at 14-day intervals. Apply immediately after harvest. Two or three fungicide applications after harvest are generally sufficient to prevent major outbreaks of Septoria leaf spot. When hedging is conducted immediately following harvest, this is a good time to consider an application. Do not exceed 1.44 quarts per acre per season, and do not apply more than two sequential applications of Abound before switching to a fungicide with another mode of action.
Septoria leaf spot only	cyprodinil + fludioxonil (Switch 62.5WG)	11–14 oz	+++	12 hrs	0 days	Applications can be made at 7- 10-day intervals when conditions warrant. Do not apply more than 56 oz of product per acre per year. Make no more than two sequential applications before using another fungicide with a different mode of action.
Septoria and rust leaf spots only	chlorothalonil (Bravo Weather Stik)	Bravo Weather Stik-3–4 pt	++++	12 hrs (with restrictions) 6.5 days(w/o)	42 days	Apply only as a postharvest fungicide for Septoria and rust. Do not combine with other pesticides, surfactants or fertilizers.

Table 8. Late-Season and After-Harvest Blueberry Foliage Management

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
	fenbuconazole (Indar 75 WSP)	2.0 oz	+++++	12 hrs	30 days	Do not make more than 4 applications or apply more than 8 oz of Indar 75WSP (0.38 lb active) per acre per year. Indar 75WSP belongs to the sterol demethylation inhibitor (DMI) class of fungicides or target site of action fungicides. Alternation with fungicides of different classes is recommended. **Captan cannot be applied by aerial application.**
	Propiconazole (Orbit 3.6 E)	6.0 fl oz	+++++	24 hrs	30 days	Orbit, another DMI fungicide, may be applied by either ground or aerial application (see label). Do not apply more than 30 fl oz per acre per season. Orbit is more effective when it dries ahead of a rain.
Septoria, Anthracnose and rust leaf spots	pyraclostrobin (Cabrio EG)	14 oz	++++	24 hrs	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 per acre per crop year.
	pyraclostrobin + boscalid (Pristine WG)	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.

Table 9. Efficacy of Selected Fungicides Against Diseases of Blueberry

Fungicide	Phytophthora Root Rot	Mummy Berry	Botrytis (Gray Mold)	Alternaria Rot	Phomopsis Twig Blight	Ripe rot (Anthracnose)	Septoria Leaf Spot	Anthracnose Leaf Spot	Rust
Azoxystrobin (Abound)	NAa	++	NA	+++++	++	+++++	++++	++++	???
Captan (Captan, Captec)	NA	+	++	++	++	+++	++	+++	NA
Chlorothalonil (Bravo)	NA **Do not use before harvest**	NA **Do not use before harvest**	NA **Do not use before harvest**	NA **Do not use before harvest**	NA **Do not use before harvest**	NA **Do not use before harvest**	++++ **Do not use before harvest**	??? **Do not use before harvest**	**+++ Do not use before harvest**
Cyprodinil + fludioxonil (Switch)	NA	++	+++++	+++++	+++	+++++	+++	++++	???
Fenbuconazole (Indar)* *During mummy berry applications, tank mix with captan products to prevent rots	NA	+++++	NA	NA	NA	NA	++++	NA	+++
Fenhexamid (Elevate)	NA	++	+++++	NA	NA	NA	NA	NA	NA
Fenhexamid + captan (CaptEvate)	NA	++	+++++	++	++	+++	++	???	NA
Fosetyl-Al (Aliette WDG)	+++	NA	NA	NA	+	+	++++	++++	NA
Mefenoxam (Ridomil Gold)	+++	NA	NA	NA	NA	NA	NA	NA	NA
Mono and di-potassium salts of phosphorous acid (AgriFos)	+++	NA	NA	NA	NA	NA	++++	++++	NA
Mono and di-potassium salts of phosphorous acid (K-phite)	+++	NA	NA	NA	NA	NA	++++	++++	NA
Potassium phosphite (ProPhyt)	+++	NA	NA	NA	NA	NA	++++	++++	NA
Pyraclostrobin (Cabrio)	NA	NA	NA	++++	+++	++++	++++	+++++	+++++

Table 9. Efficacy of Selected Fungicides Against Diseases of Blueberry

Fungicide	Phytophthora Root Rot	Mummy Berry	Botrytis (Gray Mold)	Alternaria Rot	Phomopsis Twig Blight	Ripe rot (Anthracnose)	Septoria Leaf Spot	Anthracnose Leaf Spot	Rust
Pyraclostrobin + boscalid (Pristine)	NA	++++	+++++	+++++	+++	+++++	+++++	+++++	+++++
Ziram (Ziram)	NA	+	++	+	+++	+++	???	++	???

[a]NA = no significant activity, ??? = unknown activity; + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity, +++++ = excellent activity.

Table 10. Fungicide Classes With Moderate to High Risk of Resistance Development (Generally Single Sites of Action)

Fungicide Class	Trade Name and Chemical Name
Anilopyrimidines	Switch (cyprodinil; one component of a two-part mixture)
Carboximide demethylation inhibitors (DMIs) or sterol inhibitors	Pristine (boscalid; one component of a two-part mixture) Indar (fenbuconazole)
Hydroxyanelides	Orbit (propiconazole) Elevate (fenhexamid)
Phenylamides	Ridomil Gold (mefanoxam)
Phenylpyrroles strobilurins or QoI (quinone outside inhibitors)	Switch (fludioxanil; one component of a two-part mixture) Abound (azoxystrobin) Cabrio (pyraclostrobin)
Fungicide Classes With Low Risk of Resistance Development (Generally Multiple Sites of Action)	
Fungicide Class	**Trade Name and Chemical Name**
Coppers	Coppers (numerous formulations)
Dithiocarbamates	Ziram (ziram)
Phthalimides	Captan (Captan or Captec)
Phthalonitriles	Bravo (Chlorothalonil)
Fungicide Classes With Moderate to High Risk of Resistance Development (Generally Single Sites of Action	
Fungicide Class	**Trade Name and Chemical Name**
Phosphonates	Aliette (Fosetyl-Al) AgriFos (Mono and di-potassium salts of phosphorous acid) K-phite (Mono and di-potassium salts of phosphorous acid) ProPhyt (Potassium phosphite)

Table 11. Seasonal "At a Glance" Fungicidal Spray Schedule Options for Blueberry

Developmental Stage	Green Tip	Bloom (2-3 Applications)[a]	Petal Fall	10-14 Days after Petal Fall	20-24 Days after Petal Fall	Pre-Harvest[d]	After-Harvest Foliage Management
Disease Controlled (Fungicides)	Twig blight (Pristine or Indar)	Twig blight (Pristine or Indar[b] + Captan or Orbit) Botrytis CaptEvate or Elevate or Pristine or Switch	Alternaria and ripe rots (Abound or Cabrio or Pristine or Switch)	Alternaria and ripe rots (Abound or Cabrio or Pristine or Switch)	Alternaria and ripe rots (Abound or Cabrio or Pristine or Switch)	Alternaria and ripe rots (Abound or Cabrio or Pristine or Switch) Septoria leaf spot (Abound or Aliette or Cabrio or Pristine or Switch)[e]	Septoria leaf spot and rust (Abound or Orbit or AgriFos or Aliette or Bravo or Cabrio or Pristine or Prophyt or Switch or Indar) Anthracnose (AgriFos or Aliette or Cabrio or Pristine or Prophyt)

[a]Bloom times vary, due to varietal differences and the environment. Bloom sprays should provide protection against the primary pathogens of blooms for the entire bloom period. The number of applications required for bloom may vary from 1-3, depending on the season and the variety.
[b]When using Indar during bloom, always tank-mix with Captan. Captan provides additional control of mummy berry, and it has some activity against twig blight, Botrytis and fruit rots. However, it is mainly of value to prevent increased rots with the use of Indar, as well as providing resistance management.
[c]Many of the fungicides registered for rot control may also have activity against twig dieback organisms, such as *Phomopsis* species.
[d]In wet years, pre-harvest and post-harvest rots may be a potential problem. Under these conditions, 1–2 applications of a pre-harvest material may be necessary for rot control.
[e]Septoria leaf spot is generally controlled with 2–4 fungicide applications. This disease is more problematic on highbush blueberry varieties, but some rabbiteye varieties may experience premature defoliation from Septoria as well. For leaf spot, Aliette and other phosphites (ProPhyt, AgriFos, etc.) are best used after harvest, since they are not as efficacious against the fruit rots, and they serve as a resistance management tool.
fRust is problematic on some blueberry varieties, especially in far southern areas such as south Georgia, and it can result in complete, premature defoliation on susceptible varieties. Scout for rust in mid to late July. Applications of fungicides (2–3) from August to mid-September will generally result in good rust management. Some varieties may require yearly rust control.

Table 12. Weed Management for Blueberry

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments

Table 12. Weed Management for Blueberry

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
Preplant/ site preparation	Glyphosate Roundup and other generic formulations	See label 1 to 2 qt. Depending on formulation and weeds being treated.	Apply 30 days prior to planting.	4	Use to kill strips in blueberry fields prior to planting. Generic formulations may require the addition of a surfactant. See label for details on controlling specific perennial weeds.
Preemergence Annual grasses and small seeded broadleaf weeds	Napropamide Devrinol 50 DF	8 lb	Newly planted (once soil has settled after transplanting) and established plantings.	12	Soil surface should be relatively free of weeds and plant residue. Rate depends on soil texture. If rainfall does not occur within 24 hours of application, Devrinol must be irrigated in (overhead sprinkler) with enough water to wet soil to a depth of 2 to 4 inches.
	Napropamide Devrinol 50 DF	8 lb	Newly planted (once soil has settled after transplanting) and established plantings.	12	Soil surface should be relatively free of weeds and plant residue. Rate depends on soil texture. If rainfall does not occur within 24 hours of application, Devrinol must be irrigated in (overhead sprinkler) with enough water to wet soil to a depth of 2 to 4 inches.
	Oryzalin Surflan 4 AS or FarmSaver Oryzalin	2 to 4 qt	Newly planted (once soil has settled after transplanting) and established plantings. Do not apply when fruit are present.	24	Existing vegetation should be tilled or destroyed by a contact herbicide prior to application. A single 1/2- to 1-inch rainfall or sprinkler irrigation is needed to move oryzalin into the zone of weed seed germination. Oryzalin may be tank mixed with paraquat or Rely for postemergence weed control. In established plantings, tank mix with simazine for broad spectrum residual weed control.
	Benefin + Oryzalin XL 2G	150 lb	Newly planted and non-bearing plantings.	24	Apply with a drop or rotary spreader once soil has settled after transplanting. Do not apply within 1 year of harvest. This product will not control emerged weeds.
Preemergence Annual broadleaf weeds	Mesotrione Callisto 4L	3 to 6 oz	Apply as prebloom post-directed spray in highbush blueberry.	12	Callisto may be applied at a rate up to 6 oz per acre. May be applied as a split application of 3 oz per acre followed by 3 oz per acre. If two applications are made, do not apply less than 14 days apart. Do not exceed 6 oz per acre per year. Do not apply after the onset of bloom. A crop oil concentrate of 1 oz (v/v) is recommended.

Table 12. Weed Management for Blueberry

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
Preemergence Annual broadleaf weeds and some annual grasses	**Flumioxazin** Chateau 51 WDG	6 to 12 oz	Newly planted and established. See comments.	12	Do not apply to blueberries established less than 2 years unless they are protected from spray contact by non-porous wrap, grow tubes, or waxed containers. Do not apply after budbreak through final harvest. Do not apply more than 12 oz per acre during a 12-month period. Do not make a sequential application within 30 days of the first application. Do not apply more than 6 oz per acre per application to bushes less than 3 years old on soils having a sand-plus-gravel content greater than 80%. Apply at the base of the bush. Residual weed control will be reduced if emerged vegetation prevents Chateau from reaching the soil surface.
Preemergence Broadleaf and grass weeds	**Isoxaben + Trifluralin** Snapshot 2.5G	150 to 200 lb	**Newly planted and non-bearing plantings**.	12	PersonNameAllow soil to settle after transplanting prior to application. Apply with a drop or rotary spreader. Do not apply within 1 year of harvest. This product has no postemergence activity.
Preemergence Broadleaf and grass weeds	**Isoxaben** Gallery	0.66 to 1.33 lb	**Newly planted and non-bearing plantings**. Do not apply until packing and irrigation or rainfall have settled the soil, and be sure no cracks are present.	12	Apply in a spray volume of at least 10 gallons per acre. Can tank mix with Surflan for broad spectrum residual control. Do not apply within 1 year of harvest.
Preemergence Annual weeds and some perennial weeds	**Dichlobenil** Casaron 4G Casaron CS 1.4L	100 to 150 lb 1.4 to 2.8 gal	4 G formulation may be applied to newly planted (4 wks after planting) and established plantings. CS 1.4L formulation may only be applied to plants one year after transplanting.	12	Apply in January and February for best results. Warm temperatures increase volatility. Overhead irrigation may be used for activation when applied in early spring.

Table 12. Weed Management for Blueberry

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
Preemergence Broadleaf weeds and some annual grasses.	**Simazine** Princep 4 L or Princep Cal 90 or various generic formulations	2 to 4 qt 2.2 to 4.4 lb	Newly planted (use half rate and apply once soil has settled after transplanting) and established plantings.	12	Tank mix with glyphosate, paraquat, or Rely for postemergence weed control. The addition of oryzalin or with simazine will extend residual grass control several weeks. Rate depends on soil texture. Do not use on loamy sand, sand, or gravelly soils. Do not apply when fruit are present. **Do not apply to blueberry planted less than 6 months in a bark production system.**
Postemergence Non-selective control	**Glufosinate** Rely 1L Rely 200 1.67L	3 to 5 qt 1.8 to 3 qt	Newly planted (shielded) and established blueberry.	12	Do not allow spray solution to contact desirable foliage or green, uncallused, bark. Shield young plants from spray. Use a minimum spray volume of 20 gallons per acre. **Do not apply within 14 days of harvest**. May be tank mixed with preemergence herbicides.
Postemergence Non-selective control	**Glyphosate** Roundup and other generic formulations	See label 1 to 2 qt. Depending on formulation and weeds being treated	Blueberry established 1 year or more.	4	Leaf, stem, or exposed root contact with spray can kill or injure crop. Rainfall or irrigation after application in bark bed production systems can result in glyphosate root uptake and crop injury. No effective residual activity. Do not allow drift or mist to contact foliage, green bark, green canes or other desirable vegetation. See label for restrictions on application equipment. **Do not apply within 14 days of harvest.** Generic formulations may require additional surfactant.
Postemergence Non-selective control	**Paraquat** Gramoxone Inteon 2 SL Firestorm 3SL	2.0 to 4 pt 1.3 to 2.7 pt	Newly planted (shielded) and established blueberry plantings.	12	Do not allow herbicide to contact desirable foliage, green stems, or uncallused bark. Young plants must be shielded. Use a non-ionic surfactant (see label). Apply as a coarse spray to avoid injury from drift of fine mist. Tank mix with preemergence herbicides for residual control. **Use of paraquat in blueberry can increased incidence of stem blight if herbicide contacts green stems.**

Table 12. Weed Management for Blueberry

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
Postemergence Broadleaf weeds less than 3" tall	**Carfentrazone-ethyl** Aim 2 EC	1 to 2 oz	Established plantings only; do not use on newly set plants.	12	Apply using application equipment designed to prevent spray deposition on green stems, leaf tissues, flowers or fruit. May be used alone or tank-mixed with other herbicides; see label for mixing instructions. Aim controls morning glory, pigweed, nightshade, velvetleaf, carpetweed, and spreading dayflower. Do not apply within 3 days of harvest. Apply in a minimum spray volume of 20 GPA. Apply in combination with crop oil concentrate at 1% v/v (1 gal/100 gal of spray solution) or a non-ionic surfactant at 0.25% v/v (1 qt/100 gal of spray solution).
Postemergence Annual and perennial grasses	**Clethodim** Select 2EC Intensity 2 EC	6 to 8 oz	Newly planted or non-bearing plantings.	12	Low rates are for annual grass weeds. High rates and sequential applications are for perennial grasses (bermudagrass or johnsongrass). The addition of a non-ionic surfactant at 0.25 % v/v (1 qt/100 gal. of spray solution) is required. Best results occur when applications are made to actively growing grasses. Do not apply within 1 year of harvest.
	Sethoxydim Poast 1.5 EC	1 to 2.5 pt	Newly planted and established plantings.	12	Sequential applications will be necessary for perennial grass control. The addition of a non-ionic surfactant (1 qt/100 gal of water) or crop oil concentrate (1 gal/100 gal. of water) is necessary for optimum results. Total use cannot exceed 5 pt per acre per year. Do not apply within 30 days of harvest.

Table 13. Weed Response to Herbicides used in Small Fruits

Annual Broadleaf Weeds	Preemergence Herbicides					Postemergence Herbicides					
	Casoron	Devrinol	Gallery	Oryzalin	Simazine	Clethodim	Fusilade	Glyphosate	Paraquat	Poast	Rely
	Annual Grasses										
Crabgrass	G	G	P	E	F	E	G	E	G	E	F
Foxtails	G	G	P	E	G	E	G	E	G	E	G

Table 13. Weed Response to Herbicides used in Small Fruits

Goosegrass	G	G	P	E	G	E	G	E	G	E	G
Panicum, Fall	G	G	P	G	F	E	G	E	G	E	G
Ryegrass, Annual	G	G	P	G	G	E	G	E	G	G	G

Table 14. Weed Response to Herbicides used in Small Fruits

Annual Broadleaf Weeds	Preemergence Herbicides					Postemergence Herbicides					
	Casoron	Devrinol	Gallery	Oryzalin	Simazine	Clethodim	Fusilade	Glyphosate	Paraquat	Poast	Rely
	Annual Broadleaf Weeds										
Chickweed	G	G	G	G	G	N	N	E	G	N	G
Dock	G		F	N		N	N	G		F	N
Galinsoga	F	P	G	N	G	N	N	G	G	N	F
Geranium, Carolina	G		G		F	N	N	G	F	N	F
Common groundsel	G	G	G	F	F	N	N	E	F	N	F
Henbit	G	P	G	F	G	N	N	F	F	N	F
Jimson weed	G	N	G	N	G	N	N	E	G	N	G
Lambsquarters	G	F	G	E	E	N	N	E	G	N	G
Annual morning glory	F	N	F	F	F	N	N	G	G	N	E
Nightshades	F	N	G	P	G	N	N	E	G	N	G
Pigweed	G	G	G	E	G	N	N	E	G	N	G
Wild radish	G	N	G	P	E	N	N	G	F	N	G
Ragweed	G	N	G	P	G	N	N	E	G	N	G
Prickly sida		P	G	P	F	N	N	G	G	N	F
Smartweed	G	P	G	P	G	N	N	F	G	N	G
Spotted spurge	G	N	G	F	P	N	N	G	G	N	G

Table 15. Weed Response to Herbicides used in Small Fruits

Annual Broadleaf Weeds	Preemergence Herbicides					Postemergence Herbicides					
	Casoron	Devrinol	Gallery	Oryzalin	Simazine	Clethodim	Fusilade	Glyphosate	Paraquat	Poast	Rely
	Perennial Weeds										
Bermudagrass	N	N	N	N	N	E	E	F	P	E	F
Dandelion	G	P	G	P	P	N	N	G	P	N	G
Nutsedge, Yellow	N	N	N	N	N	N	N	F	P	N	F
Smilax	N	N	N	N	N	N	N	G	P	N	F
Virginia Creeper	N	N	N	N	N	N	N	G	P	N	P

Table 16. Plant Growth Regulator Use in Florida Blueberry Production

Problem	Management Options	Amount of formulation per acre	Effectiveness or importance	REI	PHI	Comments
Certain southern highbush and rabbiteye cultivars exhibit slow or delayed leaf development as they emerge from dormancy. This can result in delayed fruit ripening and cause stress to plants that set a heavy crop but have poor or delayed leaf canopy development.	Dormex or Duomax (50% hydrogen cyanamide)	Typically 1.5% to 2 % Dormex or Duomax plus 1 pint per acre of non-ionic surfactant in 50 gallons of water.	++++ Certain cultivars	72 hours	NA	Dormex is highly toxic to humans and is a restricted-use material with very specific restrictions on its handling and application, including use of an enclosed tractor cab. Follow all label directions. Dormex will damage flower buds if applied incorrectly. Application is based on stage of flower bud development, thus the time of application will vary, but is typically applied in north-central Florida between mid-December and early January. Cultivars vary in their response and sensitivity to injury. Use as a small-scale test on cultivars with unknown response to Dormex. Do not apply within 14 days of oil application or within 30 days of copper fungicide applications

Table 16. Plant Growth Regulator Use in Florida Blueberry Production

Problem	Management Options	Amount of formulation per acre	Effectiveness or importance	REI	PHI	Comments
Dormex - additional Information: Dormex is highly corrosive to equipment and requires thorough cleaning after application. Avoid drift to non-target areas. Dormex may be toxic to green plant tissue. It is also toxic to pets, wildlife, and livestock. Thorough spray coverage is needed for a consistent, uniform, response. A minimum of 50 gallons per acre of spray mix is usually needed on mature southern highbush plantings. Dormex advances leaf and flower bud development and may increase susceptibility to freezes. Flower buds sprayed at stage 3 or beyond, (Figure1), may be killed or injured by Dormex, especially at concentrations of 1.5% or greater. When applied during stage 1 or 2 of flower bud development, 1.5 to 2.0% Dormex usually results in better response than lower concentrations. Dormex should only be applied to dormant plants that have received some natural chilling. Typically, Dormex is applied in mid to late December or early January in Florida. Refer to label for more information on timing of sprays. Cultivars which leaf well naturally may not benefit from Dormex applications. Certain cultivars have shown greater than average sensitivity to Dormex in Florida. These include 'Sharpblue', 'Windsor', and 'Primadonna'. Individual cultivars vary in their response to Dormex and should be tested prior to large-scale use. Response to Dormex has been more erratic in central and south-central Florida compared to north Florida. This may be due to less natural chilling accumulated at the more southern locations. Flower bud morphology may affect sensitivity to injury from Dormex. Cultivars that have loose bud scales (puffy appearance) such as 'Sharpblue' may be more sensitive to Dormex.						
Poor fruit set of rabbiteye blueberries	Gibberellic acid ProGibb 4% liquid conc. or GibGro 4LS or Gibbex 4%	24 to 32 oz/acre (4% gibberellic acid) or 24 to 32 grams gibberellic acid/acre applied twice. Total of 48 to 64 oz/acre in most cases	++++	12 hours	40 days	For use on rabbiteye blueberries. Do not apply to southern highbush varieties in Florida because it can cause overfruiting. Make first application when at least 40 to 50% of the blooms are open and about 10% of the flower petals have fallen. Use a minimum of 40 gal. of water /acre. If the spray solution is alkaline (pH 8 or greater) lower the pH with a buffering agent. Apply during slow drying conditions.

Table 16. Plant Growth Regulator Use in Florida Blueberry Production

Problem	Management Options	Amount of formulation per acre	Effectiveness or importance	REI	PHI	Comments
Additional Comments: 1. Gibberellic acid may increase fruit set of rabbiteye blueberry plants affected by poor pollination. It is not recommended for southern highbush in Florida because it can cause excessive fruit set, which results in plant stress and poor quality, late ripening, berries. Poor pollination can occur for a number of reasons including adverse weather conditions (rainy weather, high humidity, temperature extremes during flowering), lack of suitable pollinizer cultivars, low bee populations or activity, and insect damage to flowers (especially from flower thrips). Gibberellic acid is not widely used in Florida blueberry production because Florida's industry is based primarily on early-ripening southern highbush cultivars. Additional fruit set from gibberellic acid treatments tend to be smaller, have low seed counts, and ripen later than fruit set by natural pollination. In Florida this product is limited to use on large rabbiteye plantings that suffer from inadequate natural pollination. 2. Good results have been obtained by using two applications of 24 to 32 oz/acre (48-64 oz/acre/total) in 40 gallons of water, spraying both sides of the bush each time. Where two cultivars with different bloom dates are planted together, cultivar-directed treatments (CDT) have been successful. Using CDT, the first and second applications of gibberellic acid are directed toward the first cultivar to bloom. Some spray will reach the adjacent cultivar, helping early flowers to set. The third and fourth sprays are directed toward the later blooming cultivar, with some spray drift reaching the later opening flowers of the early blooming cultivar. The total amount of gibberellic acid applied during the season is normally between 48 to 64 oz. per acre. 3. Apply using a minimum of 40 gals. of water per acre. Gibberellic acid is concentration dependent. See label for rates and mixing instructions. 4. Suggested surfactants include X-77, Silwet L-77, Kinetic, and Flood. Follow label rates carefully. Silwet is used at the rate of only 3.2 oz/100 gal. of spray. Although other non-ionic surfactants may be suitable, caution should be used because they could burn blueberry flowers. 5. Better responses to gibberellic acid sprays are thought to occur under slow-drying conditions such as at night, late evening, or very early morning. 6. Gibberellic acid will not completely substitute for pollination. Fruit set with a combination of gibberellic acid and some seed tend to be larger than non-pollinated (nearly seedless) berries. Natural pollination is important to optimize yield and berry size, even when using gibberellic acid. 7. Individual flowers (florets) are more receptive to fruit set from gibberellic acid at developmental stage 5 (fully elongated, but not yet open), and stage 6, (open). However, fruit set with gibberellic acid and no pollination are seedless, small, and late ripening. Allow at least 40 to 50 % of the flowers to open and be worked by bees before making the first application. Apply a second application of gibberellic acid 10 to 18 days later.						