UF IFAS Extension UNIVERSITY of FLORIDA

HS1156

2019 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 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).

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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

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

1. This document is HS1156, one of a series of the Horticultural Sciences Department, UF/IFAS Extension. Original publication date March 2009. Revised March 2013, March 2016, and September 2018. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Jeffrey G. Williamson, professor, Horticultural Sciences Department; Philip F. Harmon, associate professor, Plant Pathology Department; Oscar E. Liburd, professor, Department of Entomology and Nematology; and Peter Dittmar, assistant professor, Horticultural Sciences Department; UF/IFAS Extension, Gainesville, FL 32611.

Pesticide spills or other emergencies: 1-800-424-9300 (24 hours) CHEMTREC.

Be prepared—visit www.chemtrec.com now for a listing of the information you will be asked to provide in the event of a chemical spill emergency.

Spills on public roads: In many cases, you can call CHEMTREC at 1-800-424-9300, call 911, or call the Florida Hazardous Material Planning Section, 1-800-320-0519 (cell: call *FDCA)

Environmental emergencies (contamination of waterways, fish kills, bird kills, etc.): 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 keep from accidentally using excess pesticides because of nozzle wear, speed increases, and other calibration problems. Failing to calibrate often costs money, may cause crop damage, and is unsafe. Below is a list of online resources that deal with calibration of pesticide applicators.

- *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://ufdc.ufl.edu/IR00004194/00001)

POLLINATOR PROTECTION (from the *2016 Southeastern Blueberry Integrated Management Guide*)

Before making insecticide applications, monitor insect populations to determine if treatment is needed. If insecticide application is necessary:

1. Use selective pesticides to reduce risk to pollinators and other non-target beneficial insects.

2. Read and follow all pesticide label directions and precautions. The label is the Law! The EPA now requires the addition of a "Protection of Pollinators" advisory box on certain pesticide labels. Look for the bee hazard icon in the Directions for Use and within crop-specific sections for instructions to protect bees and other insect pollinators.

3. Minimize infield exposure of bees to pesticides by avoiding applications when bees are actively foraging in the crops. Bee flower visitation rate is highest in early morning. Apply pesticides in the late afternoon or early evening to allow for maximum residue degradation before bees return to the field. Bee foraging activity is also dependent upon time of year (temperature) and stage of crop growth. The greatest risk of bee exposure is during bloom.

4. Minimize off-target movement of pesticide applications by following label directions. Do not make pesticide applications when the wind is blowing towards bee hives or off-site pollinator habitats.

Blueberry Integrated Management Guide (Insect and Disease Control)

Establishment

STEM BLIGHT

Only purchase and use rooted cuttings that are free of disease symptoms, and carefully manage irrigation during establishment to prevent drought stress. Drought stress will dramatically increase stem blight mortality in the first two years after planting. Stem blight can be severe on some cultivars if plants produce too many berries in the first year after planting. Regularly scout and remove plants from the field that die or have severe stem dieback and low plant vigor. Replant with healthy rooted cuttings and expect to lose up to 3% to 5% of plants to stem blight during establishment.

CROWN GALL

Carefully inspect plant material prior to transplanting into the field. Discard any plants with galls (swellings) near the soil line.

ROOT ROTS

Root rots are most problematic in low-lying, poorly drained sites. To avoid root rot, provide adequate drainage by constructing raised beds *before planting*. Site selection, proper bedding, and good irrigation design are essential cultural practices to prevent root rots. Even when these factors have been addressed, blueberry root rots can be particularly problematic immediately after transplanting and until plants are well established.Root rots have been observed

even in well-drained bark-amended beds and in container production in. 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, making reestablishment very difficult.

Durring and after establishment, it is recommended that phosphite-containing materials (Aliette®, ProPhyt®, Agri-Fos®, etc.) be used on nonbearing plants to help prevent Pythium and Phytophthora root rots (for bedded, container, and high-density bark plantings). These materials are applied to foliage; therefore, leaf tissue must be fully expanded for them to be taken up by plants. In the initial year of planting, a minimum of four applications (spaced approximately 30 days apart) is advisable. In general, phosphite materials are acidic and should not be applied with acidifiers or acidic water (pH < 6). Excessive application or application intervals shorter than those dictated by the label will injure plants. These phosphite materials also suppress major foliar diseases of young plants including Septoria leaf spot and anthracnose. Some phosphonate materials are labeled for use as drenches or chemigation, and ongoing research is evaluating their potential for preventing bacterial wilt when applied in this manner.

Ridomil Gold® EC also provides good control of Pythium and Phytophthora root rots durring and after establishment. However, Ridomil Gold® EC is applied directly to the bark bed in a broadcast, banded, or through-drip-irrigation-system injection and has to be taken up by the roots for activity. Carefully follow the label instructions. Where possible, rotating Ridomil Gold® EC and phosphites is a good resistance-management practice. Label recommendations should not be exceeded.

Post-Establishment

BLUEBERRY GALL MIDGE

The blueberry gall midge (BGM) is a tiny fly whose larvae feed on vegetative and floral buds. Typically, gall midge will attack young developing floral and leaf buds and this will cause floral buds to abort or fall off the bush resulting in poor flowering and 'fruit set'. With heavy gall midge injury to floral buds, there would be a lighter bloom. Instead of the usual 5 to 6, buds producing several flowers only 2 may reach maturity resulting in poor fruit clusters. When floral buds are not available, BMG will feed on leaf or vegetative buds, leaving young leaves deformed and misshaped. 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. Delegate®, Exirel® (Cyantraniliprole), diazinon (if labeled for use on your site) and Movento® (Spirotetramat) should be applied for gall midge control between flower bud stages 2 and 3. Application should take place when the most mature buds first show slight scale separation. Sprays may need to be repeated during warm spells. Bud scale separation may occur as early as December 15th in north Florida. Among rabbiteye cultivars, 'Premier' is often particularly attractive to the gall midge and is a good sentinel variety to monitor. Gall midge sprays can also suppress a prebloom thrips population.

FLOWER AND CHILLI THRIPS

These are small insects (i.e., 1⁄16 of an inch in length), yellowish to orange in color with 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 damage 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 to monitor thrips. White traps are preferred over blue and yellow ones because the thrips show up best against a light background. White traps are also advantageous because they 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, 'Tifblue' and 'Climax'. Insecticide applications should be considered when thrips numbers reach approximately 68 thrips per trap for 'Tifblue' and 75 thrips per trap for 'Climax' in a week during bloom. It is recommended that growers use Delegate® WG at 6 oz. per acre to manage flower thrips populations in Florida blueberries (rabbiteye and southern highbush). If Delegate® is allowed to dry for 3 hours it will not hurt pollinators. Another option is Sivanto® (Flupyradifurone). The minimum interval between applications for Sivanto® is 7 days.

Chilli thrips is becoming a more pronounced problem in blueberry. Adults feed on blueberries in late spring to early summer shortly after the bushes are pruned. Chilli thrips feed primarily on young leaves, causing leaf bronzing and shoot dieback. During heavy infestation, the edges around younger leaves and stems are eaten and leaf curling occurs. The chilli thrips are smaller than the flower thrips and are approximately 0.04 inches long with dark fringed wings

and dark spots across the back of the abdomen. Insecticides that can be used to manage chilli thrips include Delegate® (Spinetoram), Assail® (Acetamiprid) and Sivanto® (Flupyradifurone). Conventional products that can be used to manage chilli thrips include Malathion and Sevin® (Carbaryl).

BLUEBERRY BUD MITE

The blueberry bud mite is an eriophyid mite so tiny (i.e, 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, and rosetted buds, which may dry up and often fail to open. Bloom on infested plants is reduced. Affected berries are small and rough 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 (i.e., mowing off old fruiting twigs) immediately after harvest greatly reduces bud mite incidence the following year. Bushes that may be infested with blueberry bud mite should never be used for propagation. The application of horticultural oil immediately after harvest can help in the control of blueberry bud mite. Currently, there are no true mitiicides that are registered for use in blueberries. A few miticides are going through the IR-4 process and will be available for use in blueberries in a few years. Conventional insecticides such as Malathion have miticidal effects and can be used to help reduce bud mite infestation. Currently, there are no true mitiicides that are registered for use in blueberries. A few miticides are going through the IR-4 process and will be available for use in blueberries in a few years. Conventional insecticides such as Malathion have miticidal effects and can be used to help reduce bud mite infestation.

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 provides better fire ant control. Most ant baits are slow acting and require up to 8 weeks to control active mounds because they interfere with reproduction, causing a gradual colony die-off. 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).

In order for the bait to be effective, active ant foraging is essential. Worker ants must be attracted to baits so that they will carry the baits back to their colonies. Ideally, temperatures should be warm and sunny. Ant baits work best when the soil is moist but not wet. Avoid applying 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 3–4 feet from the mound. Baits should not be placed directly on top of mounds so that mounds remain undisturbed. The colony will move the queen to safety if mounds are disturbed.

BLUEBERRY DISEASES

Management strategies are listed in the following tables for diseases commonly affecting blueberries in Florida. New and emerging pathogens continue to be accumulated and added, but those listed below have not been problematic for Florida growers to date.

MUMMY BERRY

VMummy berry is currently not an important disease of southern highbush blueberry in Florida. However, the disease is a major issue in production areas north of Florida. Florida growers concerned about potential mummy berry problems are encouraged to contact your local UF/IFAS Extension office for diagnostic confirmation and additional information (http://sfyl.ifas.ufl.edu/find-your-local-office/).

EXOBASIDIUM FRUIT AND LEAF SPOT

The fungal pathogen Exobasidium causes green to white spots on leaves and fruits that sporadically impact yield and fruit quality in Georgia and other parts of the Southeast. The disease has not been a problem in Florida to date. Specific dormant applications have been shown in Georgia to help reduce exobasidium, but are not recommended for Florida production. Florida growers who suspect exobasidium should contact their local UF/IFAS Extension office for confirmation and management options (http://sfyl.ifas.ufl.edu/find-your-local-office/)

VIRAL BLUEBERRY DISEASES

Diseases caused by viruses that include *Blueberry shoestring virus*, *Blueberry scorch virus*, and *Blueberry shock virus* (among others) impact highbush blueberry production in northern states but are not known to occur in Florida production. *Blueberry red ringspot virus* and *Blueberry necrotic ring blotch virus* occur in Florida but do not significantly impact production. Florida growers who suspect viral blueberry diseases should contact their local UF/IFAS Extension office for confirmation and management options (http://sfyl.ifas.ufl.edu/find-your-local-office/)

Commonly Recognized Stages of Flower Bud Development for Southern Highbush Blueberry

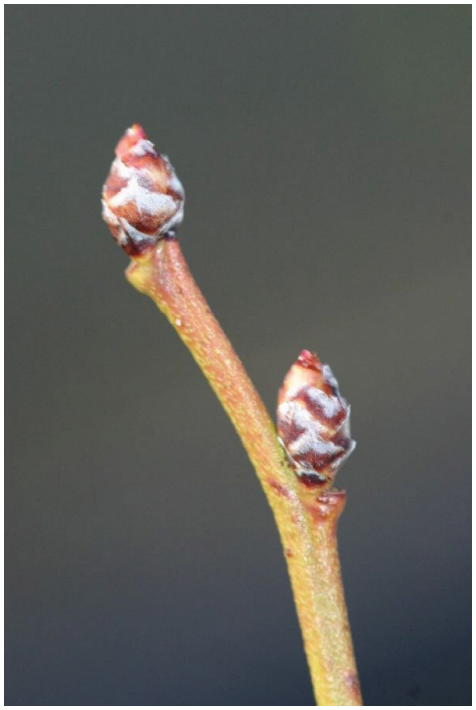

Figure 1. Flower bud stage 1
Credits: Jeff Williamson

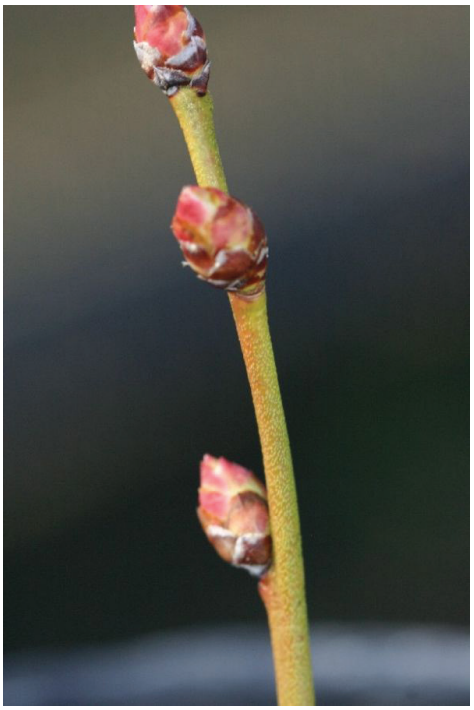

Figure 2. Flower bud stage 2
Credits: Jeff Williamson

Figure 3. Flower bud stage 3
Credits: Mark Longstroth (Michigan State University Extension)

Figure 4. Flower bud stage 4
Credits: Mark Longstroth (Michigan State University Extension)

Figure 5. Flower bud stage 5
Credits: Mark Longstroth (Michigan State University Extension)

Figure 6. Flower bud stage 6
Credits: Jeff Williamson

Figure 7. Flower bud stage 7
Credits: Jeff Williamson

Table 1. Management strategies for pest and disease problems of dormant blueberry plants.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
Phytophtora root rot	Mefenoxam (Ridomil Gold® SL)	3.6 pt.	++++	48 h	0 days	*Established plantings:* Apply 1/4 pt./1000 linear feet of row (3.6 pt. 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 pt. per acre (broadcast rate) at or after planting. An 18-inch band over the row is recommended. Do not apply more than 0.9 gal. 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) **Prebloom use only.**	2 gal./100 gal. of water/acre or 2 fl. oz./1 gal. of water	+++++	4 h	12 h (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 exceed 85°F or be lower than 40°F within 24 hours. Do not use within 14 days of lime-sulfur.
Imported fire ants	Malathion (Malathion 57 EC)	1 pt.	++	12 h	1 day	Malathion is a modestly effective foliar rescue treatment. May be applied to plants 1 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 postharvest imported fire ant controls to suppress these pests in blueberries.
	Diazinon (Diazinon AG500)	1 pt./100 gal.	++++		7 days	Mound drench. Slowly apply 1 gal. of diluted mixture on top of and 6 inches around each mound. Apply gently to avoid disturbing ants.
	Pyriproxyfen (Esteem® Ant Bait)	1.5–2.0 lb. (2–4 tbsp./mound)	++++	12 h	24 h	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.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (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 h	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.	++++		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.
	Spinetoram Delegate® WG	6 oz.	+++	4 h	3 days	Delegate® WG is the material of choice near bloom and should be applied as needed just before bloom for gall midge and/or thrips. Delegate® WG is toxic to bees until it is thoroughly dry (3 hours), but thereafter it is relatively nontoxic to bees. Delegate® WG should be applied in early morning or late evening during bloom.
	Malathion (Malathion 57 EC)	2 pt.	++++	12 h	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.
	Cyantraniliprole Exirel®	13.5–20.5 fl oz.	+++	12 h	3 days	Minimum application interval between treatments is 5 days.

Table 2. Management strategies for pest and disease problems in blueberry plants from prebloom through green tip (leaf buds) and pink bud (flower buds).

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
Flower thrips: Flower thrips can be very damaging to flower buds and blooms. Thrips numbers typically increase dramatically as corollas open and bloom progresses. Determining when or if blueberries should be treated for thrips is difficult. Blueberries are a pollination-sensitive crop, and careless use of insecticides and subsequent bee kill can easily impair pollination and ruin fruit set. Only selected insecticides (Delegate®) should be used during bloom. If Delegate® is used, the insecticide should be applied in the early morning or late evening and be given 3 hours of drying time before bees are allowed to forage on the crop. To measure treatment thresholds for southern highbush and rabbiteye blueberries: Begin sampling bloom clusters as soon as the flower begins to open. Sample four to five areas in a 1-acre block by placing a white sheet under a flower cluster and tapping lightly. Count the number of flowers and count the number of thrips dislodged from the flower cluster. If you average more than four thrips (southern highbush) or three thrips (rabbiteye) per flower, some type of management is recommended. Alternatively, two white sticky traps could be used to monitor a 5-acre block (one on the border and one in the center). If you have more than 80–100 thrips (southern highbush) or 60–70 thrips (rabbiteye), then some type of management tactic is needed. Assail® is the material of choice until 5 days prebloom and from 5 days prebloom until first bloom.						
Phomopsis cane and twig blight	Pyraclostrobin + boscalid (Pristine® WG)	18.5–23 oz.	+++	24 h	0 days	No more than two 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. Do not mix Pristine® with anything other than captan.
	Fenbuconazole (Indar® 75 WSP)	2.0 oz.	++++	12 h	30 days	Do not make more than four applications per acre per year. Apply at 8- to 14-day intervals. This product has been reported to make ripe rot more severe when used alone during bloom. Tank mix Indar® with Captan to help prevent this problem.
	Metconazole (Quash 50 WDG)	2.5 oz.	?	12 h	7 days	Apply on a 7- to 14-day interval. Alternate with a different fungicide group and do not make more than 3 applications or apply more than 7.5 oz per acre per year.
	Prothioconazole (Proline 480 SC)	5.7 fl oz	?	12 h	7 days	Make up to 2 applications per year on a 7–10 day schedule. A tank mix with Captan is recommended for resistance management and to provide Botrytis suppression.
	Fluazinam (Omega 500F)	1.25 pt.	?	12 h	30 days	Do not use more than 7.5 pints per acre per season. Do not tank mix with an adjuvant.
Gall midge	Spirotetramat Movento® 240 SC	5–6 fl/oz	++++	12 h	7 days	Do not apply more than 25 fl oz per acre per season.
	Spinetoram Delegate® WG	3–6 oz	+++	4 h	1 days	Do not apply more than 17.9 oz of Delegate 0r 0.28 lb ai spinetoram per acre per season
	Spinetoram Delegate® WG	3–6 oz	+++	4 h	3 days	Do not apply more than 19.5 oz of Delegate or 0.3 lb ai spinetoram per acre per season. Delegate® WG is toxic to bees until 3 h after application when it is thoroughly dry.
	Acetamiprid Assail® 30SG	4.5–5.3 oz	+++	12 h	1 day	Do not apply within 4 days of bloom.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
	Cyantraniliprole Exirel®	13.5–20.5 fl oz	+++	12 h	3 days	Do not apply within 4 days of bloom. Minimum application interval between treatments is 5 days.
	Spinosad (Entrust® 80%) Labeled for organic use	1.25–2 oz.	+++	4 h	3 days	Entrust® is toxic to bees until it is thoroughly dry (3 hours), but thereafter it is relatively nontoxic to bees. Entrust® should be applied in early morning or late evening during bloom.
	Malathion (Malathion 57 EC)	2 pt.	+++	12 h	1 day	Malathion has low toxicity to bees and beneficial insects.
	Diazinon Diazinon AG 500	1 pt.	+++	5 days	7 days	Do not apply within 4 days of bloom

Table 3. Management strategies for pest and disease problems in blueberry plants from 10%–20% bloom until 80%–90% bloom.

***Do not use insecticides during bloom*. Spraying with insecticides may kill or repel wild bees and honey bees that are needed for adequate pollination and fruit set.**						
Pest/problem	**Management options**	**Amount of formulation per acre**	**Effectiveness (Least = + to most = +++++)**	**Restricted entry interval (REI)**	**Postharvest Interval (PHI)**	**Comments**
	Spinetoram Delegate® WG	3–6 oz	+++	4 h	1 day	Do not apply more than 17.9 oz of Delegate 0r 0.28 lb ai spinetoram per acre per season
Flower thrips	Spinetoram Delegate® WG	6 oz.	+++	4 h	3 days	Do not apply more than 19.5 oz of Delegate or 0.3 lb ai spinetoram per acre per season. Delegate® WG is toxic to bees until 3 h after application when it is thoroughly dry.
	Flupyradifurone Sivanto®	2–4 fl oz/acre	+++	4 h	3 days	Sivanto® You should allow a minimum iof 7 days between applications.
	(Entrust® 80%)	1.25–2 oz.	+++	4 h	3 days	Entrust is toxic to bees until it is thoroughly dry (3 hours), but thereafter it is relatively nontoxic to bees. Entrust should be applied in early morning or late evening during bloom.
	Acetamiprid Assail® 30 SG	4.5–5.3 oz.	++++	12 h	1 day	Do not apply Assail® during bloom. It is an excellent prebloom spray. Application can be made 7 days prior to bloom. Assail® may negatively affect pollinating bees; therefore, application should be made in the late evening. Do not make more than four applications per season.
Botrytis flower blight	Cyprodinil + fludioxonil (Switch® 62.5WG)	11–14 oz.	+++++	12 h	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.
	Fenhexamid (Elevate® 50 WDG)	1.5 lb.	+++++	12 h	0 days	Begin application at 10% bloom. Applications should be made every 7 days when conditions favor disease. Resistance is known to occur; 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. of product per acre per year.
	Captan + fenhexamid (Captevate® 68 WDG)	3.5–4.7 lb.	+++++	72 h	0 days	Captevate® is a combination 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. per acre per season.

***Do not use insecticides during bloom*. Spraying with insecticides may kill or repel wild bees and honey bees that are needed for adequate pollination and fruit set.**						
Pest/problem	**Management options**	**Amount of formulation per acre**	**Effectiveness (Least = + to most = +++++)**	**Restricted entry interval (REI)**	**Postharvest Interval (PHI)**	**Comments**
	Pyraclostrobin + boscalid (Pristine® WG)	18.5–23 oz	+++++	24 h	0 days	Resistance is known to occur; no more than two 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. Do not mix Pristine® with anything other than captan.
	Fluopyram + Pyrimethanil (Luna Tranquility)	13.6–27 fl oz	?	12 h	0 days	Do not apply more than 54.7 fl oz per acre per year. Rotate to a different fungicide group after no more than 2 applications. Reapplication interval is 7 to 14 days. No efficacy data for this product are available for blueberry in Florida. Only Luna Tranquility is labeled by supplemental label for blueberry in Florida.
	Ziram (Ziram 76DF)	3 lb.	++	48 h	~30 days	Do not apply later than 3 weeks after full bloom.
	Captan (Captan 50WP)	5 lb.	++	72 h	0 days	Do not apply more than 70 lb. per acre per crop year.
	Captan (Captec 4L®)	2 qt.	++	72 h	0 days	Do not apply more than 35 qt. 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 as the first or second berry in a cluster ripens in order for sprays to control this pest.						
Ripe rot (anthracnose) and/ or Alternaria rots	Azoxystrobin (Abound®)	6.2–15.4 fl. oz.	+++++	4 h	0 days	Resistance to this fungicide in the ripe rot pathogen is common in central Florida. Use a captan product in a tank mix where resistance is known. 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., Switch®). Do not apply more than 1.44 qt. per acre per season.
	Cyprodinil + fludioxonil (Switch® 62.5WG)	11–14 oz	+++++	12 h	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 + boscalid (Pristine® WG)	18.5–23 oz.	+++++	24 h	0 days	No more than two 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. Do not mix Pristine® with anything other than captan.

***Do not use insecticides during bloom*. Spraying with insecticides may kill or repel wild bees and honey bees that are needed for adequate pollination and fruit set.**						
Pest/problem	**Management options**	**Amount of formulation per acre**	**Effectiveness (Least = + to most = +++++)**	**Restricted entry interval (REI)**	**Postharvest Interval (PHI)**	**Comments**
	Ziram (Ziram 76DF)	3 lb.	++	48 h	~30 days	Do not apply later than 3 weeks after full bloom.
	Captan (Captan 50 WP)	5 lb.	+++	72 h	0 days	Do not apply more than 70 lb. per acre per crop year.
	Captan (Captec 4L®)	2 qt.	+++	72 h	0 days	Do not apply more than 35 qt. per crop year.
	Fluazinam (Omega 500F)	1.25 pt.	?	12 h	30 days	Do not use more than 7.5 pints per acre per season. Do not tank mix with an adjuvant.
	Ziram (Ziram 76DF)	3 lb.	++	48 h	~30 days	Do not apply later than 3 weeks after full bloom.
	Metconazole (Quash®)	2.5 oz.	?	12 h	7 days	Do not make more than three applications per acre per crop year. Alternate with a fungicide with another mode of action.
	Prothioconazole (Proline 480 SC)	5.7 fl oz	?	12 h	7 days	Make up to 2 applications per year on a 7–10 day schedule. A tank mix with Captan is recommended for resistance management and to provide Botrytis suppression.
	Fluopyram + Pyrimethanil (Luna Tranquility)	13.6–27 fl oz	?	12 h	0 days	Do not apply more than 54.7 fl oz per acre per year. Rotate to a different fungicide group after no more than 2 applications. Reapplication interval is 7 to 14 days. Only Luna Tranquility is labeled by supplemental label for blueberry in Florida.

Table 4. Management strategies for pest and disease problems in blueberry plants from petal fall until 1 month after bloom.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
Blueberry gall midge (BMG): This is typically an early season pest of rabbiteye bushes; however, recently it has been seen late in the season attacking leaf buds and late blooming floral buds in southern highbush. BMG adults can be monitored using clear sticky sheet traps or using bucket emergence traps. These traps should be checked once per week, and, if more than 4 adults are caught in a trap, the use of insecticides is warranted. Larvae feed on young leaves resulting in leaf curl; when they feed on the floral buds the base turns brown leaving a bronzing effect. **Cranberry fruitworm, cherry fruitworm, and plum curculio**: Review field histories and scout fields for fruitworms and plum curculio to determine if and when spraying is needed. In Florida production areas, plum curculio has not been found to be a pest of southern highbush and rabbiteye blueberries. Fields with a history of infestation should be sprayed at least twice on a 7-to 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 and for 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 spot and target spot**: Septoria and anthracnose leaf spot as well as target spot 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 and target spots generally start postharvest and persist through summer.						
Ripe rot (anthracnose) and/ or Alternaria rots	Azoxystrobin (Abound®)	6.2–15.4 fl. oz.	+++++	4 h	0 days	Resistance to this fungicide in the ripe rot pathogen is common in central Florida. Use a captan product in a tank mix where resistance is known. 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., Switch®). Do not apply more than 1.44 qt. per acre per season.
	Cyprodinil + fludioxonil (Switch® 62.5WG)	11–14 oz	+++++	12 h	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 + boscalid (Pristine® WG)	18.5–23 oz.	+++++	24 h	0 days	No more than two 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. Do not mix Pristine® with anything other than captan.
	Captan (Captan 50 WP)	5 lb.	+++	72 h	0 days	Do not apply more than 70 lb. per acre per crop year.
	Captan (Captec 4L®)	2 qt.	+++	72 h	0 days	Do not apply more than 35 qt. per crop year.
	Fluazinam (Omega 500F)	1.25 pt.	?	12 h	30 days	Do not use more than 7.5 pints per acre per season. Do not tank mix with an adjuvant.
	Ziram (Ziram 76DF)	3 lb.	++	48 h	~30 days	Do not apply later than 3 weeks after full bloom.
	Metconazole (Quash®)	2.5 oz.	?	12 h	7 days	Do not make more than three applications per acre per crop year. Alternate with a fungicide with another mode of action.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
	Fluopyram + Pyrimethanil (Luna Tranquility)	16–27 fl oz	?	12 h	0 days	Do not apply more than 54.7 fl oz per acre per year. Rotate to a different fungicide group after no more than 2 applications. Reapplication interval is 7 to 14 days. Only Luna Tranquility is labeled by supplemental label for blueberry in Florida.
	Prothioconazole (Proline 480 SC)	5.7 fl oz	?	12 h	7 days	Make up to 2 applications per year on a 7–10 day schedule. A tank mix with Captan is recommended for resistance management and to provide Botrytis suppression.
Phytophthora root rot	Fosetyl-Al (Aliette® WDG)	5 lb.	+++	12 h	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 four 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 pt.	++++	4 h	0 h	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.
	Mono- and dipotassium salts of phosphorous acid (Agri-Fos®)	2.5 qt.	++++	4 h	0 h	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.
Gall midge	Spinetoram Delegate	3–6 oz	+++	4 h	3 days	Delegate® WG is toxic to bees until it is thoroughly dry. Do not make more than 6 applications per calendar year.
	Cyantraniliprole Exirel®	13.5–20.5 oz	+++	12 h	3 days	Minimum application interval between treatments is 5 days.
	Malathion (Malathion 57 EC)	1.5–2 pt.	+++	12 h	1 day	
	Acetamiprid Assail® 30 SG	4.5–5.3 oz.	+++	12 h	1 day	Do not apply when a lot of bees are foraging.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
Cranberry fruitworm	Malathion (Malathion 57 EC)	2.8–3.2 pt.	+++	12 h	1 day	Spray fruitworms when one bush in five has infested fruit clusters.
	Esfenvalerate (Asana® XL 0.66 EC)	4.8–9.6 fl. oz.	++++	12 h	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 h	14 days	Some users may be allergic to Adjourn®; discontinue use if skin or eyes become inflamed.
	Phosmet (Imidan® 70WP)	1.3 lb.	+++++	24 h	3 days	Imidan®, applied for blueberry maggot, provides excellent control of fruitworms.
	Phosmet (Imidan® 70W)	1.3 lb.	+++++ (for fruitworms) ++++++++ (for plum curculio)	24 h	3 days	Imidan® produces 7–10 days of residual control. Begin spraying after petal fall.
	Carbaryl (Sevin® 80WSP)	1.9–2.5 lb.	+++ (for fruitworms)	12 h	7 days	Sevin® gives only moderate control of fruitworms.
	Tebufenozide (Confirm® 2F)	16 fl. oz.	+++++ (for fruitworms)	4 h	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.
NOTE: No more than two sequential applications of Pristine® should be made before alternating with fungicides that have a different mode of action. Do not make more than four applications of Pristine® per acre per crop year. Mix Pristine® with only water for applications to blueberry.						

Table 5. Management strategies for pest and disease problems in preharvest blueberries.

Pest/Problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
Ripe rot (anthracnose) and/or Alternaria rots	Azoxystrobin (Abound®)	6.2–15.4 fl. oz.	+++++	4 h	0 days	Resistance to this fungicide in the ripe rot pathogen is common in central Florida. Use a captan product in a tank mix where resistance is known. 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., Switch®). Do not apply more than 1.44 qt. per acre per season.
	Cyprodinil + fludioxonil (Switch® 62.5WG)	11–14 oz	+++++	12 h	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 + boscalid (Pristine® WG)	18.5–23 oz.	+++++	24 h	0 days	No more than two 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. Do not mix Pristine® withanything other than captan.
	Captan (Captan 50 WP)	5 lb.	+++	72 h	0 days	Do not apply more than 70 lb. per acre per crop year.
	Captan (Captec 4L®)	2 qt.	+++	72 h	0 days	Do not apply more than 35 qt. per crop year.
	Metconazole (Quash®)	2.5 oz.	?	12 h	7 days	Do not make more than three applications per acre per crop year. Alternate with a fungicide with another mode of action.
	Prothioconazole (Proline 480 SC)	5.7 fl oz	?	12 h	7 days	Make up to 2 applications per year on a 7–10 day schedule. A tank mix with Captan is recommended for resistance management and to provide Botrytis suppression.
	Fluopyram + Pyrimethanil (Luna Tranquility)	16–27 fl oz	?	12 h	0 days	Do not apply more than 54.7 fl oz per acre per year. Rotate to a different fungicide group after no more than 2 applications. Reapplication interval is 7 to 14 days. No efficacy data for this product are available for blueberry in Florida. Only Luna Tranquility is labeled by supplemental label for blueberry in Florida.

NOTE: No more than two sequential applications of Pristine® should be made before alternating with fungicides that have a different mode of action. Do not make more than four applications of Pristine® per acre per crop year. Mix Pristine® with only water for applications to blueberry.

Table 6. Management strategies for pest and disease problems in harvest blueberries.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
Blueberry maggot fly (BBM): Blueberry maggot is only a problem for growers north of the Lake City and Live Oak areas. Growers in Gainesville and south of Gainesville should not experience any problems 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) within the bush canopy, at least one per cultivar. Trap catches indicate when adults are present. Traps should be hung in the planting when berries begin to turn from full green to the greenish-pink stage. See your county Extension agent for identification 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 growers in Florida who are shipping blueberries to Canada or the United Kingdom must comply with appropriate guidelines for scouting, spraying, and postharvest 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. **Spotted wing drosophila (SWD)** is a relatively new pest for Florida. SWD have been caught in all of the principal blueberry counties in Florida. Adults lay eggs in ripening blueberries, and larvae develop inside the berry, making the fruits soft and unmarketable. Adults can be monitored by placing traps in blueberry bushes. Traps can be made from plastic cups and baited with yeast sugar water. Traps should be placed within the canopy of the blueberry bush and not in direct sunlight. A number of insecticides have recently been registered for control of spotted wing drosophila. (See *Spotted Wing Drosophila Pest Management Recommendations for Southeastern Blueberries* http://edis.ifas.ufl.edu/in998) **Fruit rots**: Fungicides alone do not provide adequate control; proper harvesting and handling are essential. Pre- and postharvest rots can be greatly reduced by timely, complete harvest of all ripe fruit on the bush, followed by rapid postharvest 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. Postharvest 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.						
Blueberry maggot	Phosmet (Imidan® 70W)	1.3 lb.	++++	24 h	3 days	Imidan® is the material of choice for managing BBM. BBM sprays should protect berries from the start of oviposition until the last berries are harvested. Imidan® provides 10–14 days residual control. Do not apply more than twice per season.
	Carbaryl (Sevin® 80S)	1.9–2.5 lb.	+++	12 h	7 days	BBM sprays should protect berries from the start of oviposition until the last berries are harvested. Sevin® provides 5–7 days of residual effectiveness.
	Malathion (Malathion 57 EC)	1.5 pt.	+++	12 h	1 day	BBM sprays should protect berries from the start of oviposition until the last berries are harvested. Malathion provides 5–7 days of residual control.
	Diazinon (Diazinon AG500)	1 pt./100 gal.	++++	24 h	7 days	Allow 14 days between applications.
	Spinetoram Delegate® WG	3–6 oz.	+++	4 h	1 day	Do not apply more than 17.9 oz of Delegate 0r 0.28 lb ai spinetoram per acre per season
Spotted wing drosophila	Mustang Max™	4 oz.	++++	12 h	24 h	Use a minimum spray volume of 20 gal. by ground.
	Spinetoram Delegate® WG	6 oz.	+++	4 h	3 days	Delegate® WG is toxic to bees until it is thoroughly dry.
	Malathion Malathion 57 EC)	1.5 pt.	++++	12 h	1 day	
	Cyantraniliprole Exirel®	13.5-20.5 oz	++++	12 h	3 days	Minimum application interval between treatments is 5 days.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
	Fenpropathrin Danitol 2,4 EC	10.6-16 oz	++++	24 h	3 days	Do not make more than two consecutive applications. Rotate with insecticides from different classes.
	Brigade Bifenthrin	5.3 – 16 oz	++++	12 h	1 day	Do not make more than two consecutive applications.
	Phosmet Imidan	1.3 lb	++++	1 day	3 days	
	Spinosad Entrust	1.25–2 oz	+++	4 h	3 days	Label for organic use. Allow pesticide to dry before bees can forage.
	Acetamiprid Assail® 30 SG	4.5–5.3 oz	+++	12 h	1 day	Do not apply when a lot of bees are foraging.

Table 7. Management strategies for pest and disease problems in postharvest plant management.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
Blueberry bud mites: This is an occasional pest of blueberries in Florida. Use high-volume (300 gal. per acre), high-pressure (200 psi) applications of a postharvest insecticide/miticide and horticultural oils. In blocks infested with blueberry bud mite, make two postharvest applications using carbaryl. 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. Blueberry bud mite is a tiny eriophyid mite, best visible with a dissecting microscope. In early ripening cultivars, sanitation in the form of postharvest hedging and cutting back into one- and two-year-old wood should be the primary management response for mite-infested blocks. Postharvest application(s) of carbaryl may be helpful to augment this critical cultural practice. **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. When ant populations are high, use a dormant or early spring broadcast application in addition to the postharvest application to get better fire ant control. Ant baits are slow acting. They require up to 8 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 colony die-off. Extinguish® Professional Fire Ant Bait (0.5% methoprene) is labeled for use on all crop land sites. It is effective, but since it is an insect growth regulator, it is 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 applying 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 3–4 feet from the mound. Do not disturb mounds or place bait directly on top of mounds. **Chilli thrips**: Another species of thrips that infest southern highbush blueberries is the chilli thrips, *Scirtothrips dorsalis* Hood. Chilli thrips were first reported in Florida during summer 2008 in Hernando, Citrus, and Lake Counties. Chilli thrips are smaller than flower thrips, only about 1/4 the size of flower thrips. They have dark-fringed wings and dark spots across the back of the abdomen. They feed on young leaves and stems and are usually found in late spring and summer between the months of May to August. Several growers have reported high populations of Chilli thrips shortly after the bushes are pruned. Adults and larvae feed on young leaves and fruit, causing bronzing, leaf curl stunting, and fruit scarring. Adult chilli thrips have a pale yellow body with dark wings and are less than 1/16 of an inch in length. Females insert their eggs into blueberry tissues, and newly hatched larvae pass through two larval stages that feed on blueberry tissues and fruit. Chilli thrips can be monitored with white or yellow sticky cards placed within the canopy of the blueberry bush.						
Blueberry bud mite						
	Carbaryl Sevin 80S	1.875 – 2.5 lb.	++	12 h	7 days	Avoid using this product where bees are actively foraging.
	Horticultural oil (JMS Stylet-Oil®)	3–6 qt./100 gal.	++	4 h	0 days	Blueberry bud mite cannot 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 h	0 days	
Yellownecked caterpillars	Malathion (Malathion 57 EC)	1.5 pt.	+++	12 h	1 day	Foliage-feeding caterpillars become more difficult to control as they mature.
Azalea caterpillar	*Bacillus thuringiensis* [BT] (DiPel® DF)	0.5–1.0 lb.	++	4 h	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 h	14 days	Confirm® is very effective if applied to small, early stage caterpillars.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
	Esfenvalerate (Asana® 0.66 EC)	4.8–16 oz.	++++	12 h	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 h	14 days	Some users may be allergic to Adjourn®; discontinue use if skin or eyes become inflamed.
Imported fire ants	Diazinon (Diazinon AG500)	1 pt./100 gal.	++++	24 h	7 days	Mound drench. Slowly apply 1 gal. of diluted mixture over and 6 inches around each mound. Apply gently to avoid disturbing ants.
	Pyriproxyfen (Esteem® Ant Bait)	1.5–2.0 lb. (2–4 tbsp./ mound)	++++	12 h	24 h	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 h	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 h	7 days	Sevin® is also effective against small to medium-sized caterpillars.
	Diazinon (Diazinon AG500)	1 pt./100 gal.	++++	5 days	7 days	Diazinon is also effective against small to medium-sized caterpillars.
	Mustang Max™	4 oz.	++++	12h	24h	Use a minimum spray volume of 20 gal. by ground.
	Assail® 70WP	2.4 oz.	+++	12h	1 day	Do not make more than four applications per season.
White grubs (Grubs of Asiatic garden beetle, European and masked chafer, and Oriental beetle)	Admire® Pro	10 fl. oz.	+++	12 h	3 days	Soil application. Chemigation into root zone through low-pressure drip, trickle, or microsprinkler. It is important to moisten the soil (1/2–1 inch of water) prior to application or shortly after application.
Chilli thrips	Delegate® WG	6 oz.	+++	4 h	3 days	Delegate® WG may be applied as needed. Delegate® WG should be applied in the early morning. It is toxic to bees in the surrounding areas for the first 3 hours after application.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
	Assail® 70WP	2.4 oz.	+++	12 h	1 day	Do not make more than four applications per season. Toxic to bees until spray is dry (approximately 3 hours).
	Malathion (Malathion 57 EC)	2 pt.	+++	12 h	1 day	Malathion should be applied in the early morning or late evening to reduce the disruption of beneficial insects.
	Entrust® 80% (labeled for organic use)	1.25–2 oz.	+++	4 h	3 days	It is toxic to bees in the surrounding areas for the first 3 hours after application.

Table 8. Late-season and postharvest blueberry disease management.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (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 Captan mixed with Prophyt® may help reduce infection. Resistance to azoxystrobin has been confirmed for Anthracnose stem dieback in central Florida. Do not use Abound as a stand-alone application where resistance is known, but tank mix with Captan or Bravo. **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 Weather Stik® is labeled for control of both rust and Septoria leaf spots; this chlorothalonil product makes an excellent rotation partner for the strobilurin-containing product Pristine®. However, Bravo Weather Stik® can only be used after harvest because chlorothalonil will damage fruit.						
Algal stem blotch	Kocide 3000	1.75–3.5 lb.	++	48 h	0 days	Make applications after harvest on a monthly interval following bacterial canker use instructions. Ensure good cane coverage and canopy penetration. Do not mix with Aliette, any phosphite fungicide, or any acidifying agents. Do not exceed 28 lb. per acre per year. Copper products provide preventive management of algal stem blotch only.
	other copper products					Many formulations and products that contain copper are labeled for use on blueberry at various rates and application intervals. Carefully follow all label instructions for any product to avoid phytotoxicity. Algal stem blotch is not likely to specifically appear on the label, but these products can be used as long as the crop and site is on the label.
Septoria and anthracnose leaf spots and Phytophthora root rot	Fosetyl-Al (Aliette® WDG)	5 lb.	++++	12 h	12 h	Apply Aliette® as a foliar spray for Phytophthora and Pythium root rots and Septoria leaf spot. Subsequent applications can be made at 14- to 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 four 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.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
	Potassium phosphite (Prophyt®)	4 pt.	++++	4 h	0 days	Apply as a foliar spray for Phytophthora and Pythium. 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 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.
	Mono- and dipotassium salts of phosphorous acid (Agri-Fos®)	2.5 qt.	++++	4 h	0 days	Apply as a foliar spray for Phytophthora and Pythium. 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 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	Azoxystrobin (Abound®)	6.2–15.4 fl. oz.	++++	4 h	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 qt. per acre per season. Do not apply more than two sequential applications of Abound® before switching to a fungicide with another mode of action.
	Fluopyram + Pyrimethanil (Luna Tranquility)	16–27 fl oz	?	12 h	0 days	Do not apply more than 54.7 fl oz per acre per year. Rotate to a different fungicide group after no more than 2 applications. Reapplication interval is 7 to 14 days. No efficacy data for this product are available for blueberry in Florida. Only Luna Tranquility is labeled by supplemental label for blueberry in Florida.
Septoria leaf spot	Cyprodinil + fludioxonil (Switch® 62.5WG)	11–14 oz.	+++	12 h	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.
Septoria and rust leaf spots	Chlorothalonil (Bravo Weather Stik®)	3–4 pt.	++++	12 h (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.

Pest/problem	Management options	Amount of formulation per acre	Effectiveness (Least = + to most = +++++)	Restricted entry interval (REI)	Postharvest interval (PHI)	Comments
	Fenbuconazole (Indar® 75 WSP)	2.0 oz.	+++++	12 h	30 days	Do not make more than four applications or apply more than 8 oz. of Indar® 75 WSP (0.38 lb. active) per acre per year. Indar® 75 WSP belongs to the sterol demethylation inhibitor (DMI) class of fungicides. Alternation with fungicides of different classes is recommended.
	Propiconazole (Orbit® 3.6 E)	6.0 fl. oz.	+++++	24 h	30 days	Orbit®, another DMI fungicide, may be applied by 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 + boscalid (Pristine® WG)	18.5–23 oz.	+++++	24 h	0 days	No more than two 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.
	Prothioconazole (Proline 480 SC)	5.7 fl oz	?	12 h	7 days	Make up to 2 applications per year on a 7–10 day schedule. A tank mix with Captan is recommended for resistance management and to provide Botrytis suppression.
	Metconazole (Quash®)	2.5 oz.	?	12 h	7 days	Do not make more than three applications per acre per crop year. Alternate with a fungicide with another mode of action.

NOTE: No more than two sequential applications of Pristine® should be made before alternating with fungicides that have a different mode of action. Do not make more than four applications of Pristine® per acre per crop year. Mix Pristine® with only water for applications to blueberry.

Table 9. Efficacy of selected fungicides against blueberry diseases.

Fungicide [Mode of Action]	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®) [11]	NA	++	NA	+++++	++	+++++	++++	++++	???
Captan (Captan, Captec) [M4]	NA	+	++	++	++	+++	++	+++	NA
Chlorothalonil (Bravo®) [M5]	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®) [9+12]	NA	++	+++++	+++++	+++	+++++	+++	++++	???
Fenbuconazole (Indar®)* [3] * tank mix with captan products during bloom to prevent fruit rots	NA	+++++	NA	NA	NA	NA	++++	NA	+++
Fenhexamid (Elevate®) [17]	NA	++	+++++	NA	NA	NA	NA	NA	NA
Fenhexamid + captan (Captevate®) [17+M4]	NA	++	+++++	++	++	+++	++	???	NA
Fluazinam (Omega 500F) [29]	NA	NA	++	++	+++	+++	NA	NA	NA
Fluopyram + pyrimethanil (Luna Tranquility) [7+9]	NA	?	?	?	NA	NA	?	?	NA
Fosetyl-Al (Aliette® WDG) [33]	+++	NA	NA	NA	+	+	++++	+++	NA
Mefenoxam (Ridomil Gold®) [4]	+++	NA	NA	NA	NA	NA	NA	NA	NA
Metconazole (Quash) [3]	NA	+++++	???	???	++++	???	++++	++++	++++

Fungicide [Mode of Action]	Phytophthora root rot	Mummy berry	Botrytis (gray mold)	Alternaria rot	Phomopsis twig blight	Ripe rot (anthracnose)	Septoria leaf spot	Anthracnose leaf spot	Rust
Mono- and dipotassium salts of phosphorous acid (Agri-Fos®, K-Phite®) [33]	+++	NA	NA	NA	NA	NA	++++	++++	NA
Potassium phosphite (ProPhyt®) [33]	+++	NA	NA	NA	NA	NA	++++	++++	NA
Propiconazole (Orbit, Tilt, Bumper, PropiMax [3]	NA	+++++	NA	NA	NA	NA	++++	???	+++
Prothioconazole (Proline) [3]	NA	+++++	NA	NA	???	???	++++	???	+++
Pyraclostrobin + boscalid (Pristine®) [11 +7]	NA	++++	+++++	+++++	+++	+++++	+++++	+++++	+++++
Ziram (Ziram) [M3]	NA	+	++	+	+++	+++	???	++	**???**

NA = no significant activity, ??? = unknown activity, + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity, +++++ = excellent activity

NOTE: No more than two sequential applications of Pristine® should be made before alternating with fungicides that have a different mode of action. Do not make more than four applications of Pristine® per acre per crop year. Mix Pristine® with only water for applications to blueberry.

Table 10. Fungicide classes with moderate to high risk of resistance development (generally single sites of action).

Fungicide Class	Trade Name and Chemical Name
Anilino-pyrimidines [9]	Switch® (cyprodinil; one component of a two-part mixture), Luna Tranquility (pyrimethanil; one component)
Succinate dehydrogenase inhibitors (SDHI) [7]	Pristine® (boscalid; one component); Luna Tranquility (fluopyram; one component)
Demethylation inhibitors (DMIs) or sterol inhibitors [3]	Indar® (fenbuconazole), Orbit® (propiconazole), Proline (prothioconazole), Quash (metconazole)
2,6-dinitroanilines [29]	Omega (fluazinam)
Hydroxyanilides [17]	Elevate® (fenhexamid)
Phenylamides [4]	Ridomil Gold® (mefanoxam)
Phenylpyrroles [12]	Switch® (fludioxanil; one component)
Strobilurins or QoI (quinone outside inhibitors) [11]	Abound® (azoxystrobin)
NOTE: No more than two sequential applications of Pristine® should be made before alternating with fungicides that have a different mode of action. Do not make more than four applications of Pristine® per acre per crop year. Mix Pristine® with only water for applications to blueberry.	

Table 11. 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)
Phosphonates	Aliette® (Fosetyl-Al), Agri-Fos® (Mono- and dipotassium salts of phosphorous acid), K-Phite® (Mono- and dipotassium salts of phosphorous acid), ProPhyt® (Potassium phosphite)

Table 12. Seasonal "at a glance" fungicidal spray schedule options for blueberry.

Developmental stage	Green tip	Bloom (2–3 applications)[b]	Petal fall	10–14 days after petal fall	20–24 days after petal fall	Preharvest[e]	Postharvest foliage management
Disease controlled (Fungicides)	Twig blight (Pristine®[a] or Indar®)	Twig blight (Pristine®, Indar®[c] + Captan, or Orbit®, Quash, or Proline) Botrytis (Captevate, Elevate®, Pristine®, or Switch®	Alternaria and ripe rots (Abound®, Pristine®, Switch®, Captan, or Omega)[d]	Alternaria and ripe rots (Abound®, Pristine®, Switch®, Captan, or Omega)	Alternaria and ripe rots (Abound®, Pristine®, Switch®, Captan, or Omega)	Alternaria and ripe rots (Abound®, Pristine®, Switch®, Captan, or Omega) Septoria leaf spot (Abound®, Aliette®, Pristine®, Switch®, Quash, or Proline)[f]	Septoria leaf spot and rust (Abound®, Orbit®, Agri-Fos®, Aliette®, Bravo®, Pristine®, Prophyt®, Switch®, Proline, Quash, or Indar®)[g] anthracnose (Agri Fos®, Aliette®, Captan, Pristine®, or Prophyt®)

[a] *NOTE:* No more than two sequential applications of Pristine® should be made before alternating with fungicides that have a different mode of action. Do not make more than four applications of Pristine® per acre per crop year. Mix Pristine® with only water for applications to blueberry.

[b] Bloom times vary because of varietal differences and the environment. Bloom sprays should provide protection against the primary bloom pathogens for the entire bloom period. The number of applications required for bloom may vary from one to three, depending on the season and the variety.

[c] When using Indar® during bloom, always tank mix with Captan. Captan provides additional mummy berry control, and it has some activity against twig blight, Botrytis, and fruit rots. However, it mainly prevents rots when used with Indar®. It also provides resistance management.

[d] Many of the fungicides registered for rot control may also have activity against twig dieback organisms, such as *Phomopsis* spp.

[e] In wet years, preharvest and postharvest rots may be a potential problem. Under these conditions, one to two applications of a preharvest material may be necessary for rot control.

[f] Septoria leaf spot is generally controlled with two to four 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®, Agri-Fos®, etc.) are best used after harvest since they are not as efficacious against fruit rots, and they serve as a resistance management tool.

[g] Rust is problematic on some blueberry varieties, especially in Florida and south Georgia, and it can result in complete, premature defoliation on susceptible varieties. Scout for rust in mid to late July. Two to three applications of fungicides from August to mid-September will generally result in good rust management. Some varieties may require yearly rust control.

Table 13. Preemergence chemical weed control for blueberry.

Common name (lb. a.i./A)	Trade name (product/A)	MOA	Crop age	Comments
Dichlobenil 4–6 1.96–3.9	(Casoron®) 4 G 100–150 lb. (Casoron®) 1.4 CS 1.4–2.8 gal.	20	Bearing / nonbearing	Annual and some perennial weeds Casoron® 1.4 CS must be applied to well-established plantings and not until at least 1 year after transplanting. Casoron® 4 G can be applied 4 weeks after transplanting. Higher rates may be required to control perennial weed species.
Diuron 1.2–1.6	(Diuron, Karmex®, Karmex® XP) 80 WDG 1.5–2.0 lb. (Direx®) 4 L 1.2–1.6 qt.	7	Bearing / nonbearing	Annual broadleaf and grass weeds Bushes must be established at least 1 year from transplanting. Direct spray solution to the base of the bush to minimize contact with leaves, flowers, and fruits. Diuron may be applied as a single application in the spring (1.2–1.6 lb. a.i./acre) and another application (1.2–1.6 lb. a.i./acre) in the fall.
Flumioxazin 0.188–0.38	(Chateau®) 51 WDG 6–12 oz.	14	Bearing / nonbearing	Annual broadleaf and grass weeds Direct spray solution to the base of the bush. Do not apply to bushes less than 2 years old unless protected by a nonporous wrap, grow tubes, or waxed cylinders. Do not apply between bud break and final harvest. Do not apply more than 12 oz. in a 12-month period. Do not apply more than 6 oz. per application to bushes less than 3 years old in soils with sand plus gravel content greater than 80%. Do not allow Chateau® to come in contact with any green tissue, or injury may occur. Chateau® may be applied in sequential applications, but not within 30 days of each other.
Isoxaben 0.5–1.0	(Gallery®, Gallery® T&V) 75 DF 0.66–1.33 lb.	12	Nonbearing	Certain broadleaf weeds Allow 60 days between applications and do not apply more than 4 lb. of product within a 12-month period.
Isoxaben + Oryzalin 2.0–4.0 + 0.5–1	(Snapshot®) 2.5 TG 100–200 lb.	12 + 3	Nonbearing	Certain broadleaf and annual grass weeds. A single rainfall or sprinkler irrigation of 0.5 in. is necessary within 3 days of application for optimum +weed control. Allow 60 days between applications of 150 lb. product/acre or greater. Do not apply more than 600 lb./acre product within a 12-month period. Do not apply to bushes that have wet foliage from rainfall or dew.
Mesotrione 0.09–0.19	(Callisto®) 4 L 3–6 fl. oz.	27	Bearing / nonbearing	Annual broadleaf weeds Apply before prebloom, or illegal residues may occur. Can be applied as a split application of 3 oz. followed by 3 oz. with no less than 14 days between applications. Limit contact with green foliage and stems, or injury may result. Include a crop oil concentrate at 1% v/v. UF/IFAS has conducted limited testing; thus, any application should be made on a small acreage first to determine cultivar tolerance.
Napropamide 4	(Devrinol®) 50 DF 8 lb. (Devrinol®) 10 G 40 lb.	15	Bearing / nonbearing	Small-seed broadleaf and annual grass weeds Do not apply within 1 year of planting. Direct spray solution to the base of the bush to minimize contact with foliage and fruit. Applications should be made to a weed-free surface. Napropamide should be cultivated or irrigated to a depth of 2 in. within 24 hours of application.

Common name (lb. a.i./A)	Trade name (product/A)	MOA	Crop age	Comments
Norflurazon 2–4	(Solicam®) 80 WDG 2.5–5.0 lb.	12	Bearing / nonbearing	Small-seed broadleaf and annual grass weeds PHI 60 days Consult label for amount of formulation based on soil texture. Do not apply within 6 months of planting. Rainfall or irrigation is required within 4 weeks of application.
Oryzalin 2–4	(Oryzalin, Surflan®) 4 AS 2–4 qt.	3	Bearing / nonbearing	Certain broadleaf and annual grass weeds Irrigation or rain event of 0.5–1 in. is required within 1 week of application.
Pronamide 1–2	(Kerb®) 50 W 2–4 lb.	3	Bearing / nonbearing	Certain broadleaf and grass weeds Apply in the fall or early winter when temperature is less than 55°F for maximum efficacy. Do not apply to newly planted bushes; wait for root establishment. Immediately follow application with rainfall or irrigation for additional weed control. Do not apply more than 4 lb. product/acre or more than one application in 1 year.
Simazine 2–4	(Princep®) 90 WDG 2.2–4.4 lb. (Princep®) 4 L 2–4 qt.	5	Bearing / nonbearing	Annual broadleaf and grass weeds Do not apply more than 1 lb. a.i./acre on plantings less than 6 months old. Apply half the maximum in the spring before bud break and half in the fall.
Terbacil (5) 0.4–1.6	(Sinbar®) 80 WP 0.5–2 lb.	5	Bearing / nonbearing	Annual broadleaf and grass weeds Only apply to bushes that have been planted for 1 year or longer. Do not use in soils with less than 3% organic matter. Use in the spring or after harvest before weeds emerge or shortly after.

Table 14. Postemergence chemical weed control in blueberry.

Common name (lb. a.i./A)	Trade name (product/A)	MOA	Crop age	Comments
Carfentrazone 0.016–0.031	(Aim®) 2 EC 1–2 fl. oz. (Aim®) 1.9 EW 1–2 fl. oz.	14	Bearing / nonbearing	Broadleaf weeds Direct spray solution to the base of the bush to minimize contact with green stems, leaves, flowers, and fruits. Coverage is essential; use a minimum of 20 gal. of spray solution per acre. Include a nonionic surfactant, methylated seed oil, or crop oil concentrate; see label for rate. Do not apply more than 0.031 lb. a.i./A during the dormant stage, 0.064 lb. a.i./acre during the growing stage, and more than 0.096 lb. a.i./acre per crop season.
Clethodim 0.07–0.13	(Select Max®) 2 EC 9–16 fl. oz.	1	Bearing / nonbearing	Annual and perennial grass weeds The spray solution should include a nonionic surfactant at 0.25% v/v. Do not apply within 14 days of harvest.
Diuron 1.2–1.6	(Diuron, Karmex®, or Karmex® XP) 80 WDG 1.5–2 lb. (Direx®) 4 L 1.2–1.6 qt.	7	Bearing / nonbearing	Annual broadleaf and grass weeds Use at least 1 year from transplanting. Direct spray solution to the base of the bush to minimize contact with leaves, flowers, and fruits. Diuron may be applied as a single application in the spring (1.2–1.6 qt./acre) and another application (1.2–1.6 qt./acre) in the fall. Read labels for restrictions on soil type. Include surfactant at 0.25% v/v or crop oil concentration at 1.0% v/v to improve postemergence weed control.
Diquat 0.7–0.9	(Diquat) 2 L 1.5–2.0 pt.	22	Nonbearing	Broadleaf and grass weeds Direct spray to the base of the bush to minimize contact with green stems and foliage. Include a nonionic surfactant at 0.06%–0.5% v/v.
Fluazifop 0.25–0.375	(Fusilade® DX) 2 EC 16–24 fl. oz.	1	Nonbearing	Annual and perennial grass weeds Include nonionic surfactant at 0.25%–0.5% v/v or crop oil concentrate at 1% v/v.
Glufosinate 1.0–1.5	(Rely® 280) 2.34 SL 48–82 fl. oz.	10	Bearing / nonbearing	Broadleaf and grass weeds PHI 14 days Does not control goosegrass. Efficacy is reduced when temperatures are cool or when weeds are under drought stress. Direct spray solution to the base of the bush to minimize contact with leaf, flower, and fruit tissue. Do not apply to green or noncallused stems unless protected by nonporous wraps, grow tubes, or waxed containers. Do not apply more than 3 lb. a.i./acre.
Glyphosate 0.5–1.5	(Various formulations)	9	Bearing / nonbearing	Broadleaf and grass weeds PHI 14 days Direct spray solution to the base of the bush to minimize contact with green stems, leaves, and fruits.
Halosulfuron	(Sandea) 75DF 1 to 4 yr. bushes 0.5–0.6 oz. >4 yr. bushes 0.5 to 1 oz.	2	Bearing / nonbearing	Broadleaf and sedge weeds PHI 14 days Avoid contact with green tissues and leaves. Do not apply to bushes less than 1 year old. Minimum of 45 days between applications. Do not apply more than 2 oz./acre per 12 mo. period. Cultivar tolerance is variable. 'Emerald' and 'Jewel' are more tolerant. Some growers have reported 'Prima Donna', 'Scintilla', and 'Springhigh' are less tolerant.

Common name (lb. a.i./A)	Trade name (product/A)	MOA	Crop age	Comments
Mesotrione 0.09–0.19	(Callisto®) 4 L 3–6 fl. oz.	27	Bearing / nonbearing	Annual broadleaf weeds The University of Florida has conducted limited testing; thus, any application should be made on a small acreage first to determine cultivar tolerance. Apply before prebloom, or illegal residues may occur. Can be applied as a split application of 3 oz. followed by 3 oz. with no less than 14 days between applications. Include a crop oil concentrate at 1% v/v. Limit spray contact with green foliage and stems, or injury may result.
Paraquat 0.56–1	(Gramoxone Inteon®) 2 SL 2–4 pt. (Firestorm®) 3 SL 1.3–2.7 pt.	22	Bearing / nonbearing	Broadleaf and grass weeds Direct spray to the base of the stem. Use a coarse spray and hooded sprayer to minimize contact with foliage. New canes or shoots can be injured. Include a nonionic surfactant at 0.125%–0.25% v/v or crop oil concentrate at 1% v/v.
Pelargonic Acid	(Scythe®) 3%–10% v/v	27	Bearing / nonbearing	Broadleaf and grass weeds Contact herbicide that should be applied with a shielded sprayer and direct spray to the base of the bush to minimize contact with green tissue.
Rimsulfuron 0.063	(Matrix®) SG 4 oz.	2	Bearing / nonbearing	Broadleaf weeds and nutsedge PHI 21 days Apply after the bushes have gone through one growing season. Application after bud break may cause temporary chlorosis and/or stunting of leaves. Do not apply more than 4 oz./acre per year. New label and should be trialed on a small area before applying to the entire field.
Sethoxydim 0.3–0.5	(Poast®) 1.5 EC 1.5–2.5 pt.	1	Bearing / nonbearing	Annual and perennial grass weeds PHI 30 days Consult label for exact rate to control specific grass species. Multiple applications may be necessary to control perennial grasses, such as bermudagrass. Include a crop oil concentrate at 1 qt./acre.

Table 15. Weed response to herbicides used in small fruits.

	Chick-weed	Galin-soga	Gera-nium, Caro-lina	Common ground-sel	Hen-bit	Lambs-quarter	Morning-glory, annual	Night-shades	Pig-weed	Radish, wild	Rag-weed	Prickly sida	Smart-weed	Spotted spurge	Dande-lion	Smi-lax	Virginia creeper
	Annual														Perennial		
Preemergence																	
Dichlobenil (Casoron®)	G	F	G	G	G	G	F	F	G	G	G	-	G	G	G	N	N
Diuron (Karmex®)	G	-	-	-	F	G	G	-	E	F	E	F	F	-	N	N	N
Flumioxazin (Chateau®)	G	G	G	-	E	E	E	E	E	G	E	G	G	E	G	N	N
Hexazinone (Velpar®)	G	-	-	E	F	E	-	-	G	G	E	-	G	-	E	-	-
Isoxaben (Gallery®)	G	G	G	G	G	G	F	G	G	G	G	G	G	G	G	N	N
Mesotrione (Callisto®)	-	-	-	-	-	G	F	G	G	-	F	N	G	-	N	N	N
Napropamide (Devrinol®)	G	F	G	G	G	G	P	P	G	G	G	-	G	G	P	N	N
Norflurazon (Solicam®)	E	G	-	F	G	F	F	G	P	G	G	E	G	F	G	N	N
Oryzalin (Surflan®)	G	N	-	F	F	E	F	P	E	P	P	P	P	F	P	N	N
Pronamide (Kerb®)	G	P	-	-	G	E	G	G	G	F	-	-	F	-	P	N	N
Simazine (Princep®)	G	G	F	F	G	E	F	G	G	E	G	F	G	P	P	N	N
Terbacil (Sinbar®)	E	-	G	F	E	E	-	G	-	E	G	-	G	-	F	N	N
Postemergence																	
Carfentrazone (Aim®)	E	-	-	G	E	E	E	E	E	-	G	-	-	-	N	N	N
Clethodim (Select®)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fluazifop (Fusilade®)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

	Chick-weed	Galin-soga	Gera-nium, Caro-lina	Common ground-sel	Hen-bit	Lambs-quarter	Morning-glory, annual	Night-shades	Pig-weed	Radish, wild	Rag-weed	Prickly sida	Smart-weed	Spotted spurge	Dande-lion	Smi-lax	Virginia creeper
Glufosinate (Rely®)	G	F	F	F	F	G	E	G	G	G	G	F	G	G	G	P	P
Glyphosate (Roundup)	E	G	G	E	F	E	G	E	E	G	E	G	F	G	F	G	G
Paraquat (Gramoxone®)	G	G	F	F	F	G	G	G	G	F	G	G	G	G	P	P	P
Sethoxydim (Poast®)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
E = Excellent, G = Good, F = Fair, P = Poor, N = No activity																	

Table 16. Efficacy of preemergence and postemergence herbicides for annual and perennial grass and sedge weed control.

	Annual grass					Perennial grass	Sedge	
	Crabgrass	**Foxtail**	**Goosegrass**	**Panicum, fall**	**Ryegrass, annual**	**Bermudagrass**	**Nutsedge, purple**	**Nutsedge, yellow**
Preemergence								
Dichlobenil, (Casoron®)	G	G	G	G	G	N	N	N
Diuron, (Karmex®)	G	G	G	G	F	N	N	N
Flumioxazin, (Chateau®)	G	G	G	G	G	N	N	N
Hexazinone, (Velpar®)	E	E	G	G	E	N	N	N
Isoxaben, (Gallery®)	P	P	P	P	P	N	N	N
Mesotrione, (Callisto®)	F	P	P	P	P	N	N	N
Napropamide, (Devrinol®)	G	G	G	G	G	N	N	N
Norflurazon, (Solicam®)	E	E	E	E	E	P	P	P
Oryzalin, (Surflan®)	E	E	E	G	G	N	N	N
Pronamide, (Kerb®)	G	G	G	G	G	P	P	P
Simazine, (Princep®)	F	G	G	F	G	N	N	N
Terbacil, (Sinbar®)	E	G	-	G	E	-	F	F
Postemergence								
Carfentrazone, (Aim®)	P	P	P	P	P	N	N	N
Clethodim, (Select®)	E	E	E	E	E	E	N	N
Fluazifop, (Fusilade®)	G	G	G	G	G	E	N	N
Glufosinate, (Rely®)	F	G	G	G	G	F	F	F
Glyphosate, (Roundup)	E	E	E	E	E	F	F	F
Paraquat, (Gramoxone®)	G	G	G	G	G	P	P	P
Sethoxydim, (Poast®)	E	E	E	E	E	E	N	N

E = Excellent, G = Good, F = Fair, P = Poor, N = No activity

Table 17. Plant growth regulator use in Florida blueberry production.

Problem	Management options	Amount of formulation per acre	Effectiveness or importance	Restricted entry interval (REI)	Postharvest interval (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™, Budpro®, or Krop-Max™ (50% hydrogen cyanamide)	Typically 1.5% (v/v) [a] Dormex™, Krop-Max™, or Budpro® plus a nonionic surfactant not to exceed 0.5% (v/v).	++++ Certain cultivars	72 hours	NA	Hydrogen cyanamide 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. Hydrogen cyanamide will damage flower buds if applied incorrectly. Applications should be made 30 or more days prior to natural flower and vegetative bud break. Application is based on stage of flower bud development,; thus, the time of application will vary, but it 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 hydrogen cyanamide. Do not apply within 14 days of oil application or within 30 days of copper fungicide applications.
[a]Product label rates vary. Refer to individual labels. **Hydrogen cyanamide—additional information:** Hydrogen cyanamide is highly corrosive to equipment and requires thorough cleaning after application. Avoid drift to nontarget areas. Hydrogen cyanamide 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 gal. per acre of spray mix is usually needed on mature southern highbush plantings. Hydrogen cyanamide advances leaf and flower bud development and may increase susceptibility to freezes. Flower buds sprayed at stage 3 or beyond (Figure 3) may be killed or injured by hydrogen cyanamide, especially at concentrations of 1.5% (v/v) or greater of formulated product. Applications of 1.5% (v/v) of formulated product to dormant plants of suitable cultivars that have received significant chilling and not progressed beyond stage 2 of flower bud development are usually effective. Rates of formulated product of 2.5% (v/v) or greater have resulted in significant flower bud injury in Florida. However, lower rates may also result in flower bud injury depending on cultivar, plant dormancy level, and stage of bud development. Hydrogen cyanamide should only be applied to dormant plants that have received some natural chilling. Typically, hydrogen cyanamide is applied in mid to late December or early January in Florida depending on weather and the natural progression of chilling. Refer to labels for more information on rate and timing of sprays. Cultivars that naturally leaf well may not benefit from hydrogen cyanamide applications. Certain cultivars have shown greater than average sensitivity to hydrogen cyanamide in Florida. These include 'Sharpblue', 'Windsor', 'Primadonna', and 'Jewel'. Individual cultivars vary in their response to hydrogen cyanamide and should be tested prior to large-scale use. Response to hydrogen cyanamide has been more erratic, and in some cases more flower bud injury has been observed in central and south central Florida compared to north Florida, especially following mild winters. This may be because plants are not fully dormant at time of application and less natural chilling occurred in the more southern locations prior to application. Flower bud morphology may affect sensitivity to injury from hydrogen cyanamide. Cultivars that have loose bud scales (puffy appearance), such as 'Sharpblue', may be more sensitive to hydrogen cyanamide.						
Poor fruit set of rabbiteye blueberries	Gibberellic acid (ProGibb 4% liquid conc.), GibGro® 4LS, or Gibbex 4%	24–32 oz. (4% gibberellic acid) or 24–32 g gibberellic acid applied twice. Total of 48–64 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%–50% of the blooms are open and about 10% of the flower petals have fallen. The second application should be about 10–18 days later. Use a minimum of 40 gal. of water per acre. If the spray solution is alkaline (pH 8 or greater), lower the pH with a buffering agent. Apply during slow drying conditions.

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, or 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 24–32 oz. per acre (48–64 oz./acre total) in 40 gal. 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 and 64 oz. per acre.
3. Apply using a minimum of 40 gal. 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®, or Flood. Follow label rates carefully. Silwet® is used at a rate of only 3.2 oz./100 gal. of spray. Although other nonionic 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 tends to be larger than nonpollinated (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 is seedless, small, and late ripening. Allow at least 40%–50% of the flowers to open and be worked by bees before making the first application. Apply a second application of gibberellic acid 10–18 days later.
8. Do not apply within 40 days of harvest.
9. If possible, do not apply if rain is forecasted within 12 hours.
10. Do not apply to bushes in a low state of vigor.