2019 Southeast Regional Strawberry Integrated Pest Management Guide For Plasticulture Production

Commodity Editor
Rebecca A. Melanson (Mississippi State University)

Section Editors
Pathology: Frank J. Louws (North Carolina State University), Charles (Chuck) Johnson (Virginia Tech) Guido Schnabel (Clemson University), and Rebecca A. Melanson (Mississippi State University)

Entomology: Rebecca Schmidt-Jeffris (Clemson University), Hannah J. Burrack (North Carolina State University), Doug Pfeiffer (Virginia Tech), and Ash Sial (University of Georgia)

Weed Science: Katie Jennings (North Carolina State University)

Senior Editor
Phil Brannen (University of Georgia)

Recommendations are based on information from the manufacturer's label and performance data from research and Extension field tests.

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

This publication is intended for use only as a guide. Specific rates and 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.

Photo: Frank Louws

Southeastern Region University Small Fruits IPM Contacts

Auburn University Ed Sikora (*Pathology*) Alina Coneva (*Horticulture*) **University of Arkansas** Jackie Lee (*IPM*) Amanda McWhirt (*Horticulture*) **Clemson University** Guido Schnabel (*Pathology*) Wayne Mitchem (*Weed Science*) **University of Florida** Phil Harmon (*Pathology*) Natalia Perez (*Pathology*) Oscar Liburd (*Entomology*) Jeff Williamson (*Horticulture*)	**University of Georgia** Phil Brannen (*Pathology*) Jonathan Oliver (*Pathology*) Elizabeth Little (*Organic Pathology*) Brett Blaauw (*Entomology*) Ash Sial (*Entomology*) Wayne Mitchem (*Weed Science*) Mark Czarnota (*Weed Science*) Erick Smith (*Blueberries, Horticulture*) Cain Hickey (*Grapes, Horticulture*)	**University of Kentucky** Nicole Gauthier (*Pathology*) Ric Bessin (*Entomology*) Daniel Becker (*Horticulture*) John Strang (*Horticulture*) Patsy Wilson (*Grapes, Horticulture*) Shawn Wright (*Weeds, Horticulture*) **Louisiana State University** Raghuwinder Singh (*Pathology*) Mary Helen Ferguson (*Pathology*) Dennis Ring (*Entomology*) Ron Strahan (*Weed Science*) Kathryn Fontenot (*Horticulture*)	**Mississippi State University** Rebecca A. Melanson (*Pathology*) Blake Layton (*Entomology*) Eric Stafne (*Horticulture*) **North Carolina State University** Bill Cline (*Pathology*) Sara Villani (*Pathology*) Hannah Burrack (*Entomology*) Wayne Mitchem (*Weed Science*) Katie Jennings (*Weed Science*) Ryan Adams (*IPM*) Mark Hoffmann (*Horticulture*)	**University of Tennessee** Zach Hansen (*Pathology*) Frank Hale (*Entomology*) David Lockwood (*Horticulture*) **Virginia Tech** Mizuho Nita (*Pathology*) Chuck Johnson (*Pathology*) Doug Pfeiffer (*Entomology*) Jeff Derr (*Weed Science*) Jayesh Samtani (*Horticulture*)

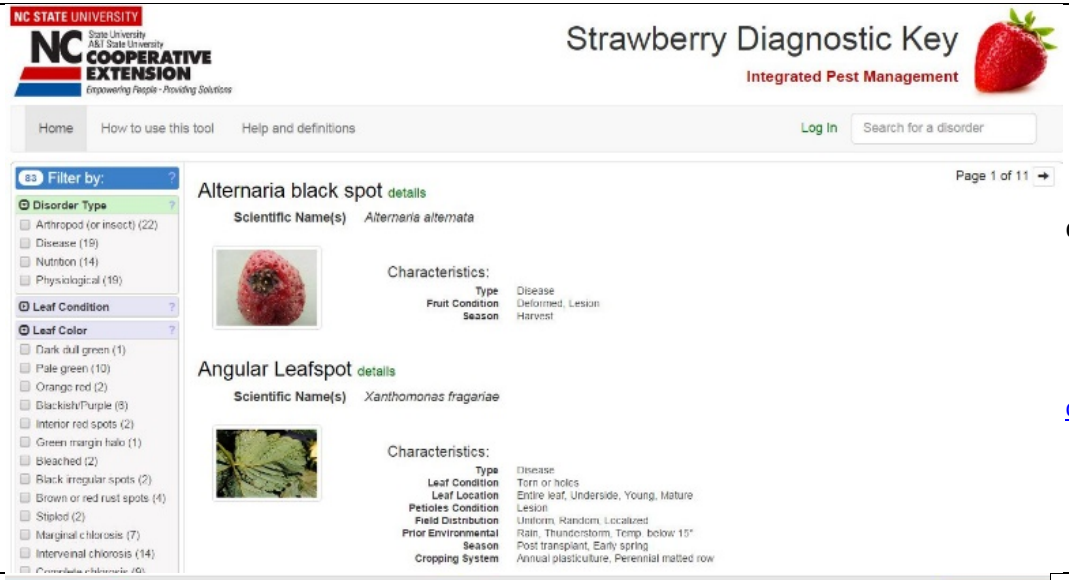
Table of Contents

MyIPM App and Online Tools

MyIPM

A smart phone app that contains useful strawberry disease information in support of this IPM guide

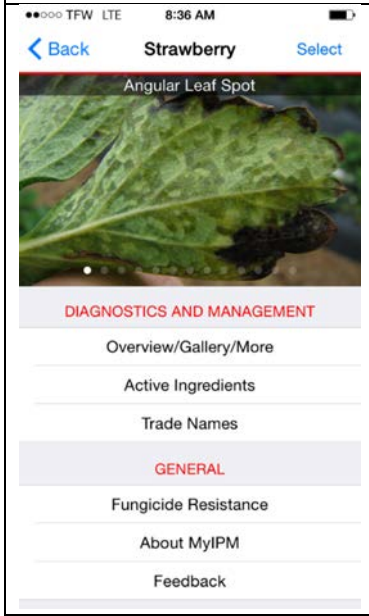
Download for FREE in Apple's App Store or Google's Play Store

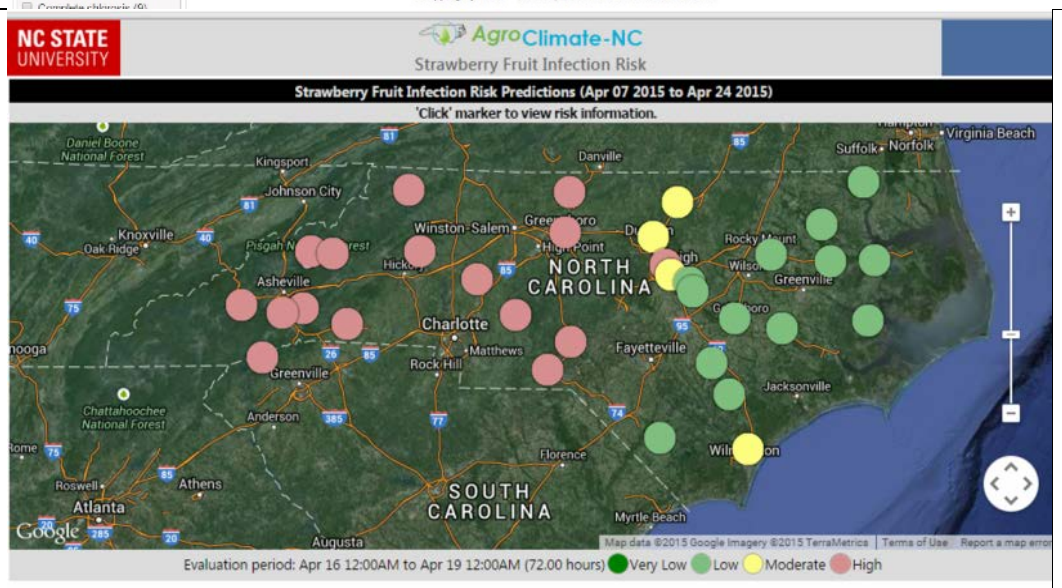


Strawberry Diagnostic Key

Includes information on insects, diseases, nutritional deficiencies and physiological disorders

Available at
diagnosis.ces.ncsu.edu/strawberry/





Strawberry Fruit Infection Risk

A weather-based decision support system to optimize spray timing for Botrytis and anthracnose fruit rots in North Carolina

Visit the Strawberry Advisory System at
https://ipm.ces.ncsu.edu/strawberry-fruit-infection-risk-tool/

General Pesticide Information

FRAC/IRAC/HRAC Codes — These acronyms refer to industry-sponsored committees addressing resistance to crop protection materials: Fungicide Resistance Action Committee (FRAC), Insecticide Resistance Action Committee (IRAC), and Herbicide Resistance Action Committee (HRAC). Pesticides affect their target pest in a variety of ways, and the way a pesticide kills the target organism is called the ***mode of action*** **(MOA).** Although pesticides have different names and may have different active ingredients, they may have the same MOA. Over time, pests can become resistant to a pesticide, and typically this resistance applies to all pesticides with the same MOA. When rotating pesticides, it is important to select pesticides with different MOAs. The FRAC/IRAC/HRAC have organized crop protection materials into groups with shared MOAs and given them specific codes, which appear on pesticide labels. The code **U** means the MOA is unknown. *When selecting pesticides, avoid successive applications of materials in the same MOA group to minimize potential resistance development*. MOA categories are listed in this guide to aid in the development of resistance management programs. More information about this topic can be found at **www.frac.info**, **www.irac-online.org**, and **www.hracglobal.com**.

Organic Materials Review Institute (OMRI; www.omri.org) listed materials are acceptable for production systems certified as organic. Organically acceptable materials (**OMRI-**listed) are in the Comments section.

Generics: Many pesticide active ingredients are available in generic formulations. For brevity, these formulations are not generally listed. Listed trade names are included to aid in identifying products and are not intended to promote the use of these products or to discourage the use of generic products. Generic products generally work similarly to their brand name counterparts, but formulation changes can impact efficacy and plant response. As with any new chemical, read and follow all label instructions. Chemical names are subject to change; please check the active ingredient for all materials.

The **Pesticide Environmental Stewardship** website is located at http://pesticidestewardship.org/Pages/default.aspx. Information on proper pesticide use and handling, calibration of equipment, reading pesticide labels, disposal, handling spills, and other topics are presented.

Resistance Management: Insects, weeds, and disease-causing organisms are all capable of developing resistance to pesticides. To minimize the likelihood of resistance development against your material of choice:

1. Only use pesticides when necessary: When the damage caused by the pest you are controlling is greater than the cost of the pesticide and no other, effective options are available.
2. Use the appropriate material for the pest.
3. Use the recommended rate of the material. Do not use a lower rate than listed on the label.
4. If more than one treatment is needed when the same pest is present, rotate the pesticide MOA between treatments.

Pollinator Protection

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! 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 the next morning. 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 to minimize off target movement of pesticides. Do not make pesticide applications when the wind is blowing towards bee hives or off-site pollinator habitats

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CAUTION: Specific rates, application methods, and sometimes target pests vary on product labels containtaing the same active ingredient and are subject to change at any time. Always refer to and read the pesticide label before making any application!!

Efficacy Ratings: ***The efficacy or importance of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, NC = no control, and ND = no data. These ratings are benchmarks; actual performance will vary. A superscript 'R' (^{R}) next to the efficacy rating indicates that the product may not be effective if the pathogen is resistant to the fungicide.***

Seasonal "At-a-Glance" Arthropod Guide[1]

Developmental Stage	Post-planting (Fall/early to mid-winter)	Pre-harvest — Bloom (Late winter to early spring)[3]	Harvest
Pests potentially present (Insecticides/ Miticides)	Crickets (carbaryl, malathion) Cutworms (carbaryl, Coragen, Entrust, malathion, *Bt*, Intrepid) Cyclamen mites (Portal, imidacloprid) Twospotted spider mites:[2] 1. All stages: Acramite/Vigilant, Kanemite, Nealta; 2. Eggs & juveniles: Oberon, Savey, Zeal; 3. Juveniles & adults: Portal, Agri-Mek, Vendex; 4. OMRI, adults: M-Pede, horticultural oils; 5. Other: predatory mites	Aphids[3] (malathion, Sivanto, imidacloprid, Platinum, insecticidal soap) Fire ants[4] (Extinguish or Esteem Ant Baits) Flower thrips[3] (Entrust, Radiant) Slugs/snails (baits containing carbaryl, metaldehyde, and/or iron phosphate) Strawberry clippers (Brigade, Danitol, carbaryl) Twospotted spider mites:[6] 1. Acramite/Vigilant, Kanemite, Nealta 2. Oberon, Savey, Zeal; 3. Portal, Agri-Mek, Vendex; 4. M-Pede, horticultural oils; 5. Predatory mites	Fire ants[4] (Extinguish, Esteem) Sap beetles[7] (cultural control, Rimon) Slugs/snails (baits containing carbaryl, metaldehyde, or iron phosphate) Spotted wing drosophila (Brigade, Danitol, Entrust, Malathion and generics, Radiant) Tarnished plant bugs[5] (Brigade, Danitol, Rimon) Twospotted spider mites:[6] 1. Acramite/Vigilant, Kanemite, Nealta 2. Oberon, Savey, Zeal; 3. Portal, Agri-Mek, Vendex; 4. M-Pede, horticultural oils; 5. Predatory mites

[1] Management of strawberry arthropod pests is based on pest presence in the field. There is no preventive spray program, and listed materials only work if target pests are present! **Treat only if damaging populations are present.** Thorough regular scouting is necessary to detect pests early before infestations build to damaging levels.

[2] A thorough inspection of planting material is necessary to avoid introducing mites from the nursery into production fields. Scouting to determine the extent of infestation and the presence of eggs is necessary. Materials in the first group have efficacy against all stages of spider mites. The second group is effective against eggs and juvenile life stages of the twospotted spider mite. The third group of materials has efficacy against all motile (or moving, non-egg stages). Materials in groups 1 and 2 are the primary tools for spring infestations. Fall use could affect the number of applications allowed in the spring. The third group of materials is organically acceptable (**OMRI-**listed) and effective only against adults; coverage is very important to the efficacy of these materials. Resistance management is crucial for all miticides. Rotate to a new mode of action (MOA) if more than one treatment is necessary (see tables for Modes of Action). Follow resistance management guidelines on labels. Native predatory mites may be effective. They may be augmented with mites from commercial sources. Carbaryl, pyrethroids, and neonicotinoids are highly toxic to predatory mites.

[3] Aphid or flower thrips populations have to be very high to cause yield loss in strawberry. Spraying insecticides during bloom is hazardous to honey bees; follow instructions on pesticide labels to minimize damage to honey bees.

[4] Fire ant baits work slower than contact materials but provide longer term management by sterilizing the queen and preventing larvae from developing over a 4–8 week period. Apply baits as soon as ant foraging is noted in the spring. Ants must be actively foraging for baits to be effective.

[5] Tarnished plant bugs can feed early in the spring on flowers and developing weed seeds. Wild radish, often called wild mustard, is a favored late winter host. Reducing weeds in and around fields will reduce populations. See note above about honey bees

[6] As weather begins to warm, scout regularly for mites. Follow label instructions about resistance management carefully when using miticides.

[7] Sap beetles are attracted to overripe fruit. Keeping fruit picked and removed from the field will reduce problems with sap beetles.

Pre-planting: Disease and Weed Management			
Pest/Problem	**Management Options**	**Effectiveness**	**Comments**
Anthracnose Angular leaf spot Phytophthora crown rot Fusarium wilt (not reported in Eastern U.S.) Viruses	Disease free plants	Importance: E Efficacy: E	Use of certified plants or plants produced in a similarly stringent program is the most important method to prevent these diseases.
Nematodes	Sample soil	Importance: G	Sample soils for nematode analysis through local state services to determine which fumigant or IPM management plan may be required.
Nematodes and soilborne pathogens (*Pythium, Phytophthora, Fusarium, Rhizoctonia*)	Crop rotation and cover crop selection	Importance: G Efficacy: G	Selected summer cover crops and rotating fields to other crops for 2 to 3 years can suppress nematode populations and reduce black root rot and other disease problems.
Weeds Root and crown rot disorders Nematodes (Black root rot; Phytophthora crown rot)	Pre-plant fumigation and laying down plastic mulch	Efficacy: E	See fumigation table below. Consult with custom applicators and/or Extension agents for product and rate recommendations.

Pre-plant Dips

Several products are registered as plant dips to manage pathogens or to protect plants just prior to field setting, but only a limited amount of research has been done with plant dips. In general, these treatments are not recommended except under specific circumstances, for example, if a disease has been diagnosed to be on the transplants. Products not labeled for dip treatments should not be used for dips, since poor plant performance has been observed in research trials.

Abound (FRAC 11) — Mix 5 to 8 fl oz/100 gal of water. Dip plants for 2 to 5 minutes. Transplant treated plants as quickly as possible. This treatment has been developed for bare root transplants with a known problem of anthracnose. The dip is a whole plant dip, and some growers do not re-use the water for fear of spreading angular (bacterial) leaf spot and other diseases. It is reasonable to expect these fungicides to have some *Rhizoctonia* suppressive activity, but there are no research results to demonstrate a benefit. For managing *Rhizoctonia*, a root dip should suffice, rather than dipping whole plants. *Rhizoctonia* (and the black root rot problem) builds up over time; it is doubtful that a root dip would offer much benefit for season long control. Growers must ensure root dip waste is properly disposed.

Switch 62.5WDG (FRAC 9 + 12) — Switch offers options for treating plants known to be infected with *Colletotrichum* species and has shown good efficacy in reducing losses due to the crown rot pathogen in bare root transplants (*Colletotrichum gloeosporioides*). Use 5 to 8 fl oz/100 gal water. Wash transplants to remove excess soil prior to dipping. Completely immerse planting stock in dip solution. Dip or expose plants for a minimum of 2 to 5 minutes. Do not reuse solution. Growers must ensure proper disposal of root dip waste. Plant treated plants as quickly as possible. Delayed planting could cause plant stunting.

Phosphites/fosetyl-Al (FRAC P07) — Dip plants in 2.5 lb/100 gal (Aliette WDG), 2 pt/100 gal (ProPhyt), or 2.5 pt/100 gal (Phostrol) for 15 to 30 minutes and then plant within 24 hours after treatment. This treatment should help to suppress *Pythium* and *Phytophthora* problems.

Little data are available for other plant dip products, including **Oxidate**, and it is doubtful that they offer management of root diseases. In most cases, root pathogens are internal to the tissue and are not controlled by surface disinfectants.

Pre-planting and Early Post-planting: Nematode Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Nematodes	Nimitz or Fluensulfone 480EC	3.5 to 7 pt per treated acre	See comments	0 hr	0 days	Nimitz is a "traditional contact nematicide". It has not been extensively tested on strawberry in the Southeast and Mid-Atlantic states, but research on other crops in these areas and on strawberry elsewhere suggests moderate to good activity – not quite as effective as soil fumigant standards – against most major plant-parasitic nematode species. Apply via drip or incorporated spray at least 7 days before planting; only 1 application per year. Soil temperature must be 60°F or above. Soil incorporation in the top 6-8 inches is critical. Irrigating (0.5-1 inches) 2-5 days after application is recommended.
	Majestene (heat-killed *Burkholderia* spp. strain A396)	4 to 8 qt	See comments	4 hr	0 days	Majestene is a biological nematicide approved for organic strawberry production. It has not been extensively field-tested on strawberry in the Southeast and Mid-Atlantic states, but research to date suggests useful activity against root-knot, lesion, sting, stunt, ring, and reniform nematodes. Can be applied as a pre-plant incorporated, in-furrow or banded spray as long as spray volume is sufficient to thoroughly soak the root zone. However, Majestene can also be drip-applied prior to planting, at planting or shortly thereafter, and again later in the season. Higher rates are likely more effective, and repeated applications also increase the extent and duration of nematode control. If nematode populations are high, another product may also be necessary for control.

Fumigants

New fumigant labels require extensive risk mitigation measures including fumigant management plans (FMPs), buffer restrictions, worker protection safety standards, and other measures. Details are on the labels and at http://www2.epa.gov/soil-fumigants. Some fumigants are registered for use on multiple crops but with crop- or soil-type -specific rates; others are registered for use on specific crops and/or in certain states only. Not all products are registered for use in all states. Follow all labels carefully.

Registered Fumigants or Fumigant Combinations for Managing Soilborne Nematodes, Diseases, and Weeds in Plasticulture Strawberries[1]						
	Rate per Treated Acre[2]		**Relative Efficacy**[3]			
Product	**Volume (gal)**	**Weight (lb)**	**Nematodes**	**Disease**	**Nutsedge**	**Weeds: Annual**
Pic-Clor 60 (chloropicrin + 1,3-dichloropropene)	48.6	588	E	E	P	G
Pic-Clor 60 EC[3] (chloropicrin + 1,3-dichloropropene)	42.6	503	E	E	P	G
Pic-Clor 80 (chloropicrin + 1,3-dichloropropene)	34	440	G	E	P	F
InLine[4] (1,3-dichloropropene + chloropicrin)	29 to 57.6 (*see label*)	325 to 645 *(see label)*	E	E	P	G
Telone C-35 (1,3-dichloropropene + chloropicrin)	39 to 50	437 to 560	E	E	P	F
chloropicrin + metam sodium[6]	see labels + see labels	see labels + see labels	F	E	F	VG
chloropicrin	see labels	see labels	P	E	ND	ND
Tri-Pic 100EC[4] (chloropicrin)	8 to 24	100 to 300	P	E	ND	ND
Paladin[7] (dimethyl disulfide)	35.0 to 51.3	310 to 455	VG	VG	VG	G[5]
Paladin EC[4,7] (dimethyl disulfide)	37.0 to 54.2	326 to 479	VG	VG	VG	G[5]
Paladin PiC-21 (dimethyl disulfide + chloropicrin)	41.2 to 60.1 *(see label)*	392 to 572 *(see label)*	VG	E	VG	G
metam potassium[6]	see labels	see labels	F	G	P	VG
metam sodium[6]	see labels	see labels	F	G	P	VG
Dominus[8] (allyl isothiocyanate)	25 to 40[5]	212 to 340[5]	F	G	P	G
Telone II (1,3-dichloropropene)	15 to 27	153 to 275	E	P	ND	ND
Telone EC[4] (1,3-dichloropropene)	9 to 24[5]	91 to 242[5]	E	P	ND	ND

[1] Fumigants with lower efficacy against weeds may require a complementary herbicide or hand-weeding program, although use of virtually impermeable film (VIF) or totally impermeable film (TIF) may increase weed control, particularly with Telone C35 or Paladin. Refer to the Herbicide Recommendation section of this guide for directions pertaining to herbicide applications. Telone can persist more than 21 days under cool or wet soil conditions.

[2] Rates can sometimes be reduced if products are applied with VIF or TIF.

[3] Efficacy Ratings: The efficacy of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, and ND = no data. These ratings are benchmarks; actual performance will vary.

[4] Product is formulated for application through drip lines under a plastic mulch; efficacy is dependent on good distribution of the product in the bed profile.

[5] Labelled rates are per *broadcast-equivalent* acre, NOT per treated acre.

(***Footnotes continued on next page.***)

(***Footnotes continued from previous page.***)

[6] Metam potassium can be Metam KLR, K-Pam, Sectagon K54 or other registered formulations and should be used in soils with high sodium content. Metam sodium can be Vapam, Sectagon 42, Metam CLR or other registered formulations.

[7] Paladin should be applied with 21% chloropicrin and VIF or TIF to enhance disease control and has low efficacy on certain small seeded broadleaf weeds and grasses. Paladin may not be registered in all states.

[8] Dominus is registered but there is limited experience with the product through University or independent trials in our region; growers may want to consider this on an experimental basis. Planting interval is 10 days. The active ingredient allyl isothiocyanate is similar to the active ingredient in metam sodium products (methyl isothiocyanate) and is likely to behave in a similar manner with a similar pest control profile.

Fungicide Resistance Management Recommendations (See page 26 for more details)

Botrytis cinerea (Botrytis fruit rot (sometimes referred to as gray mold) and Botrytis crown rot) historically has a high potential to develop resistance, and recent data suggest a high percentage of strains are resistant to several important fungicides. Therefore, it is important to give these recommendations serious consideration:

1. Limit the number of times fungicides of the same group (same FRAC code) are applied in a single year.
2. Tank-mix a broad spectrum fungicide such as **captan (FRAC M4) or thiram with Topsin M (a benzimidazole fungicide, FRAC 1) since Topsin M no longer has Botrytis activity due to resistance but is helpful for several early season foliar diseases, if present.**
3. Resistance profiles vary from farm-to-farm. Sample Botrytis fruit rot populations for their resistance profile through Clemson University (details below).

It is currently suggested that the strobilurin (QoI) fungicides (FRAC 11; e.g. Abound, Cabrio, Intuity, Merivon, Pristine, and **Quadris Top) not be used to control Botrytis and other disease problems but be saved for use in controlling anthracnose diseases when there is a high potential for disease pressure. Captan or thiram should help suppress anthracnose when utilized in Botrytis or other disease control applications, but the QoI fungicides are currently the most effective materials for control of anthracnose**. Some of these QoI fungicides may have activity against multiple pathogens other than the anthracnose pathogens, but unless anthracnose occurs in conjunction with these other diseases of concern, it is suggested that the QoI fungicides not be used. With only 4-5 total applications of the QoI fungicides per crop, it is an imperative that they be utilized effectively. Also, resistance management is extremely important with the QoI fungicides; make sure to follow all resistance management guidelines. Recently, we have documented reduced activity with azoxystrobin (Abound) with certain strains of the anthracnose fruit rot (AFR) pathogen. Other strains appear to be resistant to all QoI fungicides. Cabrio, Merivon, or Pristine have offered better control of AFR in recent research efforts AND if the strains are not resistant to QoI funfgicdes. If resistance is known, see page 26 for additional details.

Anthracnose (*Colletotrichum* spp.) — Most plantings are rarely at risk for anthracnose. Thus, anthracnose fungicides may not be needed. In most cases, contaminated plant sources are identified before or soon after planting. Know your plant source. If present, anthracnose on plants can cause petiole lesions (black sunken areas), stunting, and plant death. Fall fungicide applications will be required for *Colletotrichum* only if plant source problems are identified, usually appearing as symptomatic plants or assayed for quiescent infections. **Research results show that QoIs are more effective against the fruit rot pathogen (‘*acutatum*’) compared to the crown rot pathogen (‘*gloeosporioides*’). Captan, Topsin M, or Switch are effective for controlling the crown rot pathogen**. In general, it is BEST to save the QoI (FRAC 11) chemistry for spring applications and protect the fruit if anthracnose (‘*acutatum*’) is known to be present. Failure in management of some ‘acutatum’ populations has been observed due to resistance to the QoI fungicides (FRAC 11) (see above).

Powdery mildew — Monitor the field for the first signs of powdery mildew (leaf distortion and discoloration). Mildew in the fall does not appear to cause significant damage and may not reappear in the spring. ***Therefore, most growers will not need to spray for powdery mildew***. However, fields have been observed in the fall with severe foliar disease incidence, and plant productivity may then be hampered, justifying control measures. Likewise, if powdery mildew pressure occurs in the spring and affects the fruit, the fruit will have a dull appearance and be unmarketable unless managed well. High tunnels favor powdery mildew development. **Certain fungicides, such as the QoIs and Protocol, are registered and effective for powdery mildew, but are not recommended when only powdery mildew is present to avoid fungicide resistance selection in the anthracnose and *Botrytis* pathogens.**

Planting and Early Post-planting: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
NOTE: A treated acre is the amount of area under the plastic, i.e. in most strawberry fields there is about one acre under plastic on two acres of land.						
Red stele; Phytophthora crown/root rots	mefenoxam (Ridomil Gold SL) (Ultra Flourish)	 1 pt/treated A 2 pt/treated A	VG	 See label See label	 0 days 0 days	Apply in sufficient water in drip applications to move the fungicide into the root zone. Use proportionately less Ridomil Gold for band treatments. REI varies and is dependent upon method of application. **FRAC 4.** **Ridomil Gold SL:** Do not exceed 3 applications per crop. **Ultra Flourish:** Do not exceed 6 pt/A per crop.
	metalaxyl (MetaStar 2E)	 2 qt/treated A	VG	 See label	 See label	Apply in sufficient water to move the fungicide into the root zone. **Do not exceed 6 qt/treated A/year. FRAC 4.**
	phosphites (ProPhyt) (Phostrol)	(foliar) 2 to 4 pt 2.5 to 5.0 pt	F	 4 hr 4 hr	 0 days 0 days	Listed rates are for foliar applications. See product labels for rates specified for use for dip applications. Phosphite-based chemicals are not as effective as Ridomil Gold. Consider phosphites if the pathogen is known to be resistant to mefenoxam or if root systems are poor AND foliage is healthy for chemical uptake. **See product labels for state-specific restrictions. FRAC P07.**
	fosetyl-Al (Aliette WDG)	(foliar) 2.5 to 5.0 lb	F	12 hr	12 hr	
Rhizoctonia sp. (seedling root rot, basal stem rot)	azoxystrobin (Abound) [*other products available*]	0.40 to 0.80 fl oz/1,000 row feet *See labels*	F	4 hr *See labels*	0 days *See labels*	This is a drip irrigation application method. Can be considered especially for plug plants with poor root systems or plants placed into non-fumigated beds or beds with excess water in heavy soils. **FRAC 11.**
Charcoal rot	flutriafol (Rhyme)	 7 fl oz	ND	12 hr	0 days	Product is to be applied through drip irrigation. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. **FRAC 3.**
Powdery mildew only	Powdery mildew is not a common problem at this time of year; it may come in on transplants but usually does not persist or present an economic problem in open fields. There is a greater risk of powdery mildew in high tunnels. FRAC 11 products or product mixtures with FRAC 11 fungicides are labeled for use against powdery mildew but are not recommended for powdery mildew management in order to optimize FRAC 11 fungicide use for anthracnose fruit rot control.					
	triflumizole (Procure 480SC)	 4 to 8 fl oz	E^R	12 hr	1 day	Check label for prohibited rotational crops. Do not plant leafy or fruiting vegetables within 30 days after application. Do not plant bulb or root vegetables within 60 days after application. Do not plant cotton, small cereal grains and all other crops not registered within one year of application. Do not apply more than 32 fl oz of product per acre per season. **FRAC 3.**

Planting and Early Post-planting: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Powdery mildew only (cont'd)	myclobutanil (Rally 40WSP)	2.5 to 5 oz	E^{R}	24 hr	24 hr	Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. **FRAC 3.**
	flutriafol (Rhyme)	5 to 7 fl oz	E^{R}	12 hr	0 days	Rhyme is registered for control of powdery mildew and for drip application to manage charcoal rot. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. **FRAC 3.**
	quinoxyfen (Quintec)	4 to 6 fl oz	E	12 hr	1 day	Do not use more than 4 times per crop and no more than 2 times in a row. Do not apply more than 24 fl oz of product per acre per crop. Rotate with other mildewcides. See label for additional restrictions. **FRAC 13.**
	sulfur (various products and formulations)	*See labels*	G^{R}	*See labels*	*See labels*	Spray as needed. Avoid using in middle of a hot sunny day that may cause leaf burning. See label for additional restrictions. **FRAC M02.**
Anthracnose fruit rot (acutatum)	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E^{R}	12 hr	0 days	Do not apply more than 115 oz of product per acre per year. See resistance management notes on pages 12 and 26. **FRAC 11 + 7.**
	fluxapyroxad + pyraclostrobin (Merivon)	5.5 to 8 fl oz	E^{R}	12 hr	0 days	Do not apply more than 3 applications of product per season. Do not apply more than 33 fl oz of product per acre per year. See resistance management notes on pages 12 and 26. **FRAC 11 + 7.**
	fluopyram + trifloxystrobin (Luna Sensation)	4.0 to 7.6 fl oz	E^{R}	12 hr	0 days	Do not apply more than 27.1 fl oz of product per acre per year. See label for active ingredient limits per year. See resistance management notes on pages 12 and 26. **FRAC 7 + 11.**
	pyraclostrobin (Cabrio EG)	12 to 14 oz	E^{R}	12 hr	0 days	Do not apply more than 70 oz of product per acre per season. See label for active ingredient limits per season. **FRAC 11.**
	azoxystrobin (Abound) [*other products available*]	6.2 to 15.5 fl oz *See labels*	E^{R}	4 hr *See labels*	0 days *See labels*	Do not apply more than 61.5 fl oz of Abound per acre per season. Do not apply more than 1.0 lb azoxystrobin per acre per season. See other product labels for product specific limits. Failure in management of some 'acutatum' populations has been observed with Abound and similar products. **FRAC 11.**

Planting and Early Post-planting: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Anthracnose fruit rot (acutatum) (cont'd)	azoxystrobin + difenoconazole (Quadris Top)	12 to 14 fl oz	E^R	12 hr	0 days	No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. **FRAC 11 + 3.**
	propiconazole (Tilt) [*other products available*]	4 fl oz *See labels*	G	12 hr *See labels*	0 days *See labels*	No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 16 fl oz of Tilt per acre per year. Do not apply more than 4 applications of Tilt per year. Do not apply more than 0.45 lb of propiconazole per acre per year. See other product labels for product specific limits. **FRAC 3.**
	thiophanate-methyl + propiconazole (Protocol)	1.33 pt	G^R	24 hr	1 day	Do not apply more than 5.3 pt of product per acre per season. Do not apply more than 0.45 lb of propiconazole per acre per season. Do not apply more than 2.8 lb thiophanate-methyl per acre per season. No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. **FRAC 1 + 3.**
Anthracnose crown rot (gloeosporioides)	captan (Captan 50W) (Captan 80 WDG) (Captec 4L) [*other products available*]	 3 to 6 lb 1.87 to 3.75 lb 1.5 to 3.0 qt/100 gal *See labels*	G	 24 hr 24 hr 24 hr *See labels*	 1 day 1 day 1 day *See labels*	See product labels for product and/or actitve ingredient season limits. In plantings known to be infected with the anthracnose crown rot pathogen, consider applying captan plus thiophanate-methyl (FRAC 1) at 10- to 14-day intervals, for a total of 2 to 3 applications in the fall. **FRAC M04.**
	thiophanate-methyl (Topsin M WSB)	0.75 to 1 lb	G^R	24 hr	1 day	*For suppression only.* Do not apply more than 4 lb of product per acre per year. Do not apply more than 2.8 lb thiophanate-methyl per acre per year. See resistance management notes on pages 12 and 26. **FRAC 1.**
	azoxystrobin + difenoconazole (Quadris Top)	12 to 14 fl oz	G^R	12 hr	0 days	No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. **FRAC 11 + 3.**

Post-planting: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Crickets	Crickets are an infrequent problem in strawberries and rarely require management.					
	carbaryl (Sevin 4F) (Sevin XLR)	 1 to 2 qt 1 to 2 qt	G	 12 hr 12 hr	 7 days 7 days	Repeated use of carbaryl may flare spider mite populations. DO NOT apply when bees are foraging. **IRAC 1A.**
	malathion (Malathion 57 EC) [*other products available*]	 1.5 to 3 pt *See labels*	F	 12 hr *See labels*	 3 days *See labels*	Apply when damage is first noted. DO NOT apply when bees are foraging. **IRAC 1B.**
Cutworms	Cutworms are usually more of a problem in matted-row culture or weedy plantings. Scout for cutworm damage and presence after transplant.					
	Bacillus thuringiensis (Bt) (many products)	 *See labels*	G	 *See labels*	 *See labels*	Many Bt formulations are **OMRI**-listed. **IRAC 11B2.**
	carbaryl (Sevin 4F) (Sevin 4 XLR)	 1 to 2 qt 1 to 2 qt	G	 12 hr 12 hr	 7 days 7 days	Repeated use of carbaryl can cause spider mite problems. Apply late in the day when plants clipped at the base are first noticed. DO NOT apply when bees are foraging. **IRAC 1A.**
	chloran-traniliprole (Coragen)	 3.5 to 7.5 fl oz	E	 4 hr	 1 day	**IRAC 28.**
	malathion (Malathion 8 Flowable)	 1.5 to 2 pt	G	 12 hr	 3 days	Malathion 8 Flowable can be applied via drip lines, allowing treatment under plastic if cutworms are present. **IRAC 1B.**
	methoxyfenozide (Intrepid)	 6 to 12 fl oz	VG	 4 hr	 3 days	**IRAC 18.**
	spinosad (Entrust 80W)	 1 to 1.25 oz	VG	 4 hr	 1 day	Rotate to a different class of insect control products after 2 successive applications of spinosad. Do not make more than 5 applications per year. Do not apply more than 9 oz of Entrust (0.45 AI of spinosad) per acre per crop. Entrust is **OMRI**-listed. **IRAC 5.**
Cyclamen mites	fenpyroximate (Portal)	 2 pt	ND	 12 hr	 1 day	Limited data on Portal is available in the southeast. **IRAC 21A.**
	imidacloprid (Admire Pro 4.6 F)	 10.5 to 14 oz	VG	 12 hr	 14 days	Apply in transplant water or through irrigation. DO NOT apply when bees are foraging or within 10 days of bloom. **IRAC 4A.**

Post-planting: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Strawberry clippers	All common plasticulture varieties and many matted row varieties compensate for bud loss due to strawberry clipper injury, and clippers do not typically justify treatment. Materials effective against clippers are also toxic to honey bees.					
	bifenthrin (Brigade WSB)	6.4 to 32 oz	VG	12 hr	0 days	DO NOT apply when bees are foraging. **IRAC 3.**
	carbaryl (Sevin XLR)	1 to 2 qt	G	12 hr	1 day	If carbaryl is your material of choice for strawberry clippers, Sevin XLR will have a lower impact on bees. Apply material at dusk when bees are not foraging, and allow the maximum amount of dry time before bees become active. **IRAC 1A.**
	fenpropathrin (Danitol 2.4 EC)	16 to 21.33 fl oz	VG	24 hr	2 days	DO NOT make more than 2 applications per crop per season. Apply in at least 100 gal of water per acre. DO NOT apply when bees are foraging. **IRAC 3A.**
Twospotted spider mites	Check with local Cooperative Extension specialists to determine twospotted spider mite treatment thresholds in your area.					
	Predatory mites (*Phytoseiulus persimilis*, *Neoseiulus fallacis* and others)	Release rates vary based upon predatory species and prey density	Very important Effectiveness: VG	N/A	N/A	In general, release 2 to 3 mites per plant when mite populations are low and 5 predators per plant when populations are high. Predatory mite releases must be initiated at or before twospotted spider mites reach threshold levels (5 mites per leaflet), and spider mite populations must be followed closely after predatory mite releases because they may vary in efficacy.
	abamectin (Agri-Mek 0.15 EC)	16 fl oz	VG	12 hr	3 days	Make 2 applications 7 to 10 days apart when mites first appear. Do not exceed 64 fl oz per acre in a growing season. Apply in in a minimum of 100 gal of water per acre. Do not repeat treatment within 21 days of second application. For resistance management, do not use in strawberry nurseries. **IRAC 6.**
	acequinocyl (Kanemite 15 SC)	31 fl oz	E	12 hr	1 day	Allow 21 days between treatments. Do not make more than 2 applications per season. Use in a minimum of 100 gal/acre. Use in a minimum of 100 gal/acre. **IRAC 20B.**
	bifenazate (Acramite 50WP)	1 lb	E	12 hr	1 day	Allow 21 days between treatments. Use only 2 applications per year. Use in a minimum of 100 gal/acre. **IRAC 20D.**
	bifenazate (Vigilant 4SC)	12-16 fl oz	ND (likely similar to Acramite)	12 hr	1 day	Allow 21 days between treatments. Use only 2 applications per year. Use in a minimum of 100 gal/acre. **IRAC 20D.**
	cyflumetofen (Nealta)	13.7 fl oz	E	12 hr	1 day	Use only 2 applications per year. Use in a minimum of 50 gal/acre. Allow 14 days between applications. Use an effective miticide with a different mode of action between applications. **IRAC 25.**

Post-planting: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Twospotted spider mites (cont'd)	etoxazole (Zeal 72 WSP)	3 oz	VG	12 hr	1 day	Make only 1 application per crop. DO NOT apply more than 3 oz per acre per crop. Use in a minimum of 100 gal/acre. **IRAC 10B.**
	fenpyroximate (Portal)	2 pt	VG	12 hr	1 day	Do not make more than 2 applications per crop cycle. Allow 14 days between applications. Use in a minimum of 25 gal/acre. **IRAC 21A.**
	funbutatin-oxide (Vendex 50 WP)	1.5 to 2 lb	G	48 hr	1 day	Do not make more than 2 applications per season. DO NOT apply more than 4 lbs per acre per season. Use in a minimum of 50-100 gal/acre for small plants, 150-300 gal/acre for large plants. **IRAC 12B.**
	hexythiazox (Savey 50 WP)	6 oz	VG	12 hr	3 days	Controls eggs and immature mites but not adults. Use only once. DO NOT apply more than 6 oz per crop, 1 application per year. DO NOT use in strawberry nurseries. If many adult mites are present, use a material effective on adult mites, such as Agri-Mek. **IRAC 10A.**
	insecticidal soap (M-Pede)	1 to 2 gal per 100 gal	F	12 hr	0 days	Thorough coverage is needed. Plant damage has been noted under particularly cold or hot conditions. For best results begin use with low mite populations.
	rosemary & peppermint oils (Ecotec Plus) (Ecotrol Plus)	1 to 4 pt per 100 gal or 2 to 6 fl oz per 10 gal 1 to 4 pt per 100 gal	F	0 hr 0 hr	0 days 0 days	Because oils lack the residual activity of conventional insecticides, they may need to be applied repeatedly for control. Plant damage has been noted for some oils under some weather conditions. Ecotec and Ecotrol are **OMRI**-listed.
	sucrose octanoate (SucraShield)	0.8 to 1.0 % v/v	F	48 hr	0 days	Data for SucraShield against twospotted spider mites are limited. Apply in a volume of 100 to 200 gal per acre. **OMRI**-listed.
	spiromesifen (Oberon 2 SC)	12 to 16 fl oz	E	12 hr	3 days	Make no more than 3 applications per crop. Use in a minimum of 100 gal/acre. **IRAC 23.**

Post-planting: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Twospotted spider mites (cont'd)	horticultural oils (JMS Stylet Oil) (Organic JMS Stylet Oil) (Omni Supreme Spray) (Saf T Side) [*other products available*]	 3 qt per 100 gal 3 qt per 100 gal 1 to 2% by volume in 200 gal 2.5 to 5 tbsp per gal *See labels*	G	 4 hr 4 hr 12 hr 0 hr *See labels*	 0 days 0 days 0 days 0 days *See labels*	Oils should not be applied 48 hours or less before freezing temperature, at temperatures over 90°F, or to water-stressed plants. Use sufficient water to achieve coverage; a volume of 100 to 200 gal per acre is recommended. For best results begin use with low mite populations. Because oils lack the residual activity of conventional insecticides, they may need to be applied repeatedly to control mites. Organic JMS Stylet Oil and Saf T Side are **OMRI**-listed.

New Leaf Growth to Pre-bloom: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Botrytis crown rot may occur during warm winter periods after early bloom is killed by frost and colonized by *Botrytis*. The pathogen typically grows down the flower stem (peduncle) and colonizes the upper crown tissue, causing death of the leaf petioles, particularly if plants are large or planted densely.						
Botrytis crown rot	iprodione (Rovral 4F)	(foliar) 1.5 to 2 pt (alone) 1.0 pt (tank-mix)	VG	24 hr	See comments	Do not apply after first fruiting flower. Do not make more than one application of product per season. Do not apply more than 2 pt of product per acre per season (stand-alone) or 1 pt of product per acre per season (tank-mix). Crown rot control during the early winter and prior to bloom may be the most effective use of the one Rovral application allowed in strawberries. **FRAC 2.**
	cyprodinil + fludioxonil (Switch 62.5 WG)	11 to 14 oz	VG	12 hr	0 days	Do not apply more than 56 oz of product per acre per year. See product label for actitve ingredient season limits. See resistance management notes on pages 12 and 26. **See the supplemental label (expiring on July 12, 2019) for rotational crop restrictions. FRAC 9 + 12.**
	captan (Captan 50W) (Captan 80WDG) (Captec 4L) [*other products available*]	3 to 6 lb 1.87 to 3.75 lb 1.5 to 3.0 qt/100 gal *See labels*	F	24 hr 24 hr 24 hr *See labels*	1 day 1 day 1 day *See labels*	See product labels for product and/or actitve ingredient season limits. **FRAC M04.**
Botrytis crown rot and fruit rot	Remove dead and dying leaves just before bloom	N/A	Importance: F Efficacy: G	N/A	N/A	Symptomatic leaf removal is effective but may not be economical if fungicides are heavily used for Botrytis management. If anthracnose fruit rot is present, hand-pruning plants may create more anthracnose disease problems. Do not use QoI fungicides; these should be saved for use as fruit develop and to avoid selection of resistant populations.

New Leaf Growth to Pre-bloom: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Leaf spots, leaf blights, and powdery mildew generally do not become economically important diseases in the fall or early spring. Thus, fungicides are generally not required for these problems. Thresholds have not been established, so the need for fungicides should be determined on a farm-by-farm basis depending on the disease pressure present. Phomopsis and leaf spot may be associated with plant sources; therefore, disease incidence can vary from year to year. Warm, wet weather favors disease progress. See previous notes on powdery mildew on pages 12 and 13. In the spring, monitor fields closely observing the underside of strawberry leaves to determine if powdery mildew is present. FRAC 11 products or mixtures with FRAC 11 fungicides are labeled but not listed to manage powdery mildew and leaf spots in order to optimize FRAC 11 fungicide use for anthracnose fruit rot control.						
Common leaf spot, leaf scorch, leaf blight (e.g. *Mycosphaerella*, *Phomopsis*, *Gnomonia*)	myclobutanil (Rally 40WSP)	2.5 to 5 oz	VG	24 hr	24 hr	Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. **FRAC 3.**
	captan (Captan 50W) or (Captan 80 WDG) + thiophanate-methyl (Topsin M WSB)	 3 to 6 lb 1.87 to 3.75 lb 1 lb	G	 24 hr 24 hr 24 hr	 1 day 1 day 1 day	When foliar symptoms appear, make 1 or 2 captan applications plus thiophanate-methyl (FRAC 1) at a 10- to 14-day interval for better control than captan products alone would provide. See product labels for product and/or actitve ingredient season limits. Do not tank mix captan products with highly alkaline pesticides, such as Bordeaux mixture. See resistance management notes on page 12. **FRAC M04 + FRAC 1**
	captan (Captan 50W) (Captan 80 WDG) (Captec 4L) [*other products available*]	 3 to 6 lb 1.87 to 3.75 lb 1.5 to 3.0 qt/100 gal *See labels*	F	 24 hr 24 hr 24 hr *See labels*	 1 day 1 day 1 day *See labels*	See product labels for product and/or actitve ingredient season limits. Do not tank mix captan products with highly alkaline pesticides, such as Bordeaux mixture. See resistance management notes on page 12. **FRAC M04.**
Powdery mildew only	triflumizole (Procure 480SC)	 4 to 8 fl oz	E^R	 12 hr	 1 day	Check label for prohibited rotational crops. Do not plant leafy or fruiting vegetables within 30 days after application. Do not plant bulb or root vegetables within 60 days after application. Do not plant cotton, small cereal grains and all other crops not registered within one year of application. Do not apply more than 32 fl oz of product per acre per season. **FRAC 3.**
	myclobutanil (Rally 40WSP)	 2.5 to 5 oz	E^R	 24 hr	 24 hr	Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. **FRAC 3.**
	flutriafol (Rhyme)	 5 to 7 fl oz	E^R	 12 hr	 0 days	Rhyme is registered for control of powdery mildew and for drip application to manage charcoal rot. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. **FRAC 3.**

New Leaf Growth to Pre-bloom: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Powdery mildew only (cont'd)	quinoxyfen (Quintec)	4 to 6 fl oz	E	24 hr	1 day	Do not use more than 4 times per crop and no more than 2 times in a row. Rotate with other mildewcides. Do not apply more than 24 fl oz of product per acre per crop. Rotation to non-registered crops less than 30 days after application is prohibited. **FRAC 13.**
	cyflufenamid (Torino)	3.4 oz	VG	4 hr	0 days	Do not make more than 2 applications per year. Do not apply more than once every 14 days. **FRAC U06.**
	propiconazole (Tilt) [*other products available*]	4 fl oz *See labels*	VG^R	12 hr *See labels*	0 days *See labels*	No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 16 fl oz of Tilt per acre per year. Do not apply more than 4 applications of Tilt per year. Do not apply more than 0.45 lb of propiconazole per acre per year. See other product labels for product specific limits. **FRAC 3.**
Angular (bacterial) leaf spot (*Xanthomonas fragariae*)	copper (basic copper sulfate, copper hydroxide, copper salts of fatty and rosin acids, cuprous oxide) (various products and formulations)	*See labels*	P	*See labels*	*See labels*	Angular (bacterial) leaf spot can be a serious problem during cool, wet conditions. These compounds provide some control unless conditions highly favor disease. Repeat applications at 7 to 10 day intervals. Discontinue when phytotoxicity appears, usually after 4 to 5 applications. Check product labels to be sure that products are labeled for use on strawberry. Individual products have various percents of active ingredient. Follow all instructions on the specific product label. **FRAC M1.**
	acibenzolar-S-methyl (Actigard 50WG)	0.5 to 0.75 oz	P	12 hr	0 days	Labeled for suppression. Do not apply to stressed plants. **DO NOT EXCEED MAXIMUM RATE**. Actigard is a plant activator and has no direct activity on the bacteria. See 2(ee) Recommendation for angular leaf spot in FL. This 2(ee) Recommendation expires February 10, 2020. **FRAC 21.**
Red stele; Phytophthora crown/root rots	mefenoxam (Ridomil Gold SL) (Ultra Flourish)	1 pt/treated A 2 pt/treated A	VG	See label See label	0 days 0 days	Strawberry plants initiate considerable root growth in the early spring. Time control applications in problem fields when new growth begins in the spring. Apply in sufficient water to move the fungicide into the root zone. Use proportionately less fungicide for band treatments (e.g., for drip applications). **FRAC 4.** **Ridomil Gold SL:** Do not exceed 3 applications per crop. **Ultra Flourish:** Do not exceed 6 pt/A per crop.

New Leaf Growth to Pre-bloom: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Red stele; Phytophthora crown/root rots (cont'd)	metalaxyl (MetaStar 2E)	2 qt/treated A	VG	See label	0 days	Apply in sufficient water to move the fungicide into the root zone. Do not exceed 6 qt/treated A/year. **FRAC 4.**
	phosphites (ProPhyt) (Phostrol)	(foliar) 2 to 4 pt 2.5 to 5.0 pt	F	 4 hr 4 hr	 0 days 0 days	The phosphite-based chemicals are not as effective as Ridomil Gold. Consider phosphites if the pathogen is known to be resistant to mefenoxam or if strawberry plants have poor root systems but sufficient foliage for chemical uptake. **FRAC P07.**
	fosetyl-Al (Aliette WDG)	(foliar) 2.5 to 5.0 lb	F	12 hr	12 hr	

Pre-bloom to Harvest: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Use extreme caution with bloom period treatments. Insecticides and fungicides can negatively impact bees. Do not treat unless economically significant populations of insects or mites are present. Apply all necessary bloom period treatments at dusk, when bees are not foraging, and allow for the maximum dry time possible between application and when foraging resumes.						
Aphids	Aphids rarely reach damaging populations in strawberries, and late season populations are often controlled by natural enemies. Aphids should not be treated unless populations exceed 10 per newly expanded leaves and/or excessive sooty mold is present.					
	bifenthrin (Brigade 10 WSB)	6.4 to 32 oz	VG	12 hr	0 days	The use of broad-spectrum insecticides during bloom will damage honeybee populations. DO NOT apply when bees are foraging. Refer to label. **IRAC 3A.**
	flupyradifurone (Sivanto 200 SL)	7.0 to 10.5 fl oz	VG	4 hr	0 days	Do not tank mix with azole fungicides (FRAC 3) during bloom period. Apply no more often than every 10 days and no more than 28 fl oz per acre per year. **IRAC 4D.**
	imidacloprid (Admire Pro)	10.5 to 14 fl oz (soil) 1.3 fl oz (foliar)	VG	12 hr	14 days 7 days	Can be applied through drip irrigation or as a foliar spray. DO NOT apply when bees are foraging or within 10 days of bloom. **IRAC 4A.**
	thiamethoxam (Platinum) (Actara)	5 to 12 fl oz (soil) 1.5 to 3 oz (foliar)	G	12 hr 12 hr	50 days 3 days	Long PHI makes Platinum useful only as a post-transplant material. Do not apply more than 12 oz/acre Actara and 4.01 oz/acre Platinum per year; allow 10 days between applications. DO NOT apply when bees are foraging; after a Platinum or Actara application, WAIT FIVE DAYS before placing beehives into treated fields. **IRAC 4A.**
	malathion (Malathion 57 EC) [*other products available*]	1.5 pt *See labels*	F	12 hr *See labels*	3 days *See labels*	DO NOT apply when bees are foraging. **IRAC 1B.**
	insecticidal soap (M-Pede)	1 to 2 gal per 100 gal	F	12 hr	0 days	Thorough coverage is needed. Plant damage has been noted under some weather conditions.
Cutworms	See **Post-planting: Insect Management** recommendations.					
Flower thrips	Thrips populations rarely or sporadically require treatment in strawberries. Because materials effective against thrips are often toxic to pollinators, only treat if damaging populations are present and apply materials in the evening to allow for maximum time between application and bee foraging activity. If using insecticides to manage thrips, rotate between different classes if more than one treatment is made.					
	acetamiprid (Assail 30 SG)	4.0 to 6.9 oz	G	12 hr	1 day	Do not apply when bees are foraging. **IRAC 4A.**

Pre-bloom to Harvest: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Use extreme caution with bloom period treatments. Insecticides and fungicides can negatively impact bees. Do not treat unless economically significant populations of insects or mites are present. Apply all necessary bloom period treatments at dusk, when bees are not foraging, and allow for the maximum dry time possible between application and when foraging resumes.						
Flower thrips (cont'd)	spinosad (Entrust 80W)	1.25 to 1.5 oz	G	4 hr	1 day	Rotate to a different class of insecticide after 2 successive applications. DO NOT apply more than 9 oz (Entrust) per acre per crop. Entrust is OMRI listed. Spinosad is highly toxic to pollinators when wet. If treatment is necessary, treat in the evening when bees are not foraging to allow for maximum dry time. **IRAC 5.**
	spinetoram (Radiant SC)	6 to 10 fl oz	G	4 hr	1 day	Spinetoram is highly toxic to pollinators when wet. If treatment is necessary, treat in the evening when bees are not foraging to allow for maximum dry time. **IRAC 5.**
Imported fire ants	Ensure that ants are actively foraging before applying baits.					
	pyriproxyfen (Esteem Ant Bait 0.5% B)	1.5 to 2 lb	VG	12 hr	1 day	Apply when ants are actively foraging. Apply during dry weather; do not water for 24 hours after application. See label for individual mound treatment instructions. **IRAC 7C.**
	methoprene (Extinguish Ant Bait 0.5 % B)	1 to 1.5 lb	VG	4 hr	0 days	Esteem and Extinguish are insect growth regulators (IGR) and act on the reproductive activity of the queen(s). Allow 3 weeks to see reduction in mound activity and 8 to 10 weeks for mound elimination. Extinguish can be applied as a mound treatment or broadcast. Extinguish is labeled for use on cropland, but Extinguish Plus is **NOT** labeled for use on cropland. Read labels carefully. **IRAC 7A.**
Slugs and snails	carbaryl (Sevin 5 Bait)	40 lb	F	12 hr	7 days	Apply bait to edges of beds at dusk. DO NOT contaminate fruit. Repeated applications may be necessary. May also control other soil dwelling insects. **IRAC 1A.**
	Iron phosphate (Sluggo Snail and Slug Bait)	20 to 44 lb	G	0 hr	0 days	Apply in the evening. Some iron phosphate formulations are **OMRI**-listed, check the label.
Strawberry clippers	See **Post-Planting: Insect Management** recommendations.					
Twospotted spider mites	See **Post-Planting: Insect Management** recommendations.					

Early Bloom (10%) and into Harvest: Disease Management

The primary diseases of concern at early bloom and into harvest are **Botrytis fruit rot** (BFR) and **anthracnose fruit rot (AFR)**. Most growers rarely experience anthracnose problems and may not need an anthracnose management program. Several **key principles** should be kept in mind:

1. Abound, Cabrio, Inutity, Merivon, Pristine, and Luna Sensation belong to the same family of chemicals (QoIs; FRAC 11). Pyraclostrobin (Cabrio, Merivon, and Pristine) has offered better control of AFR in recent research efforts. No more than 2 applications of a FRAC 11 fungicide should be made per season for resistance management. Strategic timing is necessary. Pristine, Luna Sensation, and Merivon also have a second chemical that has good broad-spectrum activity against a number of diseases, especially those caused by *Botrytis*. QoI resistance has been found in 'acutatum' populations in the south. The problem tends to be plant-source-aassociated.
2. Captan, thiram, and Switch offer a broad spectrum of disease control. Switch is modest against AFR in NC research.
3. Polyoxin D zinc salt (Ph-D and OSO 5%SC) is as effective as captan for *Botrytis* at high label rates and can help reduce reliance on fungicides that have resistance concerns.
4. Elevate should not be used more than twice per season due to resistance concerns. It is effective against *Botrytis* but no other fungal pathogens.
5. High risk fungicides of the same chemical class (FRAC group) should not be applied in consecutive applications.
6. CaptEvate is a premix of captan and fenhexamid (Elevate) which has good broad-spectrum activity.
7. Bloom sprays are the most important for managing *Botrytis*, because 90% of fruit infection occurs through the flower at bloom. Recent research suggests bloom sprays are also critical for AFR control.
8. Fruit rot diseases develop rapidly during wet periods or in poorly ventilated locations. Control is easier when initiated before the problem develops. Spray coverage is important and dependent on nozzle condition, tractor speed, pressure, and plant density. Spray coverage can be checked with water sensitive cards.

Fungicide Selection for Botrytis and Anthracnose Fruit Rot Management

Management of Botrytis fruit rot (**BFR**) and anthracnose fruit rot (**AFR**) caused by "*Colletotrichum acutatum*" has become more complex. Growers need to use products that work against resistant strains of BFR and manage AFR. We developed a new table to help with the decision process (see below).

The table (right) shows our current understanding of the efficacy of fungicides for the Southeastern US (north of Florida). Efficacy in the table is indicated as follows: E = excellent, VG = very good, G = good, F = fair, P = poor. A large number of farms are experiencing problems with *Botrytis* strains that are resistant to one or more fungicide. (Color codes are similar to the codes in the MyIPM App).

BOTRYTIS CONTROL: *Botrytis cinerea* historically has a high potential to develop resistance. Therefore, it is important to give these recommendations serious consideration:

1. If a Botrytis spray is needed before bloom (e.g. to control Botrytis crown rot) use Rovral (FRAC 2).
2. Use members of any FRAC group (except M03 or M04) no more than twice per season (For example, if you used Fontelis once and Merivon once you maxed out the 2 applications for FRAC 7 fungicides.)

Product	FRAC Group	BFR	Botrytis Resistance	AFR
Captan; Captec	M04	G	None	G
CaptEvate	M04 + 17	E	Prevalent for 'Elevate'	G
Thiram	M03	G	None	G
Fracture	BM01	P	No data	No data
Topsin M	1	Not effective	Widespread	Not effective
Rovral	2	G	Prevalent	Not effective
Tilt; generics	3	Not effective	Not applicable	G
Fontelis	7	E	Prevalent	F
Kenja	7	E	NOT prevalent	Not effective
Scala	9	G	Prevalent	Not effective
Pristine	7 + 11	G	Prevalent	E
Merivon	7 + 11	E	Prevalent	E
Luna Sensation	7 + 11	E	NOT prevalent	E
Cabrio	11	F	Widespread	E
Abound	11	F	Widespread	E
Intuity	11	F	No data	P
Switch	12 + 9	E	NOT prevalent	G
Elevate	17	E	Prevalent	Not effective
Ph-D, OSO	19	G	NOT prevalent	No data

*Resistance issues to FRAC 11 fungicides have been reported in multiple states. Problems tend to be plant-source associated.

3. Resistance profiles vary from farm-to-farm. Sample BFR populations for their resistance profile through Clemson University (http://www.clemson.edu/extension/peach/commercial/diseases/index.html).
   Based on samples submitted to Clemson, the **Fungicide Decision Management Table** below shows a decision guide to manage BFR**. If you do not know your profile, it is best to avoid over-reliance on products where resistance is prevalent. If in doubt, follow Decision Code E-1 since this will address the most common resistance issues for BFR control.** If you also have FRAC 11 resistance for AFR, follow Decision Code E-2.
4. Specific plant sources may be identified as having AFR infestations. In that case growers need to manage both BFR and AFR.

AFR CONTROL: Resistance to FRAC 11 fungicides (e.g. Abound, Cabrio, Intuity, Luna Sensation Merivon, Pristine,) has been found in Florida, North Carolina, and California; problems tend to be plant-source associated. Therefore, it is a good idea to use the FRAC 11 fungicides only in a mixture at the lower labeled rate with the higher labeled rate of captan products (e.g. Captan or Captec; FRAC M04) alternated with captan alone. If you know the resistance profile, see the **Fungicide Decision Management Table** below. Also, recently, we have documented reduced activity with azoxystrobin (e.g. Abound, etc.; FRAC 11) with certain strains of the AFR pathogen. Cabrio (FRAC 11) and FRAC 7 + 11 products have offered better control of AFR in recent research efforts and if the strains are not resistant to FRAC 11 fungicides.

FRAC 7 + 11 products can be used if your resistance profile shows the FRAC 7 component is still effective against BFR. If FRAC 7 resistance is diagnosed or you don't know, we recommend using Cabrio (plus captan). Like BFR, our data shows early bloom sprays are also critically important for AFR management.

For cases when there is no anthracnose and growers need to focus on *Botrytis* control (most fields), follow Decision Code A.

Options: For a reduced fungicide program, initiate applications at FIRST bloom as above, but apply subsequent sprays before predicted wet weather that favors *Botrytis*; end applications about 26 to 30 days before expected final harvests. Increase the time between spray applications when dry weather persists. Research trials have documented that 4 sprays during bloom often are sufficient to offer season-long BFR control. Also, consult available forecasting models linked through this guide.

For cases when anthracnose is present and there is no known resistance within the *Botrytis* population, follow Decision Code B-1.

Before predicted periods of cool and wet weather during bloom, use Switch (FRAC 12 + 9) for better *Botrytis* control. Use Switch with captan if *Botrytis* pressure is expected to be heavy. Switch also has decent anthracnose control. FRAC 7 + 11 products or Cabrio show the best efficacy against AFR under high anthracnose pressure in research studies and either can be used if there is no resistance to FRAC 7 fungicides (an active ingredient in FRAC 7 + 11 products). Also, if weather conditions (warm & wet) favor AFR or you start to approach the upper limit of FRAC 11 fungicides allowed (4 to 5 applications), consider rotating to a tank-mix of captan + Tilt (FRAC 3).

Consult the rest of this guide for additional information on total IPM Programs and download the MyIPM-SED app to learn more about disease/pest management and FRAC codes. Also consult the Diagnosis Tool (https://diagnosis.ces.ncsu.edu/strawberry/) and Strawberry Disease Factsheets (https://strawberries.ces.ncsu.edu/strawberries-diseases/) for additional information and assistance in identifying diseases.

Fungicide Decision Management Table									
Decision Code	Fungicide Resistance Issue		Sprays During Bloom and Fruit Ripening						
	Botrytis	**Anthracnose**	**1**	**2**	**3**	**4**	**5**	**6**
A	No resistance	No Disease	12+9	7	thiram+17	thiram+19	captan	Goto 1
B-1	No resistance	No resistance	captan+17	11+7	12+9	captan+19	11+7	Goto 1
C-1	FRAC 7	No resistance	captan+17	captan+11	12+9	captan+11	captan+19	Goto 1
D-1	FRAC 17	No resistance	thiram+11	captan	12+9	11+7	captan+19	Goto 1
E-1	FRAC 7+17	No resistance	thiram+11	captan	11+9	captan+11	captan+19	Goto 1
F-1	FRAC 12+9	No resistance	captan+17	11+7	thiram	captan+19	captan+19	Goto 1
G-1	FRAC 12+9+17	No resistance	thiram+11	captan	thiram	captan+11	captan+19	Goto 1
H-1	FRAC 12+9+7	No resistance	captan+17	captan	thiram	captan+11	captan+19	Goto 1
I-1	FRAC 12+9+7+17	No resistance	thiram+11	captan	thiram	captan+11	captan+19	Goto 1
B-2	No resistance	FRAC 11	captan+17	captan+7	12+9	captan+19	captan+7	Goto 1
C-2	FRAC 7	FRAC 11	captan+17	captan	12+9	captan+17	captan+19	Goto 1
D-2	FRAC 17	FRAC 11	captan+7	captan+7	12+9	captan+7	captan+19	Goto 1
E-2	FRAC 7+17	FRAC 11	12+9	captan	captan+19	12+9	captan	Goto 1
F-2	FRAC 12+9	FRAC 11	captan+17	captan+7	thiram	captan+19	captan	Goto 1
G-2	FRAC 12+9+17	FRAC 11	thiram+7	captan	captan+7	captan	captan+19	Goto 1
H-2	FRAC 12+9+7	FRAC 11	captan+17	captan	thiram	captan+17	captan+19	Goto 1
I-2	FRAC 12+9+7+17	FRAC 11	thiram	captan	captan+19	captan	captan+19	Goto 1

Decision Management Code Guidelines:
A: Botrytis is expected with no resistance and plants are verified to be anthracnose free.
B-1 to I-1: The anthracnose pathogen is known to be sensitive to FRAC 11 products.
B-2 to I-2: The anthracnose pathogen is known to be resistant to FRAC 11 products.
NOTE: For B-1 to I-1: If anthracnose is known to be absent, then the FRAC 11 products are **NOT** needed.
B-1: Botrytis is expected, no resistance is documented, and plants are verified to harbor the anthracnose pathogen.
C-1: Botrytis is resistant to FRAC 7 products, and plants are verified to harbor the anthracnose pathogen.

Early Bloom (10%) and into Harvest: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Switch 62.5 WG also has decent anthracnose control. Pristine, Merivon, or Cabrio show the best efficacy against AFR under high anthracnose pressure in research studies and either can be used if there is no resistance to FRAC 7 fungicides. Also, if weather conditions (warm & wet) favor AFR or you start to approach the upper limit of FRAC 11 fungicides allowed (4 to 5 applications), consider rotating to a tank mix of captan + Tilt.						
Botrytis fruit rot	penthiopyrad (Fontelis)	16 to 24 fl oz	E^R	12 hr	0 days	Do not apply more than 72 fl oz of product per acre per year. Do not apply FRAC 7 products more than twice per season due to resistance management. Some matted row cultivars may show phytotoxicity (see label). **FRAC 7.**
	isofetamid (Kenja 400SC)	13.5 to 15.5 fl oz	E^R	12 hr	0 days	Do not apply FRAC 7 products more than twice per season due to resistance management. Some matted row cultivars may show phytotoxicity (see label). **FRAC 7.**
	fluopyram + pyrimethanil (Luna Tranquility)	16 to 27 fl oz	E^R	12 hr	1 day	Do not apply more than 54.7 fl oz of product per acre per year. See label for active ingredient limits per year.Do not use any FRAC 9 or 7 products more than twice per season for resistance management. **Luna Tranquility is not labeled for use in LA. FRAC 7 + 9.**
	fluopyram + trifloxystrobin (Luna Sensation)	6 to 7.6 fl oz	E^R	12 hr	0 day	Do not apply more than 27.1 fl oz of product per acre per year. See label for active ingredient limits per year. Do not use any FRAC 11 or 7 products more than twice per season for resistance management. **FRAC 7 + 11.**
	cyprodinil + fludioxonil (Switch 62.5WG)	11 to 14 oz	E	12 hr	0 days	Do not apply more than 56 oz of product per acre per year. See product label for actitve ingredient season limits. Do not apply more than twice per season due to resistance management. See resistance management notes on pages 12 and 26. **FRAC 9 + 12.**
	fenhexamid (Elevate 50 WDG)	1.5 lb (stand-alone)	E^R	12 hr	0 days	Do not apply more than twice per season due to resistance management. Under light pressure, 1.0 lb Elevate plus captan may be used (see label). **FRAC 17.**
	fenhexamid + captan (CaptEvate 68 WDG)	3.5 to 5.25 lb	E	24 hr	0 days	Do not make more than 2 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. With plastic mulch, do not apply within 16 ft of naturally vegetated or aquatic ares. **FRAC 17 + 4.**

Early Bloom (10%) and into Harvest: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Botrytis fruit rot (cont'd)	thiram (Thiram SC)	2.6 qt	G	24 hr	1 day	Make 3 to 5 applications at 10-day intervals. Thiram is a broad spectrum fungicide similar to captan. Do not apply more than 5 applications per year (west of the Mississippi River or more than 12 applications per year east of the Mississippi River. Do not apply more than 2.73 lb thiram (active ingredient) per acre. **FRAC M03.**
	captan (Captan 50W) (Captan 80WDG) (Captec 4L) [*other products available*]	 3 to 6 lb 1.87 to 3.75 lb 1.5 to 3.0 q/100 gal *See labels*	G	 24 hr 24 hr 24 hr *See labels*	 1 day 1 day 1 day *See labels*	See resistance management notes and the suggested schedule beginning on page 26. See product labels for product and/or actitve ingredient season limits. **FRAC M04.**
	pyrimethanil (Scala SC)	18 fl oz (alone) 9 to 18 fl oz (tank mix)	G^R	12 hr	1 day	Do not apply more than 54 fl oz of product per crop. See label for active ingredient limits per crop. Use lower rate only in a tank mix with another fungicide active against Botrytis (e.g. captan or thiram). **FRAC 9.**
	polyoxin D zinc salt (Ph-D) (OSO 5%SC)	 6.2 oz 3.75 to 13 fl oz	G	 4 hr 4 hr	 0 days 0 days	Do not apply more than twice per season due to resistance management. **FRAC 19.**
	BLAD (Fracture)	24.4 to 36.6 fl oz	P	4 hr	1 day	Active ingredient is a protein extract of sweet white Lupin seeds. Do not make more than 5 foliar applications per harvest cycle. Do not apply by air. See label for requirements concerning drying times prior to rains. **FRAC BM01.**
Botrytis fruit rot and anthracnose fruit rot (acutatum)	***Products in this section are labeled for both Botrytis and anthracnose.***					
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E^R	12 hr	0 days	Do not apply more than 115 oz of product per acre per year. See notes on page 26 to manage risk of developing fungicide resistance. Do not apply more than 2 applications per acre per crop year. **FRAC 11 + 7.**
	fluopyram + trifloxystrobin (Luna Sensation)	6 to7.6 fl oz	E^R	12 hr	0 day	Do not apply more than 27.1 fl oz of product per acre per year. See label for active ingredient limits per year. Do not use any FRAC 11 or 7 products more than twice per season for resistance management. **FRAC 11 + 7.**

Early Bloom (10%) and into Harvest: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Botrytis fruit rot and anthracnose fruit rot (acutatum) (cont'd)	fluxapyroxad + pyraclostrobin (Merivon)	8 to 11 fl oz	E^R	12 hr	0 days	Do not apply more than 3 applications of product per season. Do not apply more than 33 fl oz of product per acre per year.See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 11 + 7.**
	captan (Captan 50W) [*other products available*]	6 lb See label	G	24 hr *See labels*	1 day *See labels*	For better control and resistance management, use captan plus thiophanate-methyl (see label). See suggested schedule above. See product labels for product and/or actitve ingredient season limits. **FRAC M04.**
Anthracnose fruit rot (acutatum)	axoxystrobin (Abound) [*other products available*]	6.0 to 15.5 fl oz *See labels*	E^R (failure found in some fields)	4 hr *See labels*	0 days *See labels*	Do not apply more than 61.5 fl oz of Abound per acre per season. Do not apply more than 1.0 lb azoxystrobin per acre per season. See other product labels for product specific limits. See notes on page 26 to manage risk of developing fungicide resistance. In recent research, Abound and similar products have performed less well than Cabrio/Pristine. **FRAC 11.**
	fluopyram + trifloxystrobin (Luna Sensation)	4.0 to 7.6 fl oz	E^R	12 hr	0 days	Do not apply more than 27.1 fl oz of product per acre per year. See label for active ingredient limits per year. See notes on page 26 to manage risk of developing fungicide resistance. Do not use any FRAC 11 or 7 products more than twice per season for resistance management. **FRAC 7 + 11.**
	fluxapyroxad + pyraclostrobin (Merivon)	5.5 to 8 fl oz	E^R	12 hr	0 days	Do not apply more than 3 applications of product per season. Do not apply more than 33 fl oz of product per acre per year. See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 7 + 11.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E^R	12 hr	0 days	Do not apply more than 115 oz of product per acre per year. See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 11 + 7.**
	pyraclostrobin (Cabrio EG)	12 to 14 oz	E^R	12 hr	0 days	Do not apply more than 70 oz of product per acre per season. See label for active ingredient limits per season. See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 11.**
	azoxystrobin + difenoconazole (Quadris Top)	12 to 14 fl oz	E^R	12 hr	0 days	No more than 2 applications should be made per season for resistance management. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. **FRAC 11 + 3.**

Early Bloom (10%) and into Harvest: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Anthracnose fruit rot (acutatum) (cont'd)	propiconazole (Tilt) [*other products available*]	4 fl oz *See labels*	G	12 hr *See labels*	0 days *See labels*	No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Do not apply more than 16 fl oz of Tilt per acre per year. Do not apply more than 4 applications of Tilt per year. Do not apply more than 0.45 lb of propiconazole per acre per year. See other product labels for product specific limits. Not registered for anthracnose crown rot control. **FRAC 3.**
	thiophanate-methyl + propiconazole (Protocol)	1.33 pt	G^R	24 hr	1 day	Do not apply more than 5.3 pt of product per acre per season. Do not apply more than 0.45 lb of propiconazole per acre per season. Do not apply more than 2.8 lb thiophanate-methyl per acre per season. No more than 2 applications should be made per season for resistance management. **FRAC 1 + 3.**
Anthracnose crown rot (gloeosporioides)	captan (Captan 50W) (Captan 80WDG) (Captec 4L) [*other products available*]	3 to 6 lb 1.87 to 3.75 lb 1.5 to 3.0 qt/100 gal *See labels*	G	24 hr 24 hr 24 hr *See labels*	1 day 1 day 1 day *See labels*	In plantings known to be infected with the anthracnose crown rot pathogen, consider applying captan plus thiophanate-methyl at 10- to 14-day intervals, for a total of 2 to 3 applications in the fall. See product labels for product and/or actitve ingredient season limits. **FRAC M04.**
	thiophanate-methyl (Topsin M WSB)	0.75 to 1 lb	G^R	24 hr	1 day	*For suppression only.* Do not apply more than 4 lb of product per acre per year. Do not apply more than 2.8 lb thiophanate-methyl per acre per year. See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 1.**
	azoxystrobin + difenoconazole (Quadris Top)	12 to 14 fl oz	G^R	12 hr	0 days	No more than 2 applications should be made per season for resistance management. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. **FRAC 11 + 3.**

Early Bloom (10%) and into Harvest: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Powdery mildew only	triflumizole (Procure 480SC)	4 to 8 fl oz	E^R	12 hr	1 day	Check label for prohibited rotational crops. Do not plant leafy or fruiting vegetables within 30 days after application. Do not plant bulb or root vegetables within 60 days after application. Do not plant cotton, small cereal grains and all other crops not registered within one year application. Do not apply more than 32 fl oz of product per acre per season. **FRAC 3.**
	myclobutanil (Rally 40WSP)	2.5 to 5 oz	E^R	24 hr	24 hr	Rally is registered for control of leaf spot, leaf blight, and powdery mildew. Do not apply more than 30 oz of product per acre per year. **FRAC 3.**
	flutriafol (Rhyme)	5 to 7 fl oz	E^R	12 hr	0 days	Rhyme is registered for control of powdery mildew and for drip application to manage charcoal rot. Do not apply more than 4 applications per year. Do not apply more than 28 fl oz of product per acre per year. **FRAC 3.**
	quinoxyfen (Quintec)	4 to 6 fl oz	E	12 hr	1 day	Do not use more than 4 times per crop and no more than 2 times in a row. Do not apply more than 24 fl oz of product per acre per crop. Rotate with other mildewcides. Rotation to all other crops within 1 year after application, unless Quintec is registered for use on those crops, is prohibited. **FRAC 13.**
	cyflufenamid (Torino)	3.4 oz	VG	4 hr	0 days	Do not make more than 2 applications per year. Do not apply more than once every 14 days. Do not apply more than 6.8 oz of product per acre per calendar year or 0.44 lb of cyflufenamid per acre per calendar year.**FRAC U6.**
Powdery mildew and anthracnose fruit rot (acutatum)	azoxystrobin (Abound) [*other products available*]	6.0 to 15.5 fl oz *See labels*	E^R	4 hr *See labels*	0 days *See labels*	Do not apply more than 61.5 fl oz of Abound per acre per season. Do not apply more than 1.0 lb azoxystrobin per acre per season. See other product labels for product specific limits. See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 11.**
	pyraclostrobin + boscalid (Pristine)	18.5 to 23 oz	E^R	12 hr	0 days	Do not apply more than 115 oz of product per acre per year. See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 7 + 11.**
	fluopyram + trifloxystrobin (Luna Sensation)	4.0 to 7.6 fl oz	E^R	12 hr	0 day	Do not apply more than 27.1 fl oz of product per acre per year. See label for active ingredient limits per year. Do not use any FRAC 11 or 7 products more than twice per season for resistance management. **FRAC 7 + 11.**

Early Bloom (10%) and into Harvest: Disease Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Powdery mildew and anthracnose fruit rot (acutatum) (cont'd)	pyraclostrobin (Cabrio EG)	12 to 14 oz	E^R	12 hr	0 days	Do not apply more than 70 oz of product per acre per season. See label for active ingredient limits per season. See notes on page 26 to manage risk of developing fungicide resistance. **FRAC 11.**
	propiconazole (Tilt) [*other products available*]	4 fl oz See labels	G	12 hr *See labels*	0 days *See labels*	No more than 2 sequential applications should be made before alternating with fungicides that have a different mode of action. Not registered for anthracnose crown rot control. Do not apply more than 16 fl oz of Tilt per acre per year. Do not apply more than 4 applications of Tilt per year. Do not apply more than 0.45 lb of propiconazole per acre per year. See other product labels for product specific limits. **FRAC 3.**
	azoxystrobin + difenoconazole (Quadris Top)	12 to 14 fl oz	E^R	12 hr	0 days	No more than 2 applications should be made per season for resistance management. Do not apply more than 56 fl oz of product per acre per year. Do not apply more than 0.46 lb of difenoconazole per acre per year. Do not apply more than 1.0 lb of azoxystrobin per acre per year. **FRAC 11 + 3.**

Harvest: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Aphids	See **Pre-bloom to Harvest: Insect Management** recommendations.					
Leaf rolling caterpillars	Leaf rolling caterpillars are rarely pests in southeastern strawberries and should only be treated if feeding or webbing is on or near fruit.					
	Bacillus thuringiensis (Bt) (numerous products)	*See labels*	G	*See labels*	*See labels*	Many Bt formulations are **OMRI**-listed. **IRAC 11B2.**
	chlorantraniliprole (Coragen)	3.5 to 7.5 fl oz	E	4 hr	1 day	**IRAC 28.**
	methoxyfenozide (Intrepid)	6 to 12 fl oz	VG	4 hr	3 days	**IRAC 18.**
	spinosad (Entrust) (Success)	1 to 1.25 oz 4 to 6 fl oz	E	4 hr 4 hr	1 day 1 day	Rotate to a different class of insect control products after 2 successive applications of spinosad. Do not make more than 5 applications per year. Do not apply more than 9 oz of Entrust (0.45 AI of spinosad) per acre per crop. Entrust is **OMRI**-listed. **IRAC 5.**
Sap beetles	Cultural controls	N/A	important	N/A	N/A	Regular, thorough harvest will help minimize sap beetle populations. Sap beetles are attracted to the odor of overripe fruit, so keeping fruit picked clean will reduce problems. Sap beetles can also be attracted away from fields using bucket traps baited with overripe fruit or wheat bread dough. Bait bucket lures and culled strawberries must be **disposed of either off site or buried.** Insecticide treatments should only be used if thorough harvest is not possible (i.e., pick-your-own operations or inclement weather).
	novaluron (Rimon 0.83 EC)	12 fl oz	E	12 hr	1 day	Allow 7 days between applications. DO NOT apply more than 36 fl oz/acre per season. The use of adjuvants or surfactants is prohibited. **IRAC 15.**
Slugs and snails	See **Pre-bloom to Harvest: Insect Management** recommendations.					
Tarnished plant bugs	Tarnished plant bugs vary in their economic significance throughout the Southeast. Check with local Cooperative Extension personnel to determine if treatment is necessary. If tarnished plant bugs are present, the treatment threshold is generally very low.					
	bifenthrin (Brigade 10 WSB)	6.4 to 32 oz	G	12 hr	0 days	The use of broad-spectrum insecticides during bloom will damage honeybee populations. DO NOT apply when bees are foraging. Refer to label. **IRAC 3A.**
	fenpropathrin (Danitol 2.4 EC)	10.67 fl oz	G	24 hr	2 days	DO NOT make more than 2 applications. DO NOT apply when bees are foraging. **IRAC 3A.**

Harvest: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Tarnished plant bugs (cont'd)	novaluron (Rimon 0.83 EC)	9 to 12 fl oz	E	12 hr	1 day	Allow 7 days between applications. DO NOT apply more than 36 fl oz/acre per season. The use of adjuvants or surfactants is prohibited. **IRAC 15.**
Spotted wing drosophila	Spotted wing drosophila (SWD) larvae have been found in both fall and spring fruiting strawberries in the southeast, but SWD populations are highest during fall. Traps may be useful in determining if SWD treatments are necessary in spring fruiting strawberries. Check with local extension personnel for recommended monitoring methods. Preventative management is strongly recommended in fall fruit strawberries. If SWD is active during strawberry harvest, treat at least weekly and reapply treatments in the event of rain. **Materials effective against SWD are toxic to bees**. Apply SWD treatments in the evening or night, when bees are not actively foraging.					
	bifenthrin (Brigade 10 WSB)	6.4 to 32 oz	E	12 hr	0 days	The use of broad-spectrum insecticides during bloom will damage honeybee populations. DO NOT apply when bees are foraging. Refer to label. **IRAC 3A.**
	fenpropathrin (Danitol 2.4 EC)	10.67 fl oz	VG	24 hr	2 days	DO NOT make more than 2 applications. DO NOT apply when bees are foraging. **IRAC 3A.**
	malathion (Malathion 57 EC) [*other products available*]	1.5 to 3 pt *See labels*	G	12 hr *See labels*	3 days *See labels*	DO NOT apply when bees are foraging. DO NOT apply more than 3.2 pts in a single application and DO NOT make more than 4 applications per season. The minimum retreatment interval is 7 days. Higher rates may be needed for SWD control**. IRAC 1B.**
	spinetoram (Radiant SC)	6 to 10 fl oz	**E**	4 hr	1 day	**IRAC 5.**
	spinosad (Entrust 80 W)	1.25 to 2 oz	G	4 hr	1 day	If organic SWD management is needed, be careful not to use Entrust for other pests as there are limited applications per season. Rotate to a different class of insect control products after 2 successive applications of spinosad. Do not make more than 5 applications per year. Do not apply more than 9 oz of Entrust (0.45 AI of spinosad) per acre per crop. Entrust is **OMRI**-listed. **IRAC 5.**
Twospotted spider mites	Same as **Post-Planting: Insect Management** recommendations.					
Whiteflies	Whiteflies are rare in open field production, but they can reach damaging densities in high tunnel or greenhouse production. Some materials cannot be used in greenhouses; check labels carefully.					
	imidacloprid (Admire Pro)	1.3 fl oz	VG	12 hr	7 days	DO NOT apply when bees are foraging. **IRAC 4A**
	novaluron (Rimon 0.83 EC)	9 to 12 fl oz	VG	12 hr	1 day	Allow 7 days between applications. DO NOT apply more than 36 fl oz/acre per season. The use of adjuvants or surfactants is prohibited. Rimon use is prohibited in greenhouses. **IRAC 15**

Harvest: Insect Management						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness**	**REI**	**PHI**	**Comments**
Whiteflies (cont'd)	spiromesifen (Oberon 2 SC)	12 to 16 fl oz	VG	12 hr	3 days	Use only 3 applications per crop. Use in a minimum of 100 gal/acre. Oberon is also an effective miticide. The Oberon label does not prohibit use in greenhouses. **IRAC 23.**
	thiamethoxam (Actara)	3 to 4 oz	G	12 hr	3 days	Do not apply more than 12 oz/acre Actara; allow 10 days between applications. DO NOT apply when bees are foraging; after an Actara application, WAIT FIVE DAYS before placing beehives into treated fields. Actara use is prohibited in greenhouses. **IRAC 4A.**

Effectiveness of Various Chemicals for Strawberry Disease Management[1]

Fungicide[2]		FRAC Group	Relative Control Rating[3] (Very good (VG) and excellent (E) ratings are shaded.)												
			Angular leaf spot	Anthracnose crown rot (gloeosporioides)	Anthracnose fruit rot (acutatum)	Botrytis crown rot	Botrytis fruit rot	Common leaf spot	Leaf blight	Leather rot	Mucor fruit rot	Phytophthora crown rot	Powdery mildew[4]	Red stele root rot	Rhizopus rot
copper[P] (various)		M01	P	NC	NC	NC	NC	P	NC	P	NC	NC	NC	NC	NC
sulfur (various)		M02	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	G[R]	NC	NC
thiram (Thiram SC)		M03	NC	F	G	F	G	F	F	F	F	NC	NC	NC	F
captan (Captan 50W, others)		M04	NC	G	G	F	G	F	F	F	F	NC	NC	NC	F
thiophanate-methyl (Topsin M WSB)		1	NC	G[R]	NC	NC[R]	NC[R]	G	G	NC	XX	NC	F[R]	NC	NC
iprodione (Rovral 4F)		2	NC	NC	NC	VG	G[R]	G	NC	NC	XX	NC	NC	NC	NC
DMIs	flutriafol (Rhyme)	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	E[R]	ND	ND
DMIs	myclobutanil (Rally 40WSP)	3	NC	NC	NC	NC	NC	VG	VG	NC	NC	NC	E[R]	NC	NC
DMIs	triflumizole (Procure 480SC)	3	NC	NC	NC	ND	ND	ND	ND	NC	NC	NC	E[R]	NC	NC
DMIs	tetraconazole (Mettle 125ME)	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	E[R]	ND	ND
DMIs	propiconazole (Tilt, others)	3	NC	F	G	NC	NC	G	ND	NC	NC	NC	VG[R]	NC	NC
DMIs	thiophanate-methyl + propiconazole (Protocol)	1 + 3	NC	G[R]	G[R]	G[R]	G[R]	G	G	NC	XX	NC	G[R]	NC	NC
penthiopyrad (Fontelis)		7	NC	F	F	ND	E[R]	NC	NC	NC	NC	NC	G[R]	NC	NC
isofetamid (Kenja 400SC)		7	NC	NC	NC	ND	E[R]	NC	NC	NC	NC	NC	G[R]	NC	NC
fluopyram + pyrimethanil (Luna Tranquility)		7 + 9	NC	NC	NC	ND	E[R]	NC	NC	NC	NC	NC	G[R]	NC	NC
pyrimethanil (Scala)		9	NC	NC	NC	ND	G[R]	NC	NC	NC	NC	NC	NC	NC	NC
cyprodinil + fludioxonil (Switch 62.5WDG)		9 + 12	ND	G	G	VG	E	F	F	NC	ND	NC	ND	NC	ND
Strobilurins (QoIs)	azoxystrobin (Abound, others)	11	NC	G[R]	E[R]	ND	F[R]	F	NC	VG	NC	NC	E[R]	NC	NC
Strobilurins (QoIs)	pyraclostrobin (Cabrio EG)	11	NC	G[R]	E[R]	ND	F[R]	F	NC	VG	NC	NC	E[R]	NC	NC
Strobilurins (QoIs)	mandestrobin (Intuity)	11	ND	ND	P	ND	F[R]	ND	ND	ND	ND	ND	E[R]	ND	ND
Strobilurins (QoIs)	azoxystrobin + difenoconazole (Quadris Top)	11 + 3	NC	G[R]	E[R]	ND	F[R]	G	ND	F	NC	NC	E[R]	NC	NC
Strobilurins (QoIs)	azoxystrobin + propiconazole (Quilt Xcel)	11 + 3	NC	G[R]	E[R]	ND	F[R]	ND	ND	NC	NC	NC	E[R]	NC	NC
Strobilurins (QoIs)	pyraclostrobin + boscalid (Pristine)	11 + 7	NC	G[R]	E[R]	ND	G[R]	VG	VG	NC	ND	NC	E[R]	NC	ND
Strobilurins (QoIs)	pyraclostrobin + fluxapyroxad (Merivon)	11 + 7	NC	G[R]	E[R]	ND	E[R]	VG	VG	NC	ND	NC	E[R]	NC	ND
Strobilurins (QoIs)	trifloxystrobin + fluopyram (Luna Sensation)	11 + 7	NC	G[R]	E[R]	ND	E[R]	VG	VG	NC	ND	NC	E[R]	NC	ND
quinoxyfen (Quintec)		13	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	E	NC	NC
fenhexamide (Elevate 50 WDG)		17	NC	NC	NC	ND	E[R]	NC	NC	NC	NC	NC	NC	NC	NC

Effectiveness of Various Chemicals for Strawberry Disease Management[1]														
		Relative Control Rating[3] (Very good (VG) and excellent (E) ratings are shaded.)												
Fungicide[2]	**FRAC Group**	**Angular leaf spot**	**Anthracnose crown rot (gloeosporioides)**	**Anthracnose fruit rot (acutatum)**	**Botrytis crown rot**	**Botrytis fruit rot**	**Common leaf spot**	**Leaf blight**	**Leather rot**	**Mucor fruit rot**	**Phytophthora crown rot**	**Powdery mildew[4]**	**Red stele root rot**	**Rhizopus rot**
captan + fenhexamide (CaptEvate 68 WDG)	M04 + 17	NC	F	G	ND	E	G	F	F	F	NC	NC	NC	F
polyoxin D (Ph-D; OSO 5%SC)	19	ND	ND	ND	ND	G	ND	ND	ND	ND	ND	NC	ND	ND
cyflufenamid (Torino)	U06	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	VG	NC	NC
mefenoxam (Ridomil Gold SL, Ultra Flourish)	4	NC	NC	NC	NC	NC	NC	NC	VG[R]	NC	VG	NC	VG	NC
metalaxyl (MetaStar 2E, others)	4	NC	NC	NC	NC	NC	NC	NC	VG[R]	NC	VG	NC	VG	NC
phosphites (ProPhyt, Phostrol, others)	P07	NC	NC	NC	NC	NC	NC	NC	F	NC	F	NC	F	NC
fosetyl-AL (Aliette, others)	P07	NC	NC	NC	NC	NC	NC	NC	F	NC	F	NC	F	NC
acibenzolar-S-methyl (Actigard 50WG)	21	P	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BLAD (Fracture)	BM01	NC	ND	ND	ND	P	ND	ND	NC	ND	NC	F	NC	ND

[1] These ratings are benchmarks; actual performance will vary. Efficacy ratings do not necessarily indicate a labeled use for every disease.
[2] Fungicides are sorted generally by FRAC group. Fungicides targeting oomycetes are listed together near the end of the table followed by plant activators and biofungicides.
[3] Efficacy Ratings: The efficacy or importance of a management option is indicated by E = excellent, VG = very good, G = good, F = fair, P = poor, NC = no control, and ND = no data. XX indicates that use of this chemical can increase the disease.
[4] Certain fungicides, such as the QoI materials and Protocol, are registered and effective for powdery mildew, but are not recommended when only powdery mildew is present to avoid fungicide resistance selection in the anthracnose and *Botrytis* pathogens.
[P] Phytotoxicity could occur.
[R] Not effective if pathogen is resistant to the fungicide.

Plasticulture Weed Control: Preplant					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Annual grasses, broadleaf weeds, and yellow and purple nutsedge	Fumigation (See table on page 10.)	See labels	See labels	See labels	Annual grass and broadleaf weeds.
Yellow and purple nutsedge, annual broadleaf weeds, and annual grasses	EPTC (Eptam 7E)	3.5 to 7 pt	Apply to soil surface at least 45 days before planting.	12 hr	For best control of nutsedge, soil must have enough moisture for tuber sprouting. Allow 10 to 14 days for nutsedge tuber sprouting to occur, and then lightly till to destroy shoots and dry the soil surface. Apply and incorporate Eptam 7E to prevent volatilization; immediately incorporate into soil to a depth of approximately 2 to 4 inches. If possible use a leveling device behind the incorporating equipment to leave soil surface as smooth as possible. Field traffic, excessive rainfall or irrigation, and other soil disturbances will reduce the level of nutsedge suppression. To avoid injury to following crops, irrigating at least 30 days prior to planting is recommended. **MOA 8.**
Annual broadleaf weeds, including Carolina geranium and cutleaf evening primrose	oxyfluorfen (Goal 2 XL)	up to 2 pt	Apply to soil surface of pre-formed beds at least 30 days before transplanting.	24 hr	Plastic mulch should be applied soon after Goal application. Best results occur when plastic is applied immediately after herbicide application. Incorporation is not necessary, but it may result in less crop injury. Soil disturbance after application will reduce weed control. **MOA 14.**
Annual broadleaf weeds	acifluorfen (Ultra Blazer 2 L)	0.5 to 1.5 pt	Apply banded application to row prior to laying plastic mulch and after final land preparation, and prior to transplanting.	48 hr	**Crop row.** Make one banded application before laying plastic mulch and after final land preparation, and prior to transplanting the crop. For best results, avoid soil disturbance during laying of plastic and planting of crop. **MOA 14.**
Annual broadleaf weeds including cutleaf evening primrose, henbit, chickweed, horseweed, pigweed species, wild radish and suppression of some annual grasses	flumioxazin (Chateau SW 51 WDG)	3 oz	Apply to soil surface of pre-formed beds at least 30 days before transplanting.	12 hr	**Crop row.** Apply a minimum of 30 days prior to transplanting and prior to plastic mulch being laid. **MOA 14.**

Plasticulture Weed Control: Preplant					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Broadleaf weeds including common chickweed, redroot and smooth pigweed, common lambsquarters and some annual grasses	napropamide (Devrinol and Devrinol 2-XT 2 EC) (Devrinol and Devrinol DF-XT 50 DF)	8 qt 8 lb	Apply to soil surface of pre-formed beds before laying plastic mulch.	24 hr	Devrinol applied to the bed before laying the plastic has potential to injure strawberry plants. For plant bed treatment preplant incorporate to weed-free soil before laying plastic mulch. Soil should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 inches. Incorporate within 24 to 72 hr (depending on formulation) of application before laying plastic mulch. If weed pressure is from small-seeded annuals, apply Devrinol to the surface of the bed immediately before laying the plastic mulch. If soil is dry, water or sprinkler irrigate with sufficient water to wet to a depth of 2 to 4 inches before laying the plastic mulch. Apply the plastic mulch over the treated soil within 24 to 72 hr. **MOA 15.**
Yellow nutsedge, purple nutsedge, corn spurry, yellow woodsorrel, henbit, chickweed	sulfentrazone (Spartan 4F)	4 to 8 oz (see label for soil restrictions)		12 hr	Apply prior to planting and before weeds have emerged. Please refer to label for soil type restrictions. **MOA 14.**

Plasticulture Weed Control: Postemergence					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Broadleaf weeds including ragweed, clover, vetch, curly dock, dandelion, sowthistle, thistle, red sorrel, and nightshade	clopyralid (Stinger 3 EC)	**Crop row:** 0.33 to 0.5 pt **Row middle:** 0.33 to 0.67 pt	Apply after strawberry plants are established and at least 30 days before harvest.	12 hr	**The Stinger registration in strawberry is issued on a state-by-state basis; therefore, it may NOT be registered for use in all states.** DO NOT apply within 30 days of harvest. DO NOT use a surfactant or apply in combination with other pesticides or crop injury may occur. DO NOT apply as a broadcast application. DO NOT compost treated vegetation if compost will be used on sensitive plants. **MOA 4.**
Annual and perennial grasses	clethodim (Arrow, Clethodim, Intensity, Select 2EC) (Intensity One, Select Max 1EC)	6 to 8 oz 9 to 16 oz	Newly planted or established plantings	12 hr	Use high rate and sequential applications for perennial grasses (bermudagrass or johnsongrass). The addition of a nonionic surfactant at 0.25 % v/v (1 qt per 100 gal of spray solution) or crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution) is required for optimum results. Do not apply within 4 days of harvest. With Select Max, add 0.25% nonionic surfactant (1 qt per 100 gal spray mix. **MOA 1.**
Annual and perennial grasses	sethoxydim (Poast 1.5 EC)	1 to 1.5 pt	Newly planted and established plantings	12 hr	Sequential applications will be necessary for perennial grass control. The addition of a nonionic surfactant (1 qt per 100 gal of water) or crop oil concentrate (1 gal per 100 gal of water) is necessary for optimum results. Do not apply within 7 days of harvest. Total use cannot exceed 2.5 pt per acre per year. **MOA 1.**

Plasticulture Weed Control: Row Middles					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Small seeded annual broadleaf weeds including common chickweed, redroot and smooth pigweed, common lambsquarters and some annual grasses	napropamide (Devrinol DF-XT 50 DF, Devrinol 50 DF) (Devrinol 2-XT 2 EC)	8 lb 8 qt	Do not apply post-transplant if new foliage is exposed to spray.	24 hr	Apply as a banded preemergence treatment to the middles between plastic before weed emergence. Tank mixture with paraquat will provide preemergence and postemergence weed control. Rainfall or irrigation within 24 hr after Devrinol application is needed for optimum control. Effective on volunteer small grains (wheat, etc.) if applied before emergence. **MOA 15.**
Annual grasses and small seeded broadleaf weeds	pendimethalin (Prowl H_2O 3.8 EC)	1.5 pt	Do not apply post-transplant if new foliage is exposed to spray.	24 hr	Avoid contact with strawberry plant. See label for more information. PHI = 35 days. **MOA 3.**
Annual broadleaf weeds	acifluorfen (Ultra Blazer 2 L)	0.5 to 1.5 pt	Apply with a shielded sprayer to middles between plastic.	48 hr	DO NOT ALLOW ULTRA BLAZER TO CONTACT STRAWBERRY PLANTS. Apply as a direct-shielded application. **MOA 14.**
Annual broadleaf weeds including cutleaf evening primrose, henbit, chickweed, horseweed, pigweed species, wild radish and suppression of some annual grasses	flumioxazin (Chateau SW 51 WDG)	3 oz	Apply with a hooded or shielded sprayer to middles between plastic.	12 hr	Apply for preemergence weed control in the middles. DO NOT APPLY AFTER FRUIT SET. Do not allow spray solution to come in contact with fruit or foliage. Spotting may occur. May kill or injure ryegrass in middles. **MOA 14.**
Nonselective weed control	glyphosate (various formulations)	See labels	Apply with hooded sprayer or wiper applicator.	4 hr	To prevent SEVERE crop injury, use application equipment and technique that will prevent contact with any portion of the crop or plastic. Do not apply within 14 days of harvest. **MOA 9.**
	paraquat (Firestorm, Parazone 3 SL) (Gramoxone SL 2L)	1.3 pt 2 pt	Apply with hooded sprayer or shields to protect crop.	12 hr	Contact kill of all green foliage. Do not allow drift or spray solution to contact crop or severe injury or crop death will occur. The addition of a nonionic surfactant at 0.25 % v/v (1 pt per 50 gal of spay solution) is required for optimum results. Apply in a minimum spray volume of 20 gal per acre. Do not make more than 3 applications per year. **MOA 22.**
	pelargonic acid (Scythe 4 EC)	3 to 10% v/v	Apply with hooded or shielded sprayer for weed control in row middles.	12 hr	Product is a nonselective, contact herbicide with foliar activity. May be tank mixed with soil residual herbicides for extended weed control. Avoid contact with strawberry plant or severe injury will occur. **MOA 27.**

Plasticulture Weed Control: Row Middles					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Annual broadleaf weeds. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. in diameter	carfentrazone (Aim 2 EC, Aim 1.9 EW)	up to 2 oz	Apply with hooded sprayer to middles between plastic.	12 hr	Apply post-directed using hooded sprayer for control of emerged weeds in row middles. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 inches tall or rosettes less than 3 inches across. Use a crop oil concentrate at up to 1 gal per 100 gal solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grass weeds. **MOA 14.**

Matted Row Weed Control: Preplant					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Annual grasses, broadleaf weeds, and yellow and purple nutsedge	Fumigation (See table on page 10.)	See labels	See labels	See labels	See labels for rates, plant-back intervals, and personal protective equipment requirements.

Matted Row Weed Control: Preemergence					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Annual grasses and small-seeded broadleaf weeds including common chickweed, field pansy	DCPA (Dacthal 6 L) (Dacthal 75-W)	 8 to 12 pt 8 to 12 lb	Newly planted and established plantings before bloom	12 hr	Apply to the soil prior to planting. Can be preplant incorporated. Apply to established plantings in fall to early spring prior to first bloom. **MOA 3.**
Annual grasses and small-seeded broadleaf weeds	napropamide (Devrinol, Devrinol 2-XT 2 EC) (Devrinol, Devrinol DF-XT 50 DF)	8 qt 8 lb	Established strawberries	12 hr	Apply any time prior to weed emergence except for the interval between bloom and harvest. Rainfall or irrigation within 24 hr is needed for optimum weed control. See XT labels for information regarding delay in irrigation event. **MOA 15.**
Annual broadleaf weeds and grasses including chickweed, henbit, annual pepperweed, Shepherd's purse	terbacil (Sinbar 80 WDG)	See label	Newly planted and established plantings	12 hr	See label for soil type and organic matter content restrictions. For winter weed control, apply 2 to 6 oz per acre in late summer or early fall. If strawberry plants are not dormant, the application must be followed immediately by 0.5 to 1 inches of overhead irrigation or rainfall. For extended control through harvest the following year, apply 2 to 4 oz per acre prior to mulching in late fall. In established plantings, apply 4 to 8 oz post-harvest renovation before new growth begins in mid-summer. For extended weed control through harvest the following year, apply 4 to 8 oz per acre prior to mulching in late fall. Do not apply within 110 days of harvest. See label for more information. **MOA 5.**
Annual broadleaf weeds including yellow rocket, shepherd's purse, Virginia pepperweed, common chickweed, common groundsel	acifluorfen (Ultra Blazer 2L)	0.5 to 1.5 pt	Apply after the last harvest or following bed renovation or when plants are dormant.	48 hr	Two applications can be made. Do not apply the last application within 120 days of strawberry harvest. **MOA 14.**
Annual broadleaf weeds	flumioxazin (Chateau SW 51 WDG)	3 oz	Apply with hooded or shielded sprayer to row middles.	12 hr	DO NOT spray over top of strawberries. Apply prior to weed emergence. Crop spotting may occur if spray contacts the crop. DO NOT apply after fruit set. **MOA 14.**

Matted Row Weed Control: Preemergence					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Yellow nutsedge, purple nutsedge, corn spurry, yellow woodsorrel, henbit, chickweed and other broadleaf weeds	sulfentrazone (Spartan 4F)	4 to 8 oz (see label for soil restrictions)	Preplant	12 hr	See label for soil type and organic matter content restrictions. Do not apply after the crop has been transplanted or serious injury may occur. **MOA 14.**

Matted Row Weed Control: Postemergence					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Broadleaf weeds including ragweed, clover, vetch, dock, cocklebur, dandelion, red sorrel, sowthistle, thistle, and nightshade	clopyralid (Stinger 3 EC)	0.33 to 0.67 pt	Newly planted and established plantings	12 hr	**The Stinger registration in strawberry is issued on a state-by-state basis. Therefore, it may NOT be registered for use in all states using this guide.** Apply in the spring before harvest or post-harvest. Do not apply within 30 days of harvest. Do not use a surfactant or apply in combination with other pesticides. **MOA 4.**
Broadleaf weeds	2, 4-D amine (2,4-D Amine 4 SL)	2 to 3 pt	Established plantings	48 hr	Apply to well-established strawberries after harvest and before runners form or when crop is dormant. Not more than two treatments per year. Do not apply during bud, flower, or fruit stage. Timing is very critical to avoid damage. Do not apply unless possible injury to the crop is acceptable. **MOA 4.**
Annual broadleaf weeds	pelargonic acid (Scythe 4 EC)	3 to 10% v/v	Apply as a directed or shielded spray.	12 hr	Product is nonselective, contact herbicide with foliar activity. May be tank mixed with soil residual herbicides for extended weed control. Avoid contact with strawberry plant or severe injury will occur. **MOA 27.**
Contact kill of all green foliage	paraquat (Firestorm, Parazone 3 SL) (Gramoxone SL 2L)	1.3 pt 2 pt	Apply with hooded sprayer or shields to protect crop.	12 hr	Contact kill of all green foliage. Do not allow drift or spray solution to contact crop or severe injury or crop death will occur. The addition of a non-ionic surfactant at 0.25 % v/v (1 pt/50 gal. of spay solution) is required for optimum results. Apply in a minimum spray volume of 20 gal. per acre. Do not make more than 3 applications per year. **MOA 22.**

Matted Row Weed Control: Postemergence					
Weed	**Management Options**	**Amount of Formulation per Acre**	**Crop Age Restrictions**	**REI**	**Comments**
Annual and perennial grasses	clethodim (Select, Clethodim, Arrow, Intensity 2 EC) (Select Max, Intensity One 1 EC)	6 to 8 oz 9 to 16 oz	Newly planted or established plantings	12 hr	Use high rate, and sequential applications are for perennial grasses (bermudagrass or johnsongrass). The addition of a non-ionic surfactant at 0.25 % v/v (1 qt/100 gal. of spray solution) or crop oil concentrate at 1% v/v (1 gal per 100 gal. of spray solution) is required for optimum results. Do not apply within 4 days of harvest. With Select Max, add 0.25% non-ionic surfactant, 1 qt per 100 gal spray mix. **MOA 1.**
	fluazifop (Fusilade DX)	12 to 24 oz	Newly planted (non-bearing only)	12 hr	Sequential applications will be necessary for perennial grass control. The addition of a non-ionic surfactant (1 qt/100 gal of water) or crop oil concentrate (1 gal/100 gal of water) is necessary for optimum control. **MOA 1.**
	sethoxydim (Poast 1.5 EC)	1 to 1.5 pt	Newly planted and established plantings	12 hr	Sequential applications will be necessary for perennial grass control. The addition of a non-ionic surfactant (1 qt/100 gal of water) or crop oil concentrate (1 gal/100 gal. of water) is necessary for optimum results. Do not apply within 7 days of harvest. Total use cannot exceed 2.5 pt/acre. **MOA 1.**

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Samuel Pardue, Dean and Director