

Commercial Crop Production: Fruit and Nut Crops

Apple

Integrated Apple Disease Management

Many diseases commonly occur on apples and can reduce flowering and the quality of the fruit in Louisiana. Disease management depends largely on the care and attention that trees are given throughout their lifetime. Achieving “store quality” apples in Louisiana is very difficult due to year-round hot and humid conditions, and they usually require an intensive fungicide and insecticide spray program. Planting resistant varieties is one of the best ways to reduce many of these disease problems. For many apple diseases, good sanitation practices are also essential for disease management.

Plant resistant cultivars: Apple scab is the most widespread and destructive disease of apples in North America. Selecting cultivars that are resistant or tolerant to apple scab is recommended, especially in southern Louisiana where warm and humid conditions favor disease development. Fire blight is also a major apple disease, and thus planting varieties with resistance is strongly recommended.

Use good sanitation practices: Certain foliage diseases and fruit rots overwinter on leaves, twigs, and fruits. Raking leaves that have fallen on the ground and burning them will help reduce the severity of apple scab the following year. Prune dead and diseased limbs from trees infected with fire blight to prevent the spread of the bacterium in the early spring. Removing dead or rotting fruit from the trees and ground will slow bitter rot development the following season.

Ensure good spray coverage: Uniform spray coverage is essential for good disease management and, to a lesser extent, for insect control. A large air blast sprayer (speed sprayer) has proven very satisfactory for treating large acreages of apple trees.

Use registered chemicals: The potential for developing isolates of pathogens resistant to fungicides is high in apple production. To slow the development of resistant pathogen populations: 1) develop a spray program that uses fungicides with different modes of action; 2) avoid consecutive sprays with fungicides with the same or similar modes of action; and 3) only use the labeled rates of recommended fungicides. More information about fungicide-resistance management can be found in the front of this guide.

Disease

Symptoms, source of inoculum and management of apple diseases.

Disease	Symptoms	Source of Inoculum	Management
Apple scab (<i>Venturia inaequalis</i>)	Scab may occur on leaves, fruit, leaf and fruit stems and green twigs. Infections of the leaves and fruit are most common and obvious. Leaf spots are diffuse, brown-to-olive green in color and often have a velvety texture. Fruit lesions are dark brown and corky-like.	Infected leaves that have fallen to the ground. Spores are wind dispersed.	The use of resistant varieties is the most effective means for avoiding apple scab disease. Pruning to establish an open canopy will allow air to move through the tree and dry leaves quickly. Rake and burn fallen leaves. Follow the apple spray schedule.
Armillaria root rot (<i>Armillaria</i> spp.)	Trees appear weak with small, yellowish leaves over the entire tree or confined to one or two branches. The entire tree or single branches may die by the end of the summer or the next year. White mycelial growth can be found beneath the bark of roots or base of affected trees at or about the time of death.	These fungi live in soil and survive for many years in old, diseased roots.	Dig up and burn old roots before planting new trees. Remove dead trees and as many roots as possible. Fumigate before replanting.
Bitter rot (<i>Glomerella cingulata</i> = <i>Colletotrichum gloeosporioides</i>)	Although infection can occur at any stage of fruit development, most infections occur after mid-season as the fruit approaches maturity. The disease is characterized by sunken (more or less), soft and watery, pinkish to brown rotten spots on the fruit. The rotten tissue has a bitter taste.	The fungus survives from season to season in mummified fruit and in dead wood and cankers. Fungal spores are dispersed primarily in splashing water, and disease develops best under warm, moist conditions.	Remove mummified fruit and prune dead wood. Follow the apple spray schedule; late cover sprays are important.
Cedar apple rust (<i>Gymnosporangium juniperi-virginianae</i>)	Galls or “cedar apples” are produced on eastern red cedar and yellow-orange spots are produced on the leaves and fruit of apples and crabapples.	The fungus survives from season to season on the familiar “cedar apples” on eastern red cedar. Windborne spores are produced during periods of rain in the spring.	Rust can be avoided by eradicating cedar trees within two miles of apples. Follow the apple spray schedule.
Fire blight (<i>Erwinia amylovora</i>)	Affects blossoms, leaves, twigs, and young fruit. Infected blossoms wilt suddenly and turn dark brown, followed by blighting of leaves and terminals. Infected twigs and leaves turn dark brown to black, and leaves cling to the stem, often remaining attached most of the season.	The bacteria overwinter at the base of blighted twigs or in cankers on larger limbs. Bacteria are spread by bees and splashing rain.	Spray during bloom with copper fungicides or streptomycin according to manufacturer’s directions. Prune out and burn infected twigs. Cut 12-15 inches below affected tissue. Dip pruning tools in 10% chlorine bleach solution between cuts.

Disease	Symptoms	Source of Inoculum	Management
Powdery mildew (<i>Podosphaera leucotricha</i>)	Affects young green tissues and young blossoms. Yellowing of the upper side of young leaves. Infected leaves may crinkle, curl, or roll upwards. Premature dropping of severely infected leaves. White fungal growth on leaves, petioles and shoots is a sign of the powdery mildew pathogen.	Developing buds become infected and overwinter as fungal strands. Disease is apparent on leaves and flower buds as they emerge in the spring.	The use of resistant varieties is the most effective means for avoiding powdery mildew disease. A strict fungicide spray program is required when susceptible varieties are planted.
Phytophthora crown, collar and root rot (<i>Phytophthora</i> spp.)	Foliar symptoms include thinning of the canopy, poor shoot growth and gradual decline. Removal of the outer bark reveals a reddish-brown to brown decay of the phloem and cambium with distinct margins between diseased and healthy tissue.	These pathogens are soil-borne organisms.	Use a combination of practices, including proper site selection, improving drainage and managing soil water, using resistant rootstocks and preventative applications of selected fungicides.

Table 1: Recommended pesticides, rates and pesticide use restrictions for apple scab (*Venturia inaequalis*).

Product Choices	Product Mode of Action Group	Rate	PHI	Maximum Use
copper hydroxide (various products)	M	See labels	1-2	See labels
MasterCop ¹	M	See label	See label	See label
Double Nickel 55OG	N/A	0.25-3 lb	0	N/A
Fontelis	29	16-20 fl oz	28	61 fl oz
Indar2F	3	6-8 fl oz	14	32 fl oz
Inspire Super	9, 3	12 fl oz	14	60 fl oz
Luna Sensation	7, 11	4-5.8 fl oz	14	21 fl oz
Omega 500F	7	10-13.8 fl oz	28	8.625 pt
PH-D (suppression only)	19	6.2 oz	0	6 app
Pristine	7, 11	14.5-18.5 oz	0	74 oz
Procure 480SC	3	8-16 fl oz	14	64 fl oz
Rally 40WSP	3	5-8 oz	14	5 lb
Rally 40WSP (post-infection)	3	8 oz	14	5 lb
Scala (applied alone)	9	7-10 fl oz	72	40 fl oz
Scala (tank mixed)	9	5 fl oz	72	40 fl oz
Sovran	11	3.2-6.4 oz	30	25.6 oz
Serenade ^{OG}	44	2-6 qt	0	N/A
Serenade MAX ^{OG}	44	1-3 lb	0	N/A
Sulfur (various products)	M	See labels	1	See labels
Thiophanate-methyl 85WDG	1	0.6-0.8 lb	3	3.3 lb
Topsin 4.5FL	1	15-20 fl oz	1	80 fl oz
Topsin M WSB	1	0.75-1 lb	1	4 lb
T-Methyl 4.5F	1	15-20 oz	1	4 lb
T-Methyl 70WSB	1	1 lb	1	4 lb
Incognito 4.5F	1	15-20 fl oz	1	80 fl oz
Cercobin	1	16-21.8 fl oz	1	87.2 fl oz
Topguard Specialty Crops	3	13 fl oz	14	52 fl oz
Vacciplant ³	N/A	14 fl oz	See label	See label
Ziram 76DF	M	6-8 lb	14	56 lb

^{OG} Indicates a pesticide that has been listed by the Organic Materials Review Institute (OMRI) as approved for use in organic production.

¹ Rates vary depending on the time of application (i.e., fall, late dormant, growing season, etc.).

² Registered for nonbearing fruits and nuts only.

³ Apply with another registered bactericide or fungicide.

Table 2: Recommended pesticides, rates and pesticide use restrictions for bitter rot (*Colletotrichum gloeosporioides*).

Product Choices	Product Mode of Action Group	Rate	PHI	Maximum Use
Adament 50WG	3, 11	4-6 oz	75	22 oz
captan (various products)	M	See labels	0	See labels
copper hydroxide (various products)	M	See labels	2-Jan	See labels
Double Nickel 55 ^{OG}		0.25-3 lb	0	
Flint 50WP	11	2-2.5 oz	14	11 oz
Luna Sensation	7, 11	4-5.8 fl oz	14	21 fl oz
Merivon	7, 11	4-5.5 fl oz	0	22 fl oz
Omega 500F	29	13.8 fl oz	28	8.625 pt
Pristine	7, 11	14.5-18.5 oz	0	74 oz
Scholar SC (post-harvest drench)	12	10-16 fl oz/100 gal	0	1 app
Serenade ^{OG}	44	2-6 qt	0	
Serenade MAX ^{OG}	44	1-3 lb	0	
Thiophanate-methyl 85WDG	1	0.6-0.8 lb	3	3.3 lb
Ziram 76DF	M	6-8 lb	14	56 lb

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Table 3: Recommended pesticides, rates and pesticide use restrictions for cedar apple rust (*Gymnosporangium juniperi-virginianae*).

Product Choices	Product Mode of Action Group	Rate	PHI	Maximum Use
Adament 50WG	3, 11	4-6 oz	75	22 oz
Double Nickel 55 ^{OG}		0.25-3 lb	0	
Flint	11	2-2.5 oz	14	11 oz
Fontelis	7	16-20 fl oz	28	61 fl oz
Indar 2F	3	6-8 fl oz	14	32 fl oz
Inspire Super	9, 3	12 fl oz	14	60 fl oz
Luna Sensation	7, 11	4-5.8 fl oz	14	21 fl oz
mancozeb (various products)	M	See labels	See labels	See labels
Merivon	7, 11	4-5.5 fl oz	0	22 fl oz
Omega 500F	29	13.8 fl oz	28	8.625 pt
Pristine	7, 11	14.5-18.5 oz	0	74 oz
Procure 480SC	3	8-16 fl oz	14	64 fl oz
Inspire Super MP	3	4 fl oz	72	20 fl oz
Propicon 3.6EC ²	3	4 fl oz	See label	20 fl oz
Topaz ²	3	4 fl oz	See label	20 fl oz
Rally 40WSP	3	5-8 oz	14	5 lb
Serenade ^{OG}	44	2-6 qt	0	
Serenade MAX ^{OG}	44	1-3 lb	0	
Sovran	11	3.2-6.4 oz	30	25.6 oz
Topguard Specialty Crops	3	8-12 fl oz	14	56 fl oz
Ziram 76DF	M	6-8 lb	14	56 lb

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Table 4: Recommended pesticides, rates and pesticide use restrictions for fire blight (*Erwinia amylovora*).

Product Choices	Product Mode of Action Group	Rate	PHI	Maximum Use
Agri-mycin 17	25	24-48 oz	50	See label
Aliette WDG	33	2-5 lb	14	20 lb
copper hydroxide (various products)	M	See labels	2-Jan	See labels
Copper sulfate crystals	M	5 lb	See label	See label
Cuprofix Ultra 40	M	5-7.5 lb	See label	40 lb
MasterCop ¹	M	See label	See label	See label
Double Nickel 55 ^{OG}		0.25-3 lb	0	
mancozeb (various products)	M	See labels	See labels	See labels
Mankocide	M	8-16 lb	77	See label
Nordox	M	1-16 lb	1	See label
Alude	33	1-2 qt	0	
Confine Extra	33	1-3 qt/100 gal		
K-Phite 7LP	33	2-8 qt/20 gal		
Phostrol	33	2.5-5 pt		
Fosphite	33	1-3 qt	0	
Fungi-phite	33	2-4 pt	0	
Rampart	33	1-3 qt/100 gal		
Serenade ^{OG}	44	2-6 qt	0	
Serenade MAX ^{OG}	44	2-3 lb	0	
Vacciplant ³		14 fl oz	See label	See label

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Table 5: Recommended pesticides, rates and pesticide use restrictions for Phytophthora crown, collar and root rot (*Phytophthora* spp.).

Product Choices	Product Mode of Action Group	Rate	PHI	Maximum Use
Aliette WDG (root dip)	33	3 lb/100 gal	0	1 app
Aliette WDG (foliar)	33	2.5-5.0 lb	14	20 lb
MasterCop ¹	M	1.5 pt	0	1 app
Ridomil Gold	4	2 qt		2 app
Metastar 2E	4	2 gal		2 app
Metalaxyl 2E AG	4	2 gal		2 app
Ultra Flourish	4	8 pt		1 app
Alude	33	0.67 fl oz/gal	See label	
Confine Extra (root dip)	33	0.67 fl oz/gal	See label	1 app
K-Phite 7LP (root dip)	33	2.5-5 pt	See label	1 app
Phostrol	33	2 qt/100 gal	See label	
Rampart (root dip)	33	1-3 qt/100 gal	See label	
Rampart (foliar)	33	1-3 qt/100 gal	See label	

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³ Apply with another registered bactericide or fungicide.

Table 6: Recommended pesticides, rates and pesticide use restrictions for powdery mildew (*Podosphaera leucotricha*).

Product Choices	Product Mode of Action Group	Rate	PHI	Maximum Use
Double Nickel 55 ^{OG}		0.25-3 lb	0	
Fontelis	7	16-20 fl oz	28	61 fl oz
Indar 2F	3	6-8 fl oz	14	32 fl oz
Inspire Super	9, 3	12 fl oz	14	60 fl oz
Luna Sensation	7, 11	5-5.8 fl oz	14	21 fl oz
PH-D	19	6.2 oz	0	6 app
Procure 480SC	3	8-16 fl oz	14	64 fl oz
Rally 40WSP	3	5-10 oz	14	5 lb
SerenadeOG	44	2-6 qt	0	
Serenade MAX ^{OG}	44	1-3 lb	0	
sulfur (various products)	M	See labels	1	See labels
Thiophanate-methyl 85WDG	1	0.6-0.8 lb	3	3.3 lb
Topsin 4.5FL	1	15-20 fl oz	1	80 fl oz
Topsin M WSB	1	0.75-1 lb	1	4 lb
T-Methyl 4.5Ag	1	15-20 oz	1	4 lb
T-Methyl 70WSB	1	1 lb	1	4 lb
Incognito 4.5F	1	15-20 fl oz	1	80 fl oz
Cercobin	1	16-21.8 fl oz	1	87.2 fl oz
Topguard Specialty Crops	3	8-12 fl oz	14	56 fl oz
Inspire Super MP	3	4 fl oz	72	20 fl oz
Propicon 3.6EC ²	3	4 fl oz	See label	20 fl oz
Topaz ²	3	4 fl oz	See label	20 fl oz

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¹ Rates vary depending on the time of application (i.e., fall, late dormant, growing season, etc.).

² Registered for nonbearing fruits and nuts only.

³ Apply with another registered bactericide or fungicide.

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