



1979 Missouri Commercial Apple Spray Schedule

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These recommendations are intended to serve as guidelines for commercial apple growers in Missouri. The pesticides and application rates listed for any given pest problem are based on their effectiveness, economy, safety and general integration into control programs for other pests present at or about the same time. The choice of which chemicals to use, when to use them, and how they are applied must be made by the individual grower relative to his own experience, equipment and special problems associated with his orchards. The effective and efficient use of all pesticides requires careful selection of the most appropriate material and the rate required, critical timing of the application(s), and uniform, thorough coverage of the trees.

PESTICIDE SAFETY

Responsible use of pesticides also includes their safe storage and handling. Most pesticides are poisonous to people and animals. Handle them with care. Store them only in their original, labeled containers in a dry, locked location out of the reach of children and animals.

READ THE LABEL! Understand it. Know the toxicity of the material you are using and wear the appropriate protective clothing. The greatest hazard with most pesticides occurs during the loading operation before the spray is applied. With highly toxic wettable powder (WP) formulations, empty containers carefully into the tank to avoid undue exposure to the dust; with liquid formulations, avoid splashing and spillage while measuring or making additions to the spray tank.

Avoid contaminating lakes, streams or ponds with any pesticide. Do not clean sprayers or dump excess spray mixtures near any such water supply. Avoid contaminating any crop used for forage or feed by drift of sprays out of the orchard.

RECOMMENDED RATES OF APPLICATION

The correct amount of pesticide required for control in any given orchard is that amount contained in a volume of the recommended dilute mixture which, when applied as a foliar spray, is sufficient to allow some run-off. Amounts applied in excess of this volume are wasted,

and volumes of dilute spray less than that required for run-off commonly result in reduced pest control.

The dilute rates listed in these recommendations are based on a standard application of 400 gallons per acre to mature, standard apple trees in full leaf (approx. 20 feet tall and planted 35-40 trees per acre). Thus, for a pesticide recommended for use at a concentration of 1 lb per 100 gallons of dilute spray, 4 lbs of the material should be applied per acre of standard orchard as described above. (Smaller trees, requiring only 200 gallons to reach the run-off point, would require 2 lbs of the same material per acre).

Experience has shown that the same amount of chemical normally applied as a dilute spray can be applied as a low volume (LV) spray using 1/3 or less the normal dilute volume. However, since little or no run-off occurs in LV applications, less total chemical should be applied per acre than in dilute sprays in order to avoid deposits in excess of that needed for control. LV rates are generally calculated (with some exceptions) by multiplying the dilute rate by the gallons per acre of dilute spray required and then subtracting 25% to adjust for the lack of run-off.

Excess run-off in dilute spraying and deposits in excess of that needed for control in low volume spraying are both economically and ecologically unsound.

'PESTICIDE CERTIFICATION' FOR GROWERS

Missouri's pesticide law went into effect October 21, 1976. This law requires certification for commercial and private applicators to purchase and apply restricted use pesticides as defined by the Environmental Protection Agency. Since several pesticides used routinely by fruit growers are potential restricted use materials, it is highly desirable that each grower become certified.

Commercial applicators (all applicators who apply pesticides for hire) must pass an examination administered by the Missouri State Department of Agriculture. Private applicators are required to attend a training program, but are not required to pass an examination. Training sessions are offered to both commercial and private applicators by the University of Missouri Cooperative Extension Service. Contact your local Extension Specialist for further information.

Timing & Major Pests Involved	Materials To Use	Varieties To Treat*	Dilute Rate Per 100 Gals.	Low Volume Rate Per Acre	Comments and Special Precautions
DORMANT					
Aphids Mites Scale	SUPERIOR OIL 70 sec	JRG	3 gal.	Not Recommended	Apply OIL at least one week before green tip when the buds are still dormant. Thorough coverage is essential, especially in the tree tops. <i>This spray can be omitted if OIL is applied later at green-tip (see below).</i>
GREEN TIP TO 1/2-INCH GREEN					
Fireblight	STREPTOMYCIN 17%	J	1/2 lb.	2 lb.	Do not apply STREPTOMYCIN in less than 70 nor in more than 400 gals. of water per acre. BENOMYL is an effective antisporegic against both the apple scab and the powdery mildew pathogens. The use of OIL with BENOMYL increases the effectiveness of this material. MANCOZEB is effective against scab but not powdery mildew. See note on use of DIFOLATAN for apple scab.
Powdery mildew Scab	BENOMYL 50W + MANCOZEB 80W	JRG	3 oz. 3/4 lb.	9 oz. 2 1/4 lb.	
	or MANCOZEB 80W	RG	1 1/2 lb.	4 1/2 lb.	
Aphids Mites Scale	SUPERIOR OIL 70 sec	JRG	2 gal.	6 gal.	
TIGHT CLUSTER TO FIRST PINK					
Fireblight	STREPTOMYCIN 17%	J	1/2 lb.	2 lb.	Tight cluster is the most critical time for early powdery mildew control. BENOMYL + OIL is the most effective combination. Note reduction in the amount of OIL. REGULAID or GLYODIN at 1 pt. per 100 gals. can be used in place of the oil. For LV sprays, the oil can be mixed to give 3 qts. per acre, but the REGULAID or GLYODIN should be added only on a volume basis—do not concentrate.
Powdery mildew Scab	BENOMYL 50W + MANCOZEB 80W	JRG	3 oz. 3/4 lb.	9 oz. 2 1/4 lb.	
Cedar apple rust	+ SUPERIOR OIL 70 sec		1 qt.	3 qt.	
	or MANCOZEB 80W	RG	1 1/2 lb.	4 1/2 lb.	
FULL PINK					
Fireblight	STREPTOMYCIN 17%	J	1/2 lb.	2 lb.	See comments on use of OIL, REGULAID, or GLYODIN above. Use of DIKAR for scab, rust and powdery mildew should be deferred until after bloom due to adverse effects on blossoms and fruit set.
Powdery mildew Scab	BENOMYL 50W + MANCOZEB 80W	JRG	3 oz. 3/4 lb.	9 oz. 2 1/4 lb.	
Cedar apple rust	+ SUPERIOR OIL 70 sec		1 qt.	3 qt.	
	or MANCOZEB 80W + SULFUR mfw	J	1 lb. 6 lb.	3 lb. 18 lb.	
	or MANCOZEB 80W	RG	1 1/2 lb.	4 1/2 lb.	
Aphids Plant bugs Leafrollers Mites	GUTHION 50W + PHOSPHAMIDON 8EC	JRG	1/2 lb. 1/4 pt.	1 1/2 lb. 3/4 pt.	This is a critical spray for insects—apple aphids can be troublesome at this time. Effective control of rosy apple aphids with later sprays is doubtful. Control of plant bugs and the early hatch of European red mites at this time reduces the need for additional sprays later.
	or DEMETON 26E		3/4 pt.	2 1/4 pt.	
BLOOM					
Fireblight	STREPTOMYCIN 17%	J	1/2 lb.	2 lb.	Repeat application if bloom period extends more than 7 days. Avoid insecticide applications during bloom to protect pollinating insects. MANCOZEB & ZINEB are both effective against cedar apple rust and quince rust.
Scab Powdery mildew Cedar apple rust Quince rust	BENOMYL 50W + MANCOZEB 80W	JRG	3 oz. 3/4 lb.	9 oz. 2 1/4 lb.	
	or SULFUR mfw + MANCOZEB 80W	J	6 lb. 1 lb.	18 lb. 3 lbs.	
	or MANCOZEB 80W	RG	1 1/2 lb.	4 1/2 lb.	
	or CAPTAN 50W + ZINEB 75W	RG	1 lb. 1 lb.	3 lbs. 3 lbs.	
PETAL FALL					
Fireblight	STREPTOMYCIN 17%	J	1/2 lb.	2 lb.	Young (1-3 years) Jonathan trees may require an additional STREPTOMYCIN spray at this time to avoid serious damage to developing scaffold limbs and trunk from fireblight. Continued use of BENOMYL at this time may result in increased mite populations.
Scab Powdery mildew Cedar apple rust Quince rust	SULFUR mfw + MANCOZEB 80W	J	6 lb. 1 lb.	18 lb. 3 lb.	
	or MANCOZEB 80W	RG	1 1/2 lb.	4 1/2 lb.	
	or CAPTAN 50W + ZINEB 75W	RG	1 lb. 1 lb.	3 lb. 3 lb.	
Curculio Codling moth Leafhoppers Aphids Mites	DIAZINON 50W	JRG	1 lb.	3 lb.	GUTHION and DIAZINON are effective for the control of codling moth, leafrollers, plant bugs, and curculio at this time. DIAZINON may cause russetting of Golden Delicious in some seasons.
	or GUTHION 50W		1/2 lb.	1 1/2 lb.	
	or IMIDAN 50W		1 1/2 lb.	4 1/2 lb.	

*J = Jonathan
R = Red Delicious
G = Golden Delicious

Timing & Major Pests Involved	Materials To Use	Varieties To Treat*	Dilute Rate Per 100 Gals.	Low Volume Rate Per Acre	Comments and Special Precautions
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EARLY COVER SPRAYS (7-10 DAY INTERVALS)

Scab	SULFUR mfw	J	6 lb.	18 lb.	SULFUR or DIKAR should be used only on those varieties susceptible to powdery mildew. Note: SULFUR offers no "after-infection activity" against apple scab. Avoid use of SULFUR as temperatures reach 85-90°F.
Powdery mildew	+ MANCOZEB 80W		1 lb.	3 lb.	
Cedar apple rust	or DIKAR 80W	J	2 lb.	6 lb.	
Quince rust	or MANCOZEB 80W	RG	1½ lb.	4½ lb.	
Curculio	DIAZINON 50W	JRG	1 lb.	3 lb.	Tentiform leafminers have become numerous in the northeast and central sections of the state in the past few years. DIAZINON is the most effective insecticide.
Codling moth	or GUTHION 50W		½ lb.	1½ lb.	
Leafrollers	or IMIDAN 50W		1½ lb.	4½ lb.	
Leafminer					

SUMMER COVER SPRAYS (10 - 14 DAY INTERVALS)

Scab	DIKAR 80W	J	2 lb.	6 lb.	DIKAR should be used on mildew susceptible varieties. FOLPET is listed here primarily as an alternative fungicide where Botryosphaeria rot (Bot. rot) is a problem.
Powdery mildew	or MANCOZEB 80W	RG	1½ lb.	4½ lb.	
Botryosphaeria rot	or CAPTAN 50W + ZINEB 75W	RG	¾ lb. ¾ lb.	2¼ lb. 2¼ lb.	
	or FOLPET	RG	1½ lb.	4½ lb.	Scale crawlers are most active during June. If a scale problem exists, obtain thorough coverage with either DIAZINON or GUTHION. The amount of GUTHION should be increased over that used in previous sprays due to the presence of scale crawlers and increased spray intervals.
Scale	DIAZINON 50W	JRG	1 lb.	3 lb.	
Codling moth	or GUTHION 50W		⅝ lb.	1⅞ lb.	
Leafroller	or IMIDAN 50W		1½ lb.	4½ lb.	
Leafminer					
E. red mites	PLICTRAN 50W	JRG	¼ lb.	¾ lb.	European red mite and 2 spotted mite populations also frequently increase at this time. PLICTRAN works best when temperatures are relatively cool. OMITE when temperatures are hot. In either case, results may not be evident for 48 hrs. or more. Note use restrictions for both these miticides (below).
2 spotted mites	or OMITE 30W		1¼ lb.	3¾ lb.	

LATE COVER SPRAYS (10-14 DAY INTERVALS)

Scab	CAPTAN 50W	JRG	¾ lb.	2¼ lb.	ZINEB has a slightly longer residual life than CAPTAN and other scab fungicides and affords good control of flyspeck, sooty blotch, bot. rot, etc. and with less surface residue than MANCOZEB. CAPTAN 50W should be used alone at 1½ lb. per 100 gal. (4½ lb. per acre, LV) if applications must be made within 15 days of harvest. Remember to check the tolerance and interval chart for all pesticides used at this time to avoid applying materials later than the approved intervals before harvest.
Bot. rot	+ ZINEB 75W		¾ lb.	2¼ lb.	
Sooty blotch	or FOLPET 50W	JRG	1½ lb.	4½ lb.	
Flyspeck					
Codling moth					USE THE SAME INSECTICIDES AND MITICIDES AS IN SUMMER COVER SPRAYS
Leafroller					
Leafminer					
E. red mites					
2 spotted mites					

*J = Jonathan
R = Red Delicious
G = Golden Delicious

Apple Pesticide Tolerances, Days to Harvest, and Other Label Restrictions^[1]

Compound	Tolerance ^[2]	Interval ^[3]	Compound	Tolerance ^[2]	Interval ^[3]
Benomyl	7	NTL	Glyodin	5	NTL
Captan	25	NTL	Guthion [4,5]	2	7
Carbaryl	10	1	Imidan	10	7
Chloropropylate	5	14	Karathane	0.10	21
Demeton [4,5]	0.75	21	Kelthane	5	7
Diazinon	0.75	14	Mancozeb	7	30
Difolatan	0.25	PB	Omite [5]	3	7
Dikar	0.10	21	Phosphamidon	1	30
Dodine	5	7	Plictran [5]	2	14
Ferbam	7	7	Streptomycin	0.25	50
Folpet	25	NTL	Zineb	2	15

[1] All references are for use on apples only. Many compounds have different limitations on other crops. READ THE LABEL!

[2] Allowable residues at harvest expressed in parts per million (ppm). Sulfur and copper are exempt from a tolerance.

[3] Time in days between last application and harvest. NTL = no time limitation; PB = pre-bloom sprays only.

[4] Do not permit workers to re-enter orchard within 24 hrs. after application of GUTHION or 48 hr after DEMETON (Systox) unless they wear protective clothing. For all other pesticides, no unprotected farm worker re-entry until the spray dries or the dust settles.

[5] Not more than 3 applications of DEMETON or OMITE nor 8 of GUTHION may be made per season. Do not exceed 12 lbs of PLICTRAN 50W per acre per season.

SPECIAL NOTES ON APPLE SCAB CONTROL PROGRAMS

Use of DIFOLATAN for Primary Scab Control.

The retention and redistribution properties of DIFOLATAN 4F allow it to be applied once at green tip with protection generally lasting until pink (3 gal/acre rate) or petal fall (5 gal/acre rate), when regular treatments with conventional fungicides must be resumed. Do not apply DIFOLATAN later than the green tip stage, since it will cause severe leaf injury. The effective life of DIFOLATAN used in this manner is dependent upon the amount of growth which occurs rather than the amount of time lapsed. Where bud development from green tip to pink is prolonged for 3 weeks or more, additional scab sprays are unnecessary. Under Missouri conditions, however, bud development is usually too rapid to justify the economic use of DIFOLATAN.

After-Infection Control of Primary Scab.

All of the fungicides recommended in this schedule for apple scab are effective as protectants; i.e. they will prevent infections from occurring if they are applied before infection occurs. Except for SULFUR, many scab fungicides also have reasonable after-infection

activity; i.e. they will stop infections already started if they are applied within a given time after the start of an infection period. An infection period occurs when the leaves are continuously wet for approximately 15 hr at 50°F to 9 hr at 62°F or above. A single application of most scab fungicides will show after-infection activity if applied within 18 hr after the start of an infection period at 60°F or within 24 hr at 50°F. Multiple applications of either DODINE (3/8 lb/100 gal) or the recommended tank mix of BENOMYL + MANCOZEB after scab lesions are apparent will inhibit lesion development and sporulation. Applications made during a light rain can still be effective since timing and coverage appear to be more important than the amount of fungicide deposited on the leaves and fruit.

Resistance to Fungicides.

The use of BENOMYL exclusively for apple scab control has led to the development of resistance to this fungicide in other fruit areas by the scab fungus. To date, benomyl resistance is not known to occur in Missouri. Prudent use of BENOMYL in tank mixtures with other effective scab fungicides (CAPTAN, MANCOZEB) is recommended to reduce the chances for resistance to develop. Where BENOMYL has been used as the predominant scab fungicide for 2 years or more, its use should be discontinued.

Missouri Poison Control Centers*

City	Poison Control Center	Telephone	City	Poison Control Center	Telephone
Cape Girardeau	St. Francis Hospital 825 Good Hope Street 63701	(314)335-1251 Ext. 217	Rolla	Phelps Co. Memorial Hospital 1000 W. 10th Street 65401	(314)364-3100 Ext. 126
Columbia	University of Missouri Medical Center 807 Stadium Road 65201	(314)882-8091	Springfield	Lester E. Cox Medical Center 1423 N. Jefferson St. 65802	(417)836-3193
Hannibal	St. Elizabeth's Hospital 109 Virginia Street 64301	(314)221-0414 Ext. 183	St. Joseph	St. John's Hospital 1235 East Cherokee 65804	(417)881-8811 Emer. Rm.
Joplin	St. John's Hospital 2727 McClelland Blvd 64801	(417)781-2727 Ext. 393	St. Louis	Methodist Hospital and Medical Center 8th & Faraon Streets 64511	(816)271-7580
Kansas City	Children's Mercy Hospital 24th & Gilham Road 64108	(816)471-0626 Emer. Rm.		Cardinal Glennon Children's Memorial Hospital 1465 S. Grant Avenue 63104	(314)772-5200
	Kansas City General Hospital and Medical Center 23rd & Cherry Streets 64108	(816)556-3106		St. Louis Children's Memorial Hospital 500 S. Kingshighway 63110	(314)367-2034
Kirkville	Kirkville Osteopathic Hospital 800 W. Jefferson St. 63501	(816)626-2121	West Plains	West Plains Memorial Hospital 1103 Alaska Avenue 65775	(417)256-9111 Ext. 36
Poplar Bluff	Lucy Lee Hospital 330 N. 2nd Street 63901	(314)785-7721 Ext. 166			

*In the case of accidental poisoning involving a pesticide, follow the first aid directions printed on the label of the container and consult your physician immediately. Additional information concerning treatment and course of action can be obtained from your nearest poison control center.



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