



# 1982 Missouri Commercial Strawberry Spray Schedule

1982

W. H. Shaffer, E. W. Palm, Plant Pathology  
W. S. Craig, Entomology  
A. E. Gaus, Horticulture

University of Missouri-Columbia  
Extension Division  
MP 266 1/82 1.5M

These recommendations are intended to serve as guidelines for commercial strawberry 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 fields. 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 plants.

## 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 treated fields.

## RECOMMENDED RATES OF APPLICATION

All of the rates for the materials in these recommendations are given on an *amount per acre* basis and should be applied in sufficient volume of water to allow thorough penetration of the dense mat of foliage, crowns, runners and mulch present in most beds. A volume of 150 to 250 gallons per acre delivered at a pressure of at least 200 pounds per square inch is suggested. Be sure to spray the *entire planting*—rows and middles.

## '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	Rate Per Acre	Comments and Special Precautions
-------------------------------	------------------	---------------	----------------------------------

## PRE-PLANTING SOIL TREATMENT

Wireworms White Grubs Carrot Beetles	No insecticides are registered		
--	--------------------------------	--	--

Soil insects are most prevalent in sod situations. To avoid excessive damage from soil insects: 1) Plant on previously cultivated soils; 2) Disc &/or plow sod land to be planted several times year prior to planting; 3) Consider soil fumigation.

## PRE-BLOOM SPRAYS

Catfacing insects	ENDOSULFAN (Thiodan 50W)	2 lb	Pre-bloom insecticides are primarily for catfacing insects. Begin applications as soon as growth starts in the spring. Continue every 7 to 10 days to early bloom but do not repeat ENDOSULFAN spray within 15 days or more than twice in 35 day period when fruit is present. During "wet" spring seasons, a fungicide should be applied with the insecticides.
Weevils	+ GUTHION 50W	1 lb	
Rootworms	or MALATHION 25W	4 lb	
Crown borers			

Leaf Spot	BENOMYL 50W	1 lb	During "wet" spring seasons, a fungicide should be applied with the insecticides. Apply BENOMYL when blossom buds begin to separate. See special note on gray mold.
Gray mold	or CAPTAN 50W	5 lb	
	or THIRAM 65W	5 lb	

## BLOOM SPRAYS THROUGH HARVEST

Fruit rots	BENOMYL 50W	1 lb	Alternate the use of BENOMYL with CAPTAN or THIRAM. Repeat applications from early bloom through harvest at 7 to 10 day intervals. THIRAM should not be used within 4 days of harvest; BENOMYL or CAPTAN can be used up to harvest.
Leaf spot	or CAPTAN 50W	5 lb	
Leaf blight	or THIRAM 65W	5 lb	
Leaf scorch			

## SPECIAL PRE-HARVEST SPRAY

Leafrollers	NALED 8EC	1 pt	Apply NALED only if needed. NALED (Dibrom) is highly corrosive—wash out spray equipment thoroughly after use to avoid problems. NALED may be used to within 1 day of harvest; KELTHANE + MALATHION to within 3 days of harvest.
Spider mites	or KELTHANE 35W	1½ lb	
	+ MALATHION 25W	4 lb	

## POST-HARVEST SPRAYS

Leafrollers	GUTHION 50W	1 lb	Check your plantings at least once a week. These sprays are recommended only on a "spray as needed" basis rather than a regular schedule.
	or DIAZINON 50W	1 lb	

Spider Mites	KELTHANE 35W	1 1/2 lb	
--------------	--------------	----------	--

Crickets, Grasshoppers	TOXAPHENE 60-65EC	1 qt	
---------------------------	-------------------	------	--

Leaf Diseases	CAPTAN 50W	5 lb	During wet seasons regular fungicide treatments may be needed to check foliar diseases. Repeat every 7 to 10 days until conditions improve.
	or THIRAM 65W	5 lb	

# DISEASES: 1982 MISSOURI COMMERCIAL STRAWBERRY SPRAY SCHEDULE

## TROUBLESOME STRAWBERRY DISEASES

A number of destructive diseases of strawberries cannot be controlled with conventional foliar pesticide sprays. They need to be considered before planting. In each case the importance of using only disease-free planting stock cannot be over emphasized. Plants should be purchased only from reputable nurseries.

Two classes of plants, REGISTERED and CERTIFIED, need to be considered. Plants bearing a "registered" label have been grown under state supervision from tested stocks that are free of certain disease causing viruses or virus-like organisms. This is usually the best stock on which to base your investment. "Certified" plants are also grown under state supervision, inspected and found to be free of most diseases and insects; however, they may still carry virus.

**Black root rot** is a common disease caused by a complex of soil-borne pathogens. Certain environmental stresses such as drought, excess water, winter injury, and nutrient deficiencies contribute to the severity of this disease. Affected plants are low in vigor, have smaller than normal root systems. Many roots of affected plants show dark, blackish lesions or they may be dead. Control is best achieved by using only disease-free planting stocks and cultural practices that promote strong vigorous growth and lessen winter injury (fertilization, minimal cultivation and mulching). At planting, plants should be inspected and only those with healthy, light-colored feeder roots used. Cut through the crowns of several sample plants and check for internal discoloration. Care should also be given to avoid drying of the roots during planting.

**Verticillium wilt** is caused by a soil-borne fungus that is most active during cool weather. The disease tends to be more serious in heavy poorly drained soils. Symptoms in new plantings usually appear at about the time runners begin to develop; in established beds they develop near the fruit ripening stage. Outer leaves are usually the first to wilt although sometimes the whole plant may appear wilted. The leaves dry up, turn brown at the margins, and few new leaves develop. New roots growing from the crown are short with blackened tips. Severely affected plants die while less severely affected plants are unproductive, develop few runners, and are predisposed to winter-kill.

The Verticillium fungus is particularly troublesome to control because it can persist in the soil for long periods and has a wide host range including many common weeds and crop plants. Unless the planting beds have been fumigated, strawberries should not be planted within two years after strawberries, tomatoes, potatoes, peppers, eggplants, peaches, cherries, plums, cane fruits or cotton. Fumigation can be costly and often requires special equipment. For this reason the use of wilt resistant varieties such as Guardian, Surecrop, Redchief or Sunrise is the most economical approach where Verticillium has become a problem.

**Red stele** is a destructive root rot disease also caused by a soil-inhabiting fungus. Infected plants are found most often in low, wet areas. Infection occurs in the late fall and early spring when soil temperatures are cool and soil moisture levels are high. Some infected plants wilt suddenly and die just before or during the first fruiting period. The center or stele of this plant is characteristically reddish brown instead of the normal yellowish white color of healthy roots. In some plants this

discoloration symptom may disappear in the summer as the plants appear to recover. However, these plants are usually stunted, produce worthless fruit and generally die the following season.

The red stele fungus is most commonly introduced into new plantings on diseased stock. Within the planting it is spread by water that moves in or over the soil and by soil carried on farm equipment. Once the fungus is introduced into a planting, the only practical alternative to locating a new site is to use red stele resistant cultivars such as Guardian, Surecrop, or Redchief.

**Root knot and lesion nematodes** are microscopic, threadlike parasitic worms that live in the soil and attack strawberry roots. Severe infections occur only when nematode populations are high and this happens more frequently in sandy soils than in the heavier clay soils. **Root knot nematodes** form swellings or galls 1/8 to 1/4 inch in diameter on roots. Usually there are several short branch roots just above the swelling. These galls interfere with normal root functions and, with severe infections, the effect is similar to removing most of the roots. **Lesion nematodes** feed mainly on the fibrous roots and with severe infections these roots appear wiry and brown. Both types of damage cause plants to be stunted, less vigorous, and more susceptible to black root rot, drought injury and winter kill. Certified disease-free plants should always be used to avoid introducing these nematodes into new sites. Like many of the soil fungi these nematodes can also be spread within an area in soil on farm implements.

## GRAY MOLD FRUIT ROT

Gray mold rot occurs wherever strawberries are grown and, in some years, can destroy the entire crop. It is caused by a fungus that can infect the berries at all stages of their development. Infection often starts on blossoms where there are frost or other injuries to the flowerstalks, caps, or petals, or where dead petals cling to developing fruit. Infection may also occur where berries are in contact with decaying plant debris, the soil, or another infected berry.

Initially gray mold fruit rot appears as a brown, soft rot which then spreads rapidly through the berry. As the berry dries out it becomes firm, uniformly brown, and is covered by a grayish brown dusty-looking growth. The disease can be especially destructive in wet seasons or when frequent showers occur during the bloom-fruiting period. BENOMYL fungicide is very effective and should be first applied in the pre-bloom period just as the blossom buds are separating. Alternate the use of benomyl with either CAPTAN or THIRAM at weekly intervals until harvest to prevent the selection and build up of fungus strains that are resistant to benomyl.

Proper spacing of plants, correct timing of fertilizer applications and good mulching are important in reducing fruit losses due to gray mold. Plants that are not densely spaced allow the blossoms and developing fruits to dry more rapidly than when plants are crowded. Fertilizer should be applied in the summer or fall rather than in the spring since spring applications encourage the development of a thick foliar canopy which inhibits rapid drying after rains or heavy dews. Straw mulch, properly placed, will help reduce the contact between ripening fruits and the soil. Frequent picking and removal of infected fruit also help reduce fruit losses.

## STRAWBERRY PESTICIDE TOLERANCES, DAYS TO HARVEST, AND OTHER LABEL RESTRICTIONS<sup>[1]</sup>

Compound	Tolerance <sup>[2]</sup>	Interval <sup>[3]</sup>	Compound	Tolerances <sup>[2]</sup>	Interval <sup>[3]</sup>
Benomyl	5	N TL	Guthion [5]	2	5
Captan	25	N TL	Malathion	8	3
Diazinon	0.75	5	Naled (Dibrom)	1	1
Dicofol (Kelthane)	5	2	Thiram	7	4
Endosulfan (Thiodan) [4]	2	4	Toxaphene	7	BF

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

[2] Allowable residues at harvest expressed in parts per million (ppm).

[3] Time in days between last application and harvest. NTL = no time limitation; PS = pre-plant soil application only; BF = do not apply after fruit starts to form.

[4] Do not repeat Endosulfan spray within 15 days or more than twice in 35 day period when fruit is present.

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

## Missouri Poison Control Centers\*

City	Poison Control Center	Telephone	City	Poison Control Center	Telephone
Cape Girardeau	St. Francis Hospital St. Francis Drive 63701	(314)651-6235	Rolla	Phelps Co. Memorial Hospital 1000 W. 10th Street 65401	(314)364-3100 Ext. 136 or 137
Columbia	University of Missouri Medical Center 807 Stadium Road 65201	(314)882-4141	Springfield	Lester E. Cox Medical Center 1423 N. Jefferson St. 65802	(417)831-9746 or 1-(800)-492-4824
Hannibal	St. Elizabeth's Hospital 109 Virginia Street 64301	(314)221-0414 Ext. 183		St. John's Hospital 1235 East Cherokee 65804	(417)885-2115 Emer. Rm.
Joplin	St. John's Hospital 2727 McClelland Blvd 64801	(417)781-2727 Ext. 393	St. Joseph	Methodist Hospital and Medical Center 8th & Faraon Streets 64511	(816)271-7580 or 232-8481
Kansas City	Children's Mercy Hospital 24th & Gilham Road 64108	(816)234-3000	St. Louis	Cardinal Glennon Children's Memorial Hospital 1465 S. Grant Avenue 63104	(314)772-5200
				St. Louis Children's Memorial Hospital 500 S. Kingshighway 63110	(314)454-6099
Kirksville	Kirksville Osteopathic Hospital 800 W. Jefferson St. 63501	(816)626-2266	West Plains	West Plains Memorial Hospital 1103 Alaska Avenue 65775	(417)256-9111 Ext. 258 or 259
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.