

Disease and Insect Control in Home Fruit Plantings

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Growing fruit in the home garden can be an interesting, fun and rewarding hobby. Many novices dream of plucking perfect fruit off trees in their yards. This does not happen without a great deal of work. Control of **pests (insects and diseases)** is an integral part of the care necessary to achieve good results.

This publication provides guidelines for spraying home fruit plantings, but good pest control is not possible if spraying is the only action taken. Cultural practices such as pruning, sanitation, variety selection and selecting open, sunny sites for planting are necessary for good pest control. Specific cultural practices for each type of fruit are provided with the spray charts.

How to Use the Spray Schedules

Most **fungicide** (disease control product) and some **insecticide** (insect control product) applications are effective only if applied preventatively, because it is not possible to control the pest satisfactorily after the fact. The timing of these preventive sprays is based on the growth stage of the plant and forms the foundation of the spray charts that follow.

In very rainy seasons, sprays may need to be applied more frequently than the schedule given in the following charts. Wet weather favors development of the disease-causing organisms; thus, more chemical protection is needed. Also, rains can wash off the **pesticides** (fungicides and insecticides). When rain occurs before a spray has dried or if rainfall totals more than 1 inch within 24 hours, the spray should be re-applied. Fungicides provide more benefit when applied before a rain than after, because protection from infection by disease-causing organisms is needed when plant surfaces are wet.

Additional Spray Tips

Thorough coverage of all above-ground plant parts is needed for good pest control. One of the biggest mistakes home fruit growers make is to allow their trees to grow too tall. If trees are maintained at a manageable height, it is easier to spray them properly, as well as to harvest the fruit. Proper pruning practices reduce the amount of spray needed and permit better coverage.

The type of sprayer used depends on the size of the fruit planting. For most plantings of small fruits or for a few small fruit trees, pump-up sprayers are adequate. Trombone-type sprayers are helpful for taller trees. For the increased spray volumes required by larger home orchards, power sprayers are recommended.

Mixing a detergent or commercial spreader-sticker with the spray solution is recommended. This provides better coverage of slick surfaces such as apple fruit or blackberry stems.

Rates of product application are not provided in these charts, because of the diversity of product concentrations offered. **The product labels give the rates; follow them.** The label rates are expressed as amount per gallon of water. The following table can be used to determine the amount of spray mixture needed.

Amount of spray needed for each application

Height in feet	Spread in feet	Gallon per tree per application
5 to 8	3 to 6	½ to 1
8 to 10	4 to 8	1 to 2
10 to 15	8 to 15	3 to 5

Protect Pollinating Insects

Honey bees and other pollinating insects must be protected from insecticides, which will kill them. **Do not spray fruit plants with insecticides while the plants are in bloom.**

Pesticide Safety

Most of the pesticides suggested for use in this publication are low-toxicity materials; however, some precautions are still needed.

- Keep pesticides in the original, labeled container.
- Keep pesticides in a locked storage cabinet, away from children or pets.
- Read the label each time before you use the product.
- Wear rubber gloves, goggles, a long-sleeved shirt, long pants and a hat when mixing and applying pesticides.
- Handle the pesticide carefully when mixing. Avoid breathing dust or vapors. Wash any chemicals off the skin immediately with plenty of water.
- Never apply insecticides or fungicides with a sprayer that has been used for weed killers.
- Do not spray if it is windy.
- Mix only as much as you need. Do not store diluted spray mixtures from one application to the next. They will lose effectiveness and are unsafe.
- Observe the harvest intervals and reentry requirements given in the following table and on the product label.

Multipurpose Fruit Spray

Multipurpose fruit tree spray products are mixtures containing a fungicide (captan) and either one (malathion) or two (malathion and carbaryl) insecticides.

Multipurpose sprays are convenient and are effective against some, but not all, pests. Suggestions for their use are provided in this spray guide. **Mixtures containing carbaryl should not be applied to apple or pear until 21 days after petal fall, as it causes the fruit to drop.**

Harvest Restrictions

The following tables contain the most readily available home fruit pesticides, the crops on which they can be used and the harvest restrictions. If any information in the tables disagrees with the product label, **FOLLOW THE INFORMATION ON THE LABEL.**

Harvest Restrictions for Common Fruit Fungicides

Common Names	Example Brand Names ^a	Waiting period in days between final spray and harvest								
		Apple	Pear	Peach	Cherry	Plum	Blackberry Raspberry	Strawberry	Grape	Blueberry
captan	Captan	0	nr	0	0	0	nr	0	0	0
chlorothalonil	Daconil, Fung-onil, Garden Disease Control	nr	nr	*	*	*	nr	nr	nr	nr
copper	Bordeaux Mix, Copper Fungicide	0	0	0	0	0	0	0	0	0
lime sulfur	Lime Sulfur	0	0	0	0	0	0	0	0	0
mancozeb	Manzate, Dithane	nr	nr	nr	nr	nr	nr	nr	66	nr
myclobutanil	Immunox ^b	14	nr	0	0	0	0	0	14	nr
propiconazole	Infuse, Liquid Systemic Fungicide	nr	nr	0	0	0	nr	nr	nr	nr
streptomycin	Agri-mycin, Fire Blight Spray	50	30	nr	nr	nr	nr	nr	nr	nr
sulfur	Sulfur	0	0	0	0	0	0	0	0	0
thiophanate-methyl	Thiomyl	1	nr	1	1	1	nr	nr	nr	nr

nr = Not registered for this use.

* Chlorothalonil cannot be applied to peach, plum or cherry between shuck split and harvest.

^a List of brand names is not complete and does not imply any preference or discrimination to other products of similar, suitable composition.

^b Immunox is labeled for use on the indicated fruits. Immunox Plus, which contains an insecticide as well as myclobutanil, is labeled only for ornamentals.

Harvest Restrictions for Common Fruit Insecticides/Miticides

Common Names	Example Brand Names ^a	Waiting period in days between final spray and harvest								
		Apple	Pear	Peach	Cherry	Plum	Blackberry Raspberry	Strawberry	Grape	Blueberry
acetamiprid	Ortho Flower, Fruit, & Vegetable Insect Killer Conc.	7	7	7	7	7	1	1	7	1
carbaryl	Sevin	3	3	3	3	3	7	7	7	7
esfenvalerate	Monterey Bug Buster II	21	28	14	14	14	21	nr	nr	14
gamma-cyhalothrin	Spectracide Triazicide Insect Killer Once & Done Conc.	21	21	14	14	14	nr	nr	nr	nr
insecticidal soap	Insecticidal Soap	0	0	0	0	0	0	0	0	0
malathion	Malathion	3	1	7	3	nr	1	3	3	1
permethrin	Eight, Total Pest Control ^c	*	14	7	nr	nr	14 ^b	14 ^b	nr	14 ^b

Common Names	Example Brand	Waiting period in days between final spray and harvest (continued)								
		Apple	Pear	Peach	Cherry	Plum	Blackberry Raspberry	Strawberry	Grape	Blueberry
pyrethrins	Monterrey Bug Buster-O ^d	0 ^e	0 ^e	0 ^e	0 ^e	0 ^e	0 ^d	0 ^e	0 ^e	0 ^e
spinosad	Monterrey Garden Insect Spray ^d	7	7	1	7	7	1 ^f	1 ^f	7	3
spinosad	Ferti-lome Borer, Bagworm, Tent Caterpillar & Leaf miner Spray	7	7	14	7	7	3	1 ^f	7 ^f	3

See label for restrictions on application frequency and number of times each crop can be sprayed each season.
nr = Not registered for this use. * Do not apply after petal fall.

^a List of brand names is not complete and does not imply any preference or discrimination to other products of similar, suitable composition.

^b Blackberry not on Total Pest Control or Eight label. Raspberry, strawberry and blueberry not on Total Pest Control label.

^c See label for restrictions on application frequency for Bonide Eight and Bonide Total Pest Control.

^d NOP-approved for organic production; also OMRI listed.

^e Do not harvest until spray dries.

^f Label does not list fruit fly for these crops.

APPLE AND PEAR

Apple and pear trees are subject to serious damage from pests and, as a result, a preventive spray program is needed. The following practices will improve the effectiveness of the pesticides and may lessen the need for sprays.

Sanitation and Cultural Practices

- Plant disease-resistant varieties. This method of disease control is especially important for fire blight, where chemical control options are limited. Varieties resistant to cedar-apple rust, scab and powdery mildew are also available.
- Rake and destroy leaves in the fall, if apple scab, pear scab or pear leaf spot are problems. The organisms that cause these diseases overwinter in infected leaves.
- For cedar-apple rust control, elimination of the source of spores — cedar trees — is effective but not always possible. Removal of the galls caused by the fungus on cedar trees is helpful.
- Pruning trees according to recommendations improves control of all above-ground diseases. In well-pruned trees, air circulation and sunlight penetration are improved. This helps control diseases by promoting rapid drying after rains and dew, and by aiding penetration of sprays into the canopy.
- Prune out and destroy all dead or diseased shoots and limbs during the dormant season. This helps reduce fire blight, fruit rots and certain leaf spots, as the organisms that cause these diseases overwinter in the wood. Removing mummified (dark, shriveled, dry) fruit helps prevent the overwintering of the fruit rot organisms.
- Thin all tree fruits so that the mature fruits will not touch each other. This spacing provides better coverage of fruit surfaces by the sprays.
- Pruning out fire blight-affected shoots and blossom clusters during the growing season is warranted if it is done just as symptoms are appearing. Otherwise it is best to let the disease run its course.

APPLE

Time to spray	Material to use*	Remarks
Delayed dormant: When buds swell	Oil emulsion plus copper	Oil for aphids, mites and scales. Use copper if a history of fire blight.
Bud break: From ½ inch long green leaves to tight cluster (when blossom buds are just visible)	Captan	For scab control.
Pink: Just before blooms open	Captan or Immunox plus malathion	If cedar-apple rust has been a problem in past, use Immunox in this and the petal fall and first cover spray. Insecticides for plant bugs, or aphids.
Bloom: Begin at early bloom, repeat at 3- to 5-day intervals	Streptomycin Note: To protect bees, do not apply insecticides during bloom!	Only for fire blight control. USE ONLY IF NECESSARY.
Petal fall: When most of petals have fallen	Captan or Immunox plus malathion	Insecticide for plum curculio, codling moth, plant bugs, aphids, or leafroller.
First cover: 7 to 10 days after petal fall spray	Captan or Immunox plus malathion	Insecticide for plum curculio, codling moth, plant bugs, leafroller, leafhoppers or Oriental fruit moth.
Remaining covers: Apply at 2-week intervals until harvest restriction date	Captan plus malathion	For fruit rots and sooty blotch.

* See pesticide labels for rates. Insecticides listed may not be effective against all insects listed.

ALTERNATIVE PRODUCTS: (1) Multipurpose spray (see discussion) can be substituted for all of the above sprays except the dormant and bloom sprays. Note: Multipurpose sprays will not control cedar-apple rust.

(2) For improved disease control, thiophanate-methyl may be mixed with captan.

PEAR - See page 7

PEACH, PLUM AND CHERRY

Peach, plum, cherry and other stone fruits are commonly affected by serious pest problems and, as a result, a conscientious spray program is needed. The following sanitation and cultural practices will improve the chances of success and may lessen the need for sprays.

Sanitation and Cultural Practices

- Prune trees according to recommendations, to allow better air circulation and sunlight penetration. This helps control diseases by promoting rapid drying after rains and dew. Penetration of sprays into the canopy is also better if the trees are well-pruned.
- Remove the overwintering structure for the brown rot fungus, old mummified fruit left hanging in the tree or on the ground.
- Control of black knot of plum and cherry is dependent on removal of the knots before they begin to produce spores. In late winter, prune out and destroy these rough, black swellings or tumors that develop on limbs and twigs.
- Rake and destroy fallen cherry leaves, the overwintering site of the cherry leaf spot organism.
- Avoid planting peach varieties that are highly susceptible to [bacterial leaf spot](#). Examples are Elberta, Halehaven, Rio-Oso-Gem and Sunhigh. Chemical control of this disease is very limited.
- Cherries will need protection from spotted wing drosophila, if present (see BLUEBERRY).

Time to spray or name of spray	Material to use	Remarks
Delayed dormant: When buds swell	Oil emulsion	For aphids, scales and mites
Bloom	Captan Note: To protect bees, do not apply insecticides during bloom!	Captan not needed on peach at this time if good sanitation is used to control brown rot. Needed on plum and cherry if black knot is a problem, but sanitation is required for good control.
Petal fall: When most of petals have fallen	Captan or sulfur or chlorothalonil plus malathion	Insecticides for control of plum curculio, oriental fruit moth, plant bugs and stink bugs.
Shuck split: When flower shucks begin to split, or 7 days after petal fall	Captan or sulfur or chlorothalonil plus malathion	
Cover sprays: Apply at 10- to 14-day intervals	Captan or sulfur plus malathion	Carbaryl is good for beetle and oriental fruit moth control and can be used beginning at second cover spray. Early cover sprays are key for oriental fruit moth control. Permethrin is very effective, but can cause mite problems.
Trunk and main scaffolds sprays: Direct the spray to the bark on May 31, June 30, July 15 (but not within 14 days of harvest). A final application can be applied after harvest.	esfenvalerate or gamma-cyhalothrin	For control of peachtree borer and lesser peachtree borer
Preharvest sprays: 2-3 weeks before harvest and within 1 week of harvest	Captan plus either thiophanate-methyl, Immunox or propiconazole	CRITICAL SPRAYS FOR BROWN ROT CONTROL .
Early dormant: Late fall, after leaf drop	Copper or chlorothalonil or lime-sulfur	Needed on peach for leaf curl and on plum if plum pockets has been a problem.

Notes: Multipurpose spray (see discussion) can be substituted for all of the above sprays except the dormant, bloom, and preharvest sprays. See pesticide labels for rates. Insecticides listed may not be effective against all insects listed. Malathion may not be labeled for plum. Substitute gamma cyhalothrin for plum curculio control.

GRAPE

Most home grape plantings will require a preventive schedule of pesticides, since certain pests such as black rot can completely destroy a crop of fruit. However, the following sanitation and cultural practices will reduce the need for pesticides.

Sanitation and Cultural Practices

- Keep vines well-pruned according to recommendations, to prevent overgrowth of vines and dense canopy. Pruning promotes air circulation and sunlight penetration, thus more rapid drying after rains and dew. Penetration of sprays into the foliar canopy is also better if the vines are well-pruned.

- Remove mummified berries (shriveled, dry, raisin-like), as they provide an overwintering site for the fungus that causes black rot. Clusters on the vines as well as those that have fallen to the ground should be removed. Also, destroy infected canes that have been pruned off.
- For control of grape root borer, mounding soil makes it difficult for larvae to reach the roots or adults to emerge. Mound some soil 1 foot high for 1½ feet around each vine between early and mid-June. Remove the mounds around Thanksgiving.

Time to spray	Material to use	Remarks
New shoot sprays: Begin when shoots are 4 to 6 inches long, and repeat 7 to 10 days later	Captan or mancozeb plus malathion	Fungicides for black rot and Phomopsis. If powdery mildew has been a problem, add sulfur. Insecticide for grape berry moth, flea beetle, plant bugs and grape phylloxera.
Pre-bloom: When first blossoms open	Captan or mancozeb or Immunox plus malathion	Most damage from black rot occurs from pre-bloom through 4 weeks after bloom. Mancozeb and Immunox are the most effective.
Post-bloom: When most bloom caps have fallen	Captan or Immunox plus malathion	Fungicides for black rot, downy mildew and powdery mildew. Insecticides for grape berry moth, flea beetle, leafhopper and rose chafer.
Cover sprays: 7 to 10 days later, then at 2-week intervals until harvest restriction date	Captan or Immunox plus malathion or carbaryl	Fungicides for black rot, downy mildew and powdery mildew. Insecticides for leaf hopper, berry moth, Japanese beetle, grape root borer. Carbaryl most effective for Japanese beetle.

Notes:

- Multipurpose spray (see discussion) can be substituted for all of the above sprays .
- Malathion EC may cause injury to Ribier, Italia, Cardinal and Almeria varieties.
- Read the pesticide label for the proper rates of chemical to use. Insecticides listed may not be effective against all insects listed.

PEAR

The only disease-control products labeled for use on home pears are copper, sulfur and streptomycin. Apply a copper product at delayed dormant (for control of fire blight) and at pre-bloom, petal fall and the cover sprays (for control of fungal diseases). Copper applied in early cover sprays may cause fruit russetting. Sulfur may be substituted, but is not as effective against fruit rots. The streptomycin bloom sprays for fire blight control and the insecticide sprays may be applied as indicated in the apple schedule.

STRAWBERRY

An intensive, preventive spray program is generally not needed on strawberry. Treatments can usually be made on an as-needed basis. The following sanitation and cultural practices will reduce the need for pesticides. Note: Day neutral strawberries will need protection from spotted wing drosophila, if present (see BLUEBERRY). For a description of strawberry diseases found in Tennessee, see [Strawberry Diseases in Tennessee](#).

Sanitation and Cultural Practices

- Bed renovation immediately after harvest is crucial to managing pest problems. Renovation involves narrowing rows, mowing leaves, removing weeds and fertilization. Rake and destroy cut-off leaves and stems after renovation.

- Maintain narrow rows throughout the growing season (maximum 18 inches wide), to maintain good sunlight and air penetration of the canopy. This provides good berry formation and rapid drying after rains and dew.
- Plant varieties with resistance to red stele and leaf spot. See UT Extension publication W018, [Strawberry Diseases in Tennessee](#). Where anthracnose is a problem, consider the resistant varieties Delmarvel, Sweet Charlie and Bish.
- Control weeds throughout the growing season. Weeds increase disease by shading the plants and by interfering with air circulation. Weeds also harbor many insect and mite pests.
- Mulch with straw before berries begin to lie on the ground, to reduce gray mold and leather rot (fruit rots).
- Keep fruit picked to avoid attracting sap beetles.

Time to spray	Material to use	Remarks
Pre-bloom: When blossom buds appear in the spring	Carbaryl or malathion	Use as needed for crown borer, strawberry weevil, strawberry leafroller and catfacing insects
Bloom: At early bloom and again at full bloom	Captan Note: To protect bees, do not apply insecticides during bloom!	Needed for gray mold control if weather is rainy during bloom. For powdery mildew (rare), add Immunox.
Post-bloom to harvest: Every 7 to 10 days as needed. Observe harvest restrictions.	malathion plus captan plus, if needed for spider mites: insecticidal soap plus, if needed for slugs: metaldehyde bait	Insecticides for spittlebugs, aphids, strawberry rootworm, whiteflies, tarnished plant bugs and leafrollers. Captan not needed until berries begin to ripen, and then only if weather is rainy. Miticides should be applied 5 to 7 days apart.
Post-harvest: Every 10 to 14 days as needed.	Malathion or carbaryl plus, if needed for leaf blight or anthracnose: captan	Insecticides for root weevils, leafrollers and rootworm.

Notes:

- Multipurpose spray (see discussion) can be substituted for all of the above sprays except the bloom spray.
- Read the pesticide label for the proper rates of chemical to use. Insecticides listed may not be effective against all insects listed.

BLUEBERRY

If diseases have been a problem in the planting in past years, captan can be used at 7- to 10-day intervals from bud break to harvest. Malathion or carbaryl can be used for occasional insect pests, but should not be used during bloom. Repeated use of carbaryl can lead to mite buildup.

The female spotted wing drosophila (SWD), a recently introduced species to Tennessee, lays eggs in blueberry fruits with its serrated ovipositor. The fruit is damaged by introduced microorganisms and the developing maggot. Protecting blueberry bushes with insect exclusion netting (1mm mesh) may help reduce the chance of an infestation. Sample SWD traps weekly (ag.tennessee.edu/EPP/Fruit%20Pest%20News/Volume%202015,%20No.%201%20May%202014,%202014.pdf).

Once a spotted wing drosophila is detected, the crop must be sprayed every 7 days from the time the fruit starts to color until harvest. Control is directed only against adults; at present, no control is available against

larvae. Recommendations for control or suppression include rotating the use of pesticides with different modes of action so that resistance does not develop. Pay particular attention to the allowable number of times a product can be used during a season. Organic pesticides may have shorter intervals between applications especially after rain since the residual time is short. Cultural control includes harvesting all ripe fruit to eliminate breeding sites. See www.fruit.cornell.edu/spottedwing/pdfs/SWDgarden.pdf and related links for more information.

Sanitation Practices

- If mummy berry disease has been a problem, rake the area beneath and around plants to collect or bury any mummified fruits from the previous year's crop.
- To reduce dieback diseases, prune out and destroy dead twigs and branches

Spray guide for use if spotted wing drosophila is found.

Time to spray	Materials to use in rotation	Remarks
From beginning of berry coloration until harvest	spinosad	Can be applied every 6 days with a limit of 6 times per season.
	acetamiprid	Can be applied every 7 days with a limit of 5 times per season.
	pyrethrins	Can be applied every 3 days or less if pest pressure is great, with unlimited applications during the season.

BLACKBERRY AND RASPBERRY

An intensive, preventive spray program is generally not needed on raspberry or blackberry. Treatments can usually be made on an as-needed basis. The following sanitation and cultural practices will reduce the need for pesticides. Note: Berries will need protection from spotted wing drosophila, if present (see BLUEBERRY).

Sanitation and Cultural Practices

- To reduce a source of pests, remove and destroy nearby wild brambles.
- Remove and destroy fruiting canes immediately after harvest.
- Promote rapid drying conditions and good air circulation in the canopy by controlling weeds, keeping the planting properly thinned and not allowing the row width to exceed 2 feet.
- Pick berries regularly during the harvest period so that overripe fruit do not accumulate. This will reduce problems with fruit rots, sap beetles, wasps and fruit flies.
- Destroy canes of cultivated or wild host plants with gall-like enlargements (red-necked cane borer) or wilting canes (raspberry crown borer) in June-July.
- Prune wilted plants 2 or more inches below where the cane is girdled due to raspberry cane borer.
- To control the spread of orange rust of blackberry and black raspberry, remove and destroy infected canes as soon as symptoms appear in the spring.
- Orange rust is recognized by a thin, willowy growth of new shoots, and the presence of orange spore pustules on the undersides of leaves.
- To control the spread of rosette of blackberry, remove and destroy infected canes before blooms begin to open. Rosette is recognized by the presence of clusters of stems on fruiting canes, producing a bunched appearance. Sepals are extended and pinkish in color.
- Mow everbearing raspberry varieties after fall harvest to reduce disease carryover. This method produces a single, fall crop the following year.

Time to spray	Material to use	Remarks
Early to mid-bloom	Copper (anthracnose, blackberry rosette, raspberry leafspot) or Immunox (raspberry leafspot, blackberry orange rust, powdery mildew) or sulfur (rusts, powdery mildew) Note: To protect bees, do not apply insecticides during bloom, if possible. Malathion	Apply these materials only if needed, based on occurrence of these pests in prior years or currently observed. Direct insecticide below blooms, if used when blooms are present.
Post-bloom: 3 to 4 additional applications at 2-week intervals. Observe harvest restrictions.	Same as above.	Same as above. Do not make more than 4 applications of Immunox per year. If mite control is needed, apply malathion or insecticidal soap every 5 to 7 days.

IMPORTED FIRE ANT BAITS

There are two approaches to managing fire ants in home fruit plantings. Two insect growth regulator baits, Extinguish Professional Fire Ant Bait and Esteem Ant Bait, are labeled for use within the fruit planting. Esteem is not labeled for caneberries such as blackberry and raspberry. Fertilome Come and Get It Fire Ant Killer (spinosad) lists most crops including, but not limited to, tree nuts, stone fruit, tree fruits, etc. Amdro Pro fire ant bait can be used in grapes and blueberries when applied in bait stations. Other fire ants baits, such as Advion, Amdro, Ascend, Award, Distance, Extinguish Plus and others, can be applied to home lawns adjacent to the planting. Fresh bait should be applied when the ground is dry and rain is not expected, preferably for the next 24 hours. Apply baits when fire ants are actively foraging, preferably when the temperatures are in the 70s and 80s.

See Fire Ants in Tennessee web site, fireants.utk.edu or the eXtension web site at www.extension.org/fire+ants for more information on fire ant management.

Precautionary Statement

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.



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