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Lane County Office
OSU Extension Service
950 West 13th Avenue
Eugene, OR 97402
682-4243 or 1-800-872-8980

EPC 0005

APPLE SCAB

Cause: *Venturia inaequalis*, a fungus that overwinters on dead apple leaves or fruit on the ground. In winter, black structures (pseudothecia) develop in the dead tissue. During the spring, in the presence of moisture and over a wide range of temperatures, the pseudothecia produce sexual spores (ascospores) which are forcibly discharged and moved by air currents to infect young developing foliage and fruit. Infections are visible 8 to 15 days later. They in turn produce asexual spores (conidia) in 15 to 18 days whenever weather is favorable. Conidia cause new infections, continuing the disease cycle.

All outer parts of unopened fruit buds are highly susceptible to infection when exposed after cluster buds break. Bud or blossom infection often leads to shedding of blossoms or to severe infection of developing fruit. Preventing infection of flower stalks and sepals is one of the most important steps in successfully controlling scab.

Mature apple fruit are much less susceptible to apple scab than immature fruit. However, infections can occur near harvest which will not develop until apples are in storage. It can take as little as 6 hours of wetness at 70^{o}F for infection of fruit around bloom, but it takes almost 48 hours of wetness at the same temperature to infect mature fruit.

Symptoms: The first visible symptoms on the leaves in spring are pale, chlorotic, water-soaked spots the size of a pinhead. These enlarge, becoming darker and smoky in appearance, later taking on an olive shade and ultimately a brownish black color. Spots may be any shape but are frequently circular. Young infections often show a radiating spread of fungus tissue through the leaf, and such areas later appear as irregular, brown-colored infections. Diseased leaves can be curled and distorted and often drop early, thus defoliating and weakening the tree.

Scab spots on fruits are at first small, raised, brown or black circular areas with no skin break. Later the skin ruptures, and the exposed tissue has a brown or black velvetlike appearance surrounded by a whitish ring or torn cuticle tissue. As fruit develops, scab spots enlarge and the central areas become brown and corky, but the dark marginal zones remain. Scabs may be scattered over the fruit surface and, when numerous, coalesce into larger irregular infections. Such fruit often cracks, allowing fruit-rotting organisms into the apple.

Late-season infections may not show on fruit until they are in storage where rough, black, circular lesions develop. The lesions, usually varying in size up to 0.25 inch in diameter, are sometimes referred to as pinpoint scab or storage scab.

Cultural control:

1. Cultivars that have shown good resistance and good quality are: 'Akane' (Tokyo Rose), 'Chehalis', 'Liberty', 'Prima', and 'Tydeman Red'. Intermediate resistance: 'Jonagold', 'Macoun', 'Melrose', 'Spartan', 'King'. Cultivars not easily grown in western Washington, Oregon, or British Columbia include 'Red Delicious', 'Rome Beauty', 'Jonathan', 'Winesap', 'Granny Smith', 'Gala', 'Summerred', and 'Jersey Mac'.

2. Apply nitrogen (urea) to leaves in fall to enhance decomposition of fallen leaves and make them more palatable to earthworms.

3. Shred fallen leaves with a flail mower to help speed decomposition of infected leaves.

4. Homeowners may reduce disease pressure by raking and disposing of leaves after they fall. If put in a compost pile, be sure leaves decompose completely.

5. Pruning also helps reduce the amount of time foliage is wet from rain or dew.

6. Reduce irrigation sets so leaves do not stay wet for extended periods of time. Use sprinkler heads that do not wet the foliage of the tree or use drip irrigation.

7. Apply dolomitic lime in fall, after leaf drop, to increase soil pH and to help reduce inoculum next spring.

Chemical control: The key to successfully controlling scab is to apply fungicides early and thoroughly to protect new growth. The first susceptible tissues exposed in opening cluster buds are the tips of the leaves and sepals. The most critical period for scab development is from the breaking of the cluster buds until leaves are fully expanded. Apply sprays at prepink, pink, calyx, and first cover. If the disease was a problem last year, begin applications at green-tip. Forecasting also can be used to time fungicide sprays. Scab resistance to certain fungicides can occur if these materials are used exclusively. To minimize the development of resistant fungi, alternate or tank-mix fungicides from different families that have different modes of action. For example, use a tank-mix of a DMI fungicide at full rates plus a different fungicide at lower rates. Some products used in the tank mix will also aid in Bull's eye rot control.

1. Captan 50 WP at 4 to 8 lb/A. Do not apply more than 64 lb/A/year. May be applied up to the day of harvest. Do not use with oils, lime, or alkaline materials. For home use, Captan (5%) at 1 lb/10 gal water. 4-day reentry. H

2. Ferbam Granuflo at 3 to 8 lb/A. Do not apply within 7 days of harvest. Some cultivars may russet if used before bloom. 24-hr reentry.

3. Flint 50 WG at 2 to 2.5 oz/A. Use on a protectant schedule and not curatively. Rotate with other fungicides that have different modes of action. Do not make more than 2 consecutive applications, 4 applications total per season, use more than 11 oz/A/season or within 14 days of harvest. Do not use organosillicate surfactants. Injury may occur to Concord grapes if accidentally sprayed. 12-hr reentry.

4. Immunox at 0.5 fl oz/gal water. Do not use within 2 weeks of harvest. Do not apply more than 10 times per season. H

5. Lime sulfur (29%) at 2 to 3 gal/100 gal water. May injure fruit on 'Delicious' apples. Polysul, Lily Miller Dormant Spray for Disease and Bonide Lime Sulfur Spray are registered for home use. 48-hr reentry. H

6. Mancozeb such as Dithane M-45, Manzate 200 DF, or Penncozeb 75DF) up to 6 lb/A prebloom or at 3 lb/A after bloom. Do not combine the 6 lb/A prebloom or the 3 lb/A all-season schedules or apply more than 21 lb/A/year. Do not apply within 77 days of harvest. See label restrictions. 24-hr reentry.

7. Messenger at 6.7 to 13.4 oz/A. The commercial efficacy of this product (a bacterial protein) is unknown in the PNW. Do not use with chlorinated water or at a pH below 5.0. Use within 4 hours of mixing. 4-hr reentry.

8. Polyram 80 DF at up to 6 lb/A prebloom or 3 lb/A after bloom. Do not combine the 6 lb/A prebloom or the 3 lb/A all-season schedules or apply more than 21 lb/A/year. Do not apply within 77 days of harvest. See label restrictions. 24-hr reentry.

9. Procure at 8 to 16 oz/A plus a standard protectant fungicide. 72 to 96-hr kickback activity. Do not apply within 14 days of harvest or more than 64 oz/A/year. 12-hr reentry.

10. Rally 40 W at 2.5 to 8 oz/A depending on tree size. Use Eagle WSP at 2 to 3 oz/100 gal water for landscape use. 72-96-hr kickback activity. Tank-mix with another fungicide to protect against scab. Do not apply within 14 days of harvest. (Aerial or concentrate application. **Washington only**. SLN WA-910015 and WA-900020.) 24-hr reentry.

11. Rubigan EC at 8 to 12 oz/A; 72-96-hr kickback activity. Tank-mix with another fungicide to protect against scab. Do not apply within 30 days of harvest. 12-hr reentry.

12. Sovran at 4 to 6.4 oz/A. Use as a protectant fungicide and not curatively. Rotate with other fungicides that have different modes of action. Do not make more than 2 consecutive applications, use more than 25.6 oz/A/season or within 30 days of harvest. Injury may occur to some sweet cherries, such as Van, if accidentally sprayed. 12-hr reentry.

13. Syllit 65 WP at 1 to 3 lb/A. 24-hr kickback activity. Do not apply within 7 days of harvest. Some cultivars may russet if used during bloom or freezing conditions. Alternate applications with other products. 48-hr reentry.

14. Thiram Granuflo at 5.2 to 6.8 lb/A plus another fungicide. Although a preharvest (PHI) interval is not listed, the manufacturer plans to amend the label with a 7-day PHI. Also can serve as an animal repellant. 24-hr reentry.

15. Vangard at 5 oz/A alone or at 3 to 5 oz/A when tank-mixed with another fungicide. Do not apply within 72 days of harvest or more than 22 oz/A/season. Use early in the season when weather is cool. Effectiveness rated as fair. 12-hr reentry.

16. Wettable sulfur (92%) at 6 to 8 lb/100 gal water. May injure certain apple cultivars. Do not use with oil. Does not give good control based on tests west of the Cascades. 24-hr reentry. H

17. Ziram 76 DF or Ziram Granuflo at 6 to 8 lb/A plus another fungicide. Do not use within 14 days of harvest. 48-hr reentry.

Notes: Although Topsin M is registered for use on apple for control of scab, it is not recommended for use in commercial orchards. Using this material in orchards increases the possibility that tolerant (resistant) strains of storage-rot fungi will develop and so increase fruit loss in orchards and packing houses. In addition, this material kills earthworms which help decompose infected leaves.

Forecasting: Apple scab infection periods can be determined by measuring temperature and leaf wetness with weather monitoring equipment. Although infection periods may start with rainfall, significant ascospore release will not occur in low inoculum orchards until day break. Identifying infection period means fungicide treatments can be planned. If a protective spray has been used recently, another spray will not be needed. On the other hand, if the time between the last protective spray and an infection period has been too long, choosing a material with curative or kickback properties would be wise. The system works well to reduce fungicide use in eastern states where many more fungicide sprays are used. Using the system in the Pacific Northwest may increase or decrease the number of fungicide sprays needed, depending on the current weather conditions. In either case, better scab control will be realized. All ascospores will have matured and be ready for dispersal once 865 degree days (base 32oF) have

accumulated since bud break.

References:
MacHardy, W.E. 1996. Apple Scab. Biology, Epidemiology and Management. St. Paul, MN: APS Press.
Koller, W. and Wicox, W.F. 1999. Evaluation of tactics for managing resistance of *Venturia inequalis* to sterol demethylation inhibitors. Plant Disease. 83:857-863.

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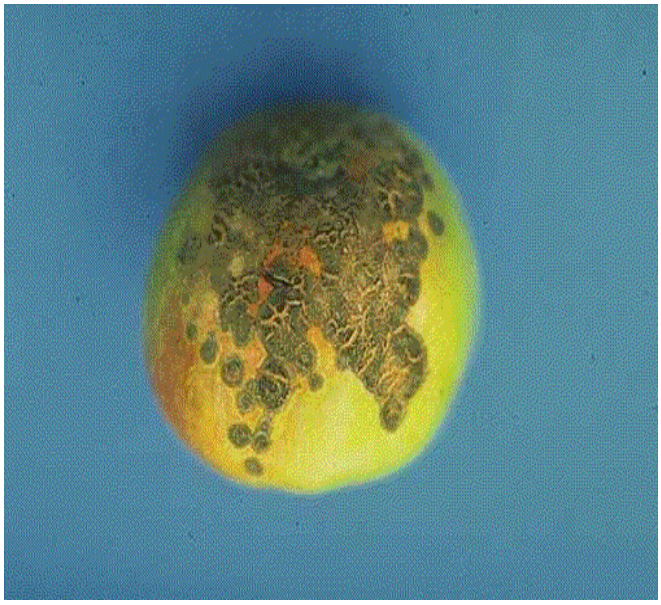
Note the olive-brown lesions on this apple leaf.

Numerous scab lesions on this apple.



The information above can be found on the web site: **http://plant-disease.ippc.orst.edu/**

Visit http://osu.orst.edu/Dept/IPPC/wea for scab predicting models.

Contents by Jay W. Pscheidt, Extension Plant Pathologist, OSU
Edited by Ross Penhallegon, Horticulture Faculty
OSU/Lane County Extension Service, Eugene, Oregon
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