Study Manual for Private Applicator Certification

Orchardist

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Preface

Any person who uses restricted-use pesticides must be licensed in order to be able to purchase such products. Licensing is not required if only general-use pesticides are used, with the exception of commercial applications.

Any person who sprays another's property in exchange for money must possess a commercial applicator's license. However, individuals that are licensed as a private applicator can spray another's property in exchange for services. (i.e.; he might trade a spray job in the spring for help with harvest in the fall)

A farmer wishing to use restricted-use pesticides would apply for a "private applicator's license." The private applicator may then buy and apply restricted-use pesticides on their own farm, property they rent or on the farms of others, provided that they do not get paid to do so.

It is not necessary for the licensed private applicator to actually perform all pesticide applications. An employee or family member can apply pesticides, however, the license holder is responsible for training the person who actually does the work, and must be available if needed.

Private applicators are required to maintain records with respect to each use of restricted-use pesticide and must file a report of their usage on or before January thirty-first each year for the previous year's applications.

This booklet was prepared as a study guide for those individuals seeking certification as private applicators in Connecticut. It contains brief descriptions of the major pests of each crop, their life cycles and the damage they cause to the host plants.

As a minimum requirement for certification, a private applicator must show that they possess a practical knowledge of laws pertaining to pesticide applications and the pest problems associated with their farming operation. This practical knowledge includes ability to recognize common pests and damage caused by them. Recognition is critical because it is the first step in control. The private applicator must be able to recognize the pest problem before they select among the available pesticides.

This booklet is not to be considered a complete source of information. Information on integrated pest management (IPM) and suggested spray schedules may be obtained from the Connecticut Cooperative Extension Service.

Insects

Apple Maggot *(Rhagoletis pomonella)*

Description
The adult is a two-winged fly, slightly smaller than the common housefly. The body is dark brown to black and the wings are marked with dark colored bands. The peg shaped larva or maggot is 3/8 inch long, milky white and very difficult to see in the flesh of the apple.

Life Cycle
The apple maggot over-winters in a pupal stage in a brown oblong case (puparium) that is about 1/4 inch long. These puparia can be within two inches of the soil surface. Adult flies begin to emerge from the puparia in late June and continue to emerge through September or early October. The flies mate, and the females begin to lay their eggs singly in tiny punctures that appear as pinpricks in the skin of the apple. The eggs hatch, and the larvae begin to tunnel through the flesh of the fruit, leaving tarnished, irregular threadlike trails. The maggot leaves the apple when full grown, usually after the drop, and enters the ground to pupate. Maggots spend the winter in the puparia until the following summer. It is not unusual for them to spend one to two years in the soil before emerging as mature flies.

Damage
Maggots tunnel through the flesh of the apple, leaving discolored trails and distorted fruit. Badly infested fruit may drop prematurely.

Management/Control
Picking up and destroying dropped apples before the maggots leave to enter the soil can achieve some control. Monitoring for the emergence of the flies can be accomplished by using red sticky spheres that can be made by painting 2-3 inch balls with red paint and then coating them with petroleum jelly. Sticky traps are also available from commercial suppliers. An application of insecticide should be made when the first fly is captured. Apple maggot fly captures made the first week after spraying are discounted because it is assumed that they would have died if they had landed on protected fruit. Monitoring is continued after the seven-day period provided no more than one inch of rain fell.

The apple maggot can be controlled with general fruit tree spray mixtures that are available under a variety of brand names. These mixtures are usually a combination of insecticides and fungicide. These products should always be applied according to the directions for use on the pesticide label.

Control measures should start a few days after the flies emerge (about July 1) and continue at intervals not exceeding ten days, as long as the flies are active. During peaks of emergence, usually the latter part of July, spray intervals should

be shortened to seven days. Any treatments missed during the period of maggot activity can result in wormy fruit.

Most damage to fruit is usually caused by late-emerging maggots. Activity usually ceases in late August or early September, but can last into October.

European Apple Sawfly *(Hoplocampa testudinea)*

Description
The adult is a clear-winged sawfly that is about 1/4 inch long, dark brown above and yellowish brown below. The head is yellow with yellow antennae and black eyes.

Eggs are laid in apple blossoms, often at the base of the stamens. The female sawfly inserts her ovipositor (the saws) through the sepal. There is often a brownish discoloration on the sepal or receptacle at the point of insertion that helps to identify infested blossoms. Eggs are about 0.8 mm long, oval, colorless and shiny. They will hatch within one to two weeks depending upon daily temperatures.

The larva is about 1.7 mm long, light cream in color with a black head and rear shield. As the larva matures, the head and shield become lighter in color. Sawfly larvae can be distinguished from other larvae that may be feeding on the apple fruit at the same time by the number of prolegs on the abdomen. There are seven pairs of prolegs on sawfly larvae but only five pairs on the larvae of lepidopteris pests. The sawfly larvae leave the fruit when they are mature, enter the soil and construct cocoons where they remain as pupae until the following spring.

Damage
The first larval instar begins feeding just below the skin of the fruit, creating a spiral path usually around the calyx end. This feeding will persist as a scar that is very visible and objectionable at harvest. The larva will molt after this feeding and then will begin tunneling toward the seed cavity of the fruit or an adjacent fruit. The larva's feeding to the core will usually result in the fruit being aborted. The larva will enlarge its exit hole as it feeds internally. The exit hole becomes highly noticeable due to the mass of wet, reddish brown frass. The frass may drip onto adjacent fruit and leaves, giving them a similarly unsightly appearance.

Management/Control
European apply sawfly adults are visually oriented toward apple blossoms. Field trials found sticky-coated, non-ultraviolet-reflecting white rectangles to be the most effective trap for capturing and monitoring sawfly adult populations. The number of adults captured may determine the necessity for treatments directed at the pest.

Application of an insecticide at calyx (petal fall) provides adequate control of the pest. Before using chemical control measures, one should consult with the local Cooperative Extension or IPM specialist about the best materials and use patterns for the area.

Because the sawfly is a hymenopterous insect, insecticides that control it also adversely affect bees. Because bees play an essential role in the pollination of the apple crop, no insecticide sprays should be permitted during the bloom period. This poses a problem at petal fall because certain apple varieties lose their petals before others. Thus in blocks of trees where petal fall has occurred on one variety but not the others, the variety that has lost its petals is likely to sustain some fruit injury from the European apple sawfly until the insecticide is applied. Growers can remedy this situation by choosing pollenizer varieties that do not overlap widely.

Because the sawfly is an introduced pest, many of its natural enemies probably remained behind in Europe. The absence of such enemies may be a major reason for the pest's highly successful establishment in this country. Studies comparing the European apple sawfly parasite and predator fauna between continents would be useful and could lead to the introduction of more effective natural enemies.

Plum Curculio (C*onotrachelus nenuphar*)

Description
Plum curculios are brownish-gray beetles about 1/4" long with four humps on their wing covers. The adult has an obvious long curved snout protruding from its head comprising ¼ of its entire body length. The adult over winters under ground debris and enters the orchard in the early spring to feed on flower parts and foliage. Eggs are deposited under the fruit skin of the fruit by the adult female. After the eggs hatch the larvae feed in the fruit. The larvae are legless, with a brown head and white to yellowish abdomen. When fully grown the larvae drop to soil and pupate. New adults begin emerging in mid July through September.

Hosts
Apple, Plum, Peach, Pear, Hawthorn, Crab Apple

Damage
Injury results from adult feeding and oviposition. Adult feeding injury appears as small round holes cut in the fruit while egg laying injury is characterized by small crescent-shaped cuts on the fruit surface. Infested fruits drop as the larvae develop, so larvae are infrequently found in picked fruit at harvest. As the fruit grows, the oviposition scar increases in size. At harvest the scare appears as an expanded russetted crescent-shaped area.

Management/Control
Control begins at petal fall and continues through third cover. Intervals between sprays vary with the temperature. The higher the temperature, the shorter the interval. Monitoring of populations can only be accomplished by actually seeing adults and their crescent shaped oviposition scars.

Oystershell Scale (*Lepidosaphes ulmi)*

Description
This scale resembles a small, flat, elongate, brown oyster shell. Eggs are deposited under the female scale where they may over winter. After the eggs hatch, crawlers move around on the bark a few hours then insert mouthparts and feed. They then slowly form their waxy protective coating.

Hosts
Apple and Pear

Damage
The bark is usually cracked and scaly on heavily infested trees. The trees lose vigor, the foliage is undersized and specked with yellow, and branch dieback may occur.

Management/Control
An oil treatment in the half-inch green stage is effective against the over wintering eggs. Crawlers are usually controlled by standard cover sprays. The scales are easily seen on tree bark.

Rosy Apple Aphid (*Dysaphis plantaginea*)

Description
Rosy apple aphids are small, soft-bodied sucking insects that usually feed in groups on the undersides of leaves. They may vary from rosy-pink to bluish-purple in color. Over wintering eggs are pale green turning to shiny black and laid only in the fall. Eggs hatch between silver tip and ½" green. Nymphs change color from green to rosy brown in 2-3 weeks as they develop into adults. Winged adults develop from 2nd and 3rd generations and migrate to summer hosts.

Host
Apple

Damage
Feeding by rosy aphids produces curled leaves first noticed at petal fall. In heavy infestations, fruit are severely dwarfed and deformed due to injection and translocation of aphid saliva.

Management/Control
Dormant oil applied at half inch green is effective against over wintering eggs. If aphids are abundant later in the season, an aphicide application at pink stage may be necessary. There are several predators or parasites of rosy apple aphid, however, they are not a dependable control at this time for commercial orchards.

Green Apple Aphid (*Aphis pomi*)

Description
Green apple aphids are small, soft-bodied sucking insects that usually feed in groups on succulent growth of the terminals and waterspouts. Adults have a yellowish-green body, with darker head, antennae tips, and legs. The season's first wingless females appear by bloom and produce live young. The nymphs are dark green and move to terminals or waterspouts and begin feeding. Winged forms of the apple aphid are black and green and may develop in response to crowding. Subsequent generations of females produce eggs which over winter.

Hosts
Apple, Pear

Damage
Feeding devitalizes the tree and causes the terminal leaves to curl, assuming a twisted appearance. The fruit may also be small and misshapen. High populations may restrict growth on young non-bearing trees. Heavy infestations can also stimulate lateral branch growth. Honeydew produced when feeding promotes growth of sooty mold on fruit resulting in fruit discoloration.

Management/Control
Moderate infestations can be tolerated. If aphids are abundant later in the season, an aphicide application may be necessary. Avoid heavy fertilization and drastic pruning since these practices induce rapid new growth and may elevate rosy aphid populations.

European Red Mite (*Panoychus ulmi*)

Description
The first nymphal stage is bright red, but later stages are usually dark red or brown. The adult form of this sucking insect is about ½ mm long and has eight legs. Bright red eggs are deposited on twigs and limbs in fall and winter. Eggs laid in summer are on leaves and fruit. Larvae begin feeding on leaves immediately after hatching from eggs. The eggs are the over wintering form.

Hosts
Apple, Pear

Damage
European red mite feeding produces a fine overall bronzing or foliar mottling. The leaves take on a grayish hue when mites are numerous. Severe European red mite infestations on apple may result in premature leaf and fruit drop, and undersized, discolored fruit. Fruit market value is reduced by egg laying in the calyx end of the apple. Mite injured leaves do not respond to growth regulators applied to delay harvest.

Management/Control
Oil applied at half inch green is effective against over wintering eggs. Petal fall miticide applications will effectively control newly hatched nymphs before summer adults begin laying eggs. If red mites become numerous in mid and late summer, further applications can be made. Monitor apple and pear leaves for population build-up especially in hot, dry weather.

Two-Spotted Mite (*Tetranychus urticae*)

Description
The adult two spotted mite can usually be recognized by their greenish hue and prominent dark spots on its back. Adults over winter under bark scales. In spring the mites generally feed on grass and orchard cover crops until mid to late summer then they move up tree trunks to the leaves. Eggs begin to appear around the first week in May. There can be from 5 to 9 generations per year.

Hosts
Apple, Pear

Damage
Injury to fruit trees is due entirely to leaf feeding which affects the fruit indirectly. Leaves may turn yellow and drop prematurely.

Management/Control
Some non-specific pesticides used in the orchard spray program can prevent heavy mite infestations. Summer mite populations may require additional miticide treatments. There are mites that prey on two-spotted mites, however, they can not always effectively keep pest populations under control. Monitoring orchard cover crops during spring and early summer may help predict a migration to orchard trees in late summer.

Plant Bugs

Description
Adults are small brownish insects which range in size from about 1/4” long (Tarnished plant bug) to ½” long (Stink bug). Eggs are laid in plant tissue. After hatching, nymphs are small and greenish and gradually increase in size to reach

the adult stage. The feeding stage is complete in June, eggs are laid again, and adults have developed for over wintering by September.

Hosts
Peach, Pear and Apple

Damage
Feeding injury on peaches leads to fruit deformation or “cat facing.” Cat facing may be the result of several feeding periods. Fruit dimpling and scabbing on fruit as well as abscission of developing flower buds may occur.

Management/Control
Plant bugs can usually be controlled with an early season pesticide application. These sprays are directed against adult insects which feed on young plant growth. Later generations are frequently controlled with sprays directed primarily against other pests. Orchards adjacent to weedy areas or areas where alfalfa and other hay crops grow have a higher probability of infestation. Non-reflective white sticky boards hung low in trees can be effective for monitoring.

Codling Moth (*Laspeyresia pomonella*)

Description
The larvae are creamy white after hatching, brown headed growing to about ¾” in length and becoming pinkish. Mature larvae within a cocoon over winter in leaf litter or under bark scales. Pupation occurs at the pink stage of apple development. The moths are about ¼” long, grayish in color, with wavy lines across the wings and a dark brown patch on the wing tips. At rest, the moth holds its wings in a tent-like formation. Adults mate and lay eggs on the leaves and fruit. When larvae hatch, they seek out the fruit and bore through the skin to feed. When feeding is complete, they exit the fruit and either over winter or seek a cocooning area.

Hosts
Apple, Pear (especially late varieties)

Damage
Damage occurs when larvae enter the fruit and feed. Larvae bore directly into the center of the apple where they chew out a large dark brown cavity and devour the seeds. Brown frass can be detected from the entry hole. After ruining the apple center, the full grown larvae emerge through a hole in the side of the fruit.

Management/Control
Insecticide applications, when necessary, should begin during petal fall and continue through sixth and seventh cover sprays. Pheromone traps are available for determining the need for pesticide sprays.

Red Banded Leaf roller (*Argyrotaenia velutinana*)

Description
The larvae are light green to tan, unmarked with a brown head. The adult moth is ½" long and has a pronounced red band across the forewings visible when the insect is at rest. Adult females lay eggs in tree bark during early pre-blossom period. The egg mass is spheroid in shape and consists of scale-like overlapping pale yellow eggs. Larvae crawl to leaves after hatching where they feed. There are three generations per year and the third generation larvae over winter.

Host
Apple

Damage
Young first generation larvae feed first on the undersides of the leaves and then tie the leaves together and feed inside. Second generation larvae often feed shallowly on the surface of the developing fruit. Leaves may become webbed to the fruit.

Management/Control
Insecticide application just after eggs hatch is found most effective. Frequent inspections of the undersides of the limbs for egg masses will determine when hatch occurs.

Oriental Fruit Moth (*Grapholitha molesta*)

Description
The adult moth is approximately 1/3" long, dark brown with inconspicuous streaks along the wing margin. Eggs are laid on foliage primarily on upper leaf surfaces of terminal growth. The larvae are ½" long, white to pink in color, with black heads. The insect over winters as full grown larvae in tree crevices or ground cover.

Hosts
Peach, Apple, Plum, Cherry and Pear

Damage
First brook larvae tunnel into the terminal growth causing it to flag and die. Second generation larvae attack the fruit through the stem leaving no detectable damage on the skin.

Management/Control
Early season control helps prevent a large population later on. Treatment should begin at shuck split and follow at 7 to 10 day intervals through the summer.

Peach Tree Borer (*Synanthedon exitiosa*)

Description
The adult is a clear winged, dark blue, day-flying moth easily mistaken for a wasp. Males have 3 or 4 narrow yellow abdominal stripes while females have a single thick abdominal stripe. Adults emerge from July to September, mate and lay eggs. Eggs hatch and larvae bore under bark. The larvae are cream to yellow in color with a brown head. Larvae may require up to two years to develop. Larvae over winter under bark usually below the soil level.

Hosts
Peach, Cherry, Plum, Apricot, Nectarine

Damage
Injury occurs near ground level to 6" below ground level where borers enter the bark and feed on the vascular tissues. Larvae may be detected by masses of sawdust filled gum exuding from the bark. Attacked young trees are particularly susceptible to death due to girdling and mature trees become weakened and less resistant to other pests and diseases.

Management/Control
Drenching sprays may be applied to the tree trunk and crotches when adults are actively laying eggs. Boring larvae may be carefully chiseled out from under bark. Pheromone traps are available for monitoring adult populations.

Lesser Peachtree Borer (*Synanthedon pictipes*)

Description
The lesser peach tree borer is similar in appearance to the peach tree borer. However, it is somewhat smaller and the female lacks the orange band across the abdomen. The life cycle is similar except larvae invade up to 8' up the tree in the trunk and limbs.

Host
Peach

Damage
The lesser peach tree borer works largely in crotches or around trunk or branch scars, generally attacking 6" above ground level and upward.

Management/Control
Insecticide applications should be made thoroughly to trunks and upper limbs in the second and third cover sprays when warranted. Pheromone traps are available to aid in timing sprays.

Pear Psylla (*Psylla pyricola*)

Description
The adult psylla is tan to light brown in summer or reddish brown in winter about 1/10" long and looks similar to a miniature cicada. The wings are transparent and are held roof like over the body. Adult females lay eggs in bark ridges of spurs or at the base of buds. The young nymphs are very tiny and yellow in color and found on the underside of the leaves. As the nymphs mature they become flat and broad, with color varying from yellowish green to reddish brown.

Host
Pear

Damage
This pest causes two types of damage. One type results from honeydew production which drips onto the foliage and fruit. In addition to the sticky condition which results, sooty mold grows on the honeydew greatly reducing the fruit value. If infestations are unchecked , it is possible that complete defoliation could occur, with adverse effects upon fruit size. Psyllas also inject a toxin while feeding. Some fruit varieties are adversely affected by this toxin and can develop graft incompatibility. Feeding by nymphs extracts water and nutrients from the tree. This reduces vigor and may influence fruit set and/or the size of fruit.

Management/Control
There are a number of predatory insects that feed on pear psylla. However, commercial orchards still need to use insecticides for blemish-free fruit. The psylla has developed resistance to some pesticides. Initial oil treatments prior to egg laying and alternating pesticides help to manage resistance. Fertilize pear trees frugally to curtail succulent new growth. Remove water sprouts as soon as possible to decrease preferred feeding sites.

White Apple Leafhopper (*Typhlocyba pomaria*)

Description
Adults are pale yellowish white, 3mm long, with light orange coloring on the head and thorax. They begin to emerge in June and the second generation leafhoppers begin to emerge by mid August and early September. Over wintering eggs are deposited by second brood females. Nymphs are 1mm long, white and wingless. Their eyes are initially red and upon hatching change to pale white with the first molt.

Host
Apple

Damage
Infestations cause white mottling of the leaves. Leafhoppers excrete honeydew which may drop to lower leaves and fruit appearing as colored streaks and spots. This may also cause development of sooty mold.

Management/Control
There are natural enemies, but commercial orchards require insecticide treatments. Some resistance has developed to organophosphate insecticides, therefore alternating recommended pesticides is suggested in order to retain effectiveness of the treatments.

Apple Blotch Leaf miner (*Phyllonorycter crataegella*)
Spotted Tentiform Leafminer (*Phyllonorycer blancardella*)

Hosts
Apple, Hawthorn, Wild Cherry, Quince, Plum, Crabapple

Description
The adults are slender brown moths with distinct lighter markings on the upper wings. Adults begin to emerge from over wintering pupae at ½" green or tight cluster of apple. Eggs are laid on the underside of leaves and are creamy to transparent in color. Initial larval stages feed on sap between the epidermis of the leaves. In later stages they feed on leaf tissues. The larvae reach about 4mm long and are white to pale green turning yellow just prior to pupation. Leafminer pupation occurs on the leaf. The pupal case remains attached to the damaged leaf after the adult disperses. Leaf miners may undergo as many as three to four generations per year. Feeding reduces photosynthetic capability of the leaves and disrupts the hormones in the leaves, which can predispose the foliage to spray injury.

Management/Control
Chemical control can be used for first and second generations. Third generation leaf miners reach the feeding larval stage too late in the growing season to cause significant damage to fruit production, therefore chemical control is unnecessary at that time. Pheromone traps are available to monitor adult activity. Parasitic wasps afford a method of biological control.

Diseases

Bacterial Spot (*Xanthomonas pruni*)

Symptoms
Bacterial spot is first evident as small circular or somewhat irregular areas on the leaves, lighter in color than the surrounding tissue. Leaf spots are numerous on the lower leaves and near the leaf margin where water stands the longest. As

the disease develops, the spots enlarge. They tend to become angular and darken to a deep purple, brown, or black. Badly infected leaves soon turn yellow and drop off. Fruit spotting appears in severely infected trees.

Hosts
Peach and Plum

Management/Control
Where this disease is a problem, begin treatments in shuck-split to avoid injury to the leaves.

Cedar-Apple Rust (*Gymnosporangium juniperi-virginianae*)

Symptoms
This fungus commonly attacks apple and requires the presence of red cedar (*Juniperus virginiana*) as an alternate host to complete its lifecycle. Rust can be recognized by small yellowish spots on the upper leaf surface which enlarge and become spots dotted with black specks. In late summer, protuberances develop on the undersides of the leaves beneath the spots. Severe infections cause heavy defoliation and poor fruit quality. The fungus over winters in spherical galls on cedar which develop orange horn-like structures in the spring.

Host
Apple, Red Cedar

Management/Control
Fungicide sprays to control this disease are applied from tight cluster through first cover. Elimination of red cedars near the orchard and planting resistant varieties should minimize the disease incidence.

Powdery Mildew (*Podosphaera leucotricha*)

Symptoms
Infected terminals may have a silvery gray color, stunted growth, and a misshapen appearance. This fungus disease primarily infects the leaves, but it may cause russetting on fruit, damage vegetative shoots and kill flower buds. Infected leaves become yellow, thickened and curled, soon withering and falling to the ground. Infected terminals are more susceptible to winter kill than healthy terminals.

Host
Peach, Apple

Management/Control
In general, sprays at 5-7 day intervals starting at tight cluster and continuing through petal fall are recommended. The fungus spores germinate during periods of high humidity as well as free moisture.

Brown Rot (*Monilla fruticola*)

Symptoms
This fungus disease attacks blossoms, twigs and fruit of stone fruits. Infected flowers turn brown, wither and drop. Twigs become affected as the infection continues. The most common symptom is fruit rot as the crop reaches maturity. Fruit infections begin as soft brown spots which expand and produce a tan powdery spore mass.

Host
Cherries, Peaches, Plums

Management/Control
Sprays to control this disease should be applied before and after bloom and a fruit ripen. Remove and destroy infected twigs and mummies as soon as they are noticed. During wet seasons and at temperatures around 60-70 F brown rot can be difficult to control.

Apple Scab (*Venturia inaequalis*)

Symptoms
Apple scab is the most injurious apple disease in Connecticut. This fungus causes circular, olive-black spots on the leaves and fruit. Severe infection will cause young fruit to distort or crack and drop. Fruit infections become brown and corky with age.

Host
Apple

Management/Control
Apple scab must be prevented beginning early in the spring and trees must be further protected throughout the growing season. Spray application timing and thoroughness are crucial to the fungicide efficacy. Improved sanitation through raking the orchard or nitrogen application to leaf debris to hasten decomposition reduces the infection. Whenever possible use resistant varieties.

Perennial Peach Canker (*Cytospora cincta. C. leucostoma*)

Symptoms
One of the worst fungal pests of peach trees, perennial canker causes gummy cankers on the limbs and twig blight often followed by heart rot and general loss

in vigor. Black gum-covered cankers often occur on the upper side of the larger branches, and do not usually heal over but continue to widen and enlarge until finally the whole branch dies.

Host
Peach

Management/Control
Any practice that promotes early maturity of trees and rapid would healing aids in controlling peach canker.

Black Rot (*Physalospora obtusa*)

Symptoms
Black rot is a fungus disease which attacks apple limbs, leaves and fruit. It appears on maturing fruit as a hard brown rot on the surface of which appear concentric rings of minute black pustules. This rot eventually involves the entire fruit which then turns coal black and shrivels to a hard mummy. Foliage infection develops as small circular purple flecks enlarging until the centers become brown and resemble a "frogeye." The fungus also causes shallow cankers on the branches. Heavily infected leaves become chlorotic and abscise. Early fruit abortion or blossom end rot occurs.

Host
Apple

Management/Control
The fungi that cause black rot are present in the orchard all year. An Apple Scab spray program should give adequate control until the third cover spray. A grower who has a fruit rot problem should use a fungicide beginning at third cover. In August, the interval between sprays should be about 14 days. For varieties harvested late in September or October, the last application should be made in early or mid-September. Dead wood, mummified fruits and cankers should be removed to control inoculums. Do not leave prunings in the orchard perimeter.

X-Disease of Peach and Chokecherries

Symptoms
X-disease is cause by a mycoplasma-like organism (MLO) which is transmitted by leafhoppers. Once in the plant MLOs reproduce and spread through the vascular system. X-disease renders peach trees commercially worthless within two to four years from initial infection. On peach trees, the characteristic symptoms of X-disease appear on the leaves. For about seven weeks in the spring, the infected tree is indistinguishable from the healthy. Then the leaves turn pale yellow, curve downward along the vein and the margins curve upward. Purplish red leaf spots develop, followed by shot holes, giving the tree a general

tattered appearance. Defoliation of the older leaves is severe, with only the youngest leaves remaining. Fruit on infected limbs usually does not develop; if it does, it tastes bitter. On chokecherries, symptoms are similar with reddening in July.

Host
Peach, Chokecherry

Management/Control
This serious disease is widespread. The prinicipal source of infection is nearby diseased chokecherries. All chokecherries within 500 ft. of the orchard site should be destroyed. Pruning out diseased limbs may reduce the infection.

Fireblight (*Erwinia amylovora*)

Symptoms
This is a bacterial disease of pear, apple, quince and several ornamentals. The disease infects the succulent tissues of the blossoms, shoots, water sprouts and root suckers. It is disseminated by rain, wind and insects and enters the plant through wounds and natural openings. The infected bark is dark brown to black and appears burned. If trunk cankers are present, the edge is sunken and very sharply defined. The most characteristic symptom of the disease is seen in the foliage and young fruit which turn brown to black and remain firmly attached to the dead twig. The disease can kill an entire tree in one season.

Host
Pear, Apple

Management/Control
Control of vectors including aphids, pear psylla, leafhoppers and plant bugs. Prune out infected branches sterilizing pruning tools between each cut. Some resistant varieties are available. Proper cultural practices can decrease susceptibility of plant tissue to this bacteria. Nitrogen fertilizers should be used only early in the season, and trees should be cultivated only until July 1 to prevent greater susceptibility to fireblight.

Fly speck (*Microthyriella rubi*) and **Sooty Blotch** (*Gloeodes pomigena*)

Symptoms
These two superficial fungi are often found on apple fruit at the same time. Their presence reduces fruit quality and market value. Sooty blotch is common during years that have cool wet springs, late summer rains, and low temperatures in early fall. It is recognized by the sooty-gray or cloudy blotches on the fruit. The spots may be ¼" in diameter or larger, even coalescing to cover the entire fruit. The outline of these blotches is indefinite. Fly speck symptoms develop on fruit

as many black shiny dots in a group, each dot with a definite outline. There are usually several specks together in one spot.

Host
Apple, Pear

Management/Control
Pruning to facilitate air circulation. Removal of alternate hosts in the orchard perimeter. A regular scab program usually gives adequate control to about the third cover.

Honey Bees and Pesticides

Pesticides are the single most serious problem to beekeeping in agricultural areas. Many crops must be protected from insect pests and diseases, but they must also be pollinated. The annual value of crops in the United States that require bee pollination exceeds one billion dollars.

Honeybees frequently are in danger of being killed when crops are treated with pesticides. Bees may be poisoned when they feed on nectar or pollen contaminated with certain pesticides. They may also be poisoned if they fly through a cloud of pesticide dust or spray, or walk on the treated parts of the plant. They may be overcome by the fuming action of certain pesticides, either in the field or in the hive if the material has drifted there. Farmers and beekeepers are dependent on each other and need to cooperate fully in protecting the bees from pesticide exposure.

Observance of precautions can significantly reduce bee losses from pesticide poisoning.

Precautions for Farmers

1. Use pesticides only when needed - Do not apply a pesticide unless its benefit will outweigh any injury that it might cause to pollinators. Consider the effect the pesticide will have on the pollination of crops in the area. An application of insecticide might increase the production of the crop, but by reducing the population of insect pollinators it could seriously reduce the production of crops in adjoining fields.

2. Select the right pesticide - All pesticides are not equally toxic to bees. Some pesticides will kill an entire colony; some will seriously weaken it; others are relatively safe. Of the pesticides that are effective against harmful insects, select one that is least toxic to bees. Do not use the more toxic pesticide on flowering plants that attract bees. (See accompanying list, "Relative Toxicity of Insecticides to Honey Bees")

3. Apply granules or sprays rather than dusts - Sprays do not drift as much as dusts and, consequently, are less likely to harm bees. Granules are usually harmless to bees.

4. Time pesticide application - Do not apply pesticides when bees are working plants to be treated. Treat plants before or after flowering, at night, or at a time of day when bees are not visiting them. Bees may cluster outside the entrance of the hive on hot nights. When this happens, pesticides drifting over the hives may kill the bees. Fumes of some pesticides can kill bees in the hive.

Beekeepers should consider the normal wind directions when placing hives near fields that may be treated.

5. Notify beekeepers - Notify beekeepers in your area several days before you apply a pesticide. This will give them an opportunity to protect their colonies. However, notification is not a release of responsibility for damage.

State law requires all beekeepers in Connecticut to register their hives. A list of registered beekeepers in your area may be obtained from the Office of the State Entomologist at the Connecticut Agricultural Experiment Station, Box 1106, New Haven, CT 06504 or www.caes.state.ct.us/Bee.

Relative Toxicity of Insecticides to Honeybees

Group I - Highly Toxic: Severe losses may be expected if the following materials are used when bees are present at treatment time or within a day thereafter:

- Acephate (Orthene)
- Carbaryl (Sevin)
- Ciodrin
- Diazinon
- Dichlorvos
- Dimethoate
- Imidicloprid
- Imidan
- Malathion
- Methyl Parathion
- Naled (Dibrom)

Group II - Moderately Toxic: These can be used around bees if dosage, timing, and method of application are correct, but should not be applied directly to exposed bees in the field or at the hives:

- Disulfoton (Disyston)
- Endosulfan (Thiodan)
- Fipronil
- Pyrethrins
- Synthetic pyrethroids

Group III - Relatively Non-Toxic: These can be used around bees with minimal injury:

- Allethrin
- Bacillus thuringensis
- Bordeau Mixture
- Captan
- Chlorobenside
- Copper sulfate (Monohydrated)
- Diquat
- Dodine
- Ferbam
- Folpet
- Kelthane
- Maneb
- Paraquat
- Rotenone
- Sulfur
- Thiram
- 2, 4-D

Herbicides

Herbicides are grouped on the basis of use into selectives and non-selectives and on the basis of mode of action into contact, translocated, and sterilant chemicals.

Selective and Non-selective Herbicides

Selective herbicides are those that kill certain weeds without seriously injuring the desirable plants among which they are growing. The reasons for selectivity in some combinations of weeds and desirable plants are known; in other situations they are unknown.

Non-selective herbicides kill vegetation with little discrimination. However, certain species of plants may be physiologically resistant to the chemical or may escape through a particular growth habit. Some escapees are perennials that have part of their root system below treated layers of soil; others are annuals and shallow rooted perennials that reinfest an area after the chemical has leached below the surface layer.

Contact, Translocated and Soil Sterilant Chemicals

Contact herbicides kill the tissues that are wetted with the spray. Whether the plant dies or recovers depends on whether it has a protected growing point. Perennials usually have underground buds that will regrow.

Translocated chemicals are absorbed by the roots and move through the vascular system to leaves, buds and root tips. When absorbed by the leaves and stems the chemical is commonly moved with the food materials that were manufactured in the leaves and stems. When absorbed by the roots, it moves in the water-conducting tissue. The growth regulator type of translocated herbicide is a synthetic compound that behaves like a plant hormone. It accumulates mostly in areas of rapidly dividing cells, upsetting the normal metabolism of the plant and causing death of the cells.

A soil sterilant herbicide makes soil incapable of supporting higher plant life, but it does not necessarily kill all life in the soil, such as fungi, bacteria or other micro-organisms. Its toxic effects may remain for only a short time or for years depending upon the product used.

Properties of Herbicides

The properties of herbicides and the mode of action of herbicides are factors of fundamental importance to be considered in how to use the chemical most effectively. These properties determine how effective the chemical will be under varying conditions.

Adsorption

One of the most important interactions of the chemical with the environment is the tie up of the chemical by soil. This tie up or adsorption by various parts of the soil determines how much of the chemical will be available for action in the soil, how readily the chemical will leach, how fast the chemical will disappear from the soil.

Leaching

The movement of the herbicide in the soil is a factor that has to be considered in determining the maximum effectiveness of an herbicide. This movement is related to the adsorption of the chemical and also to the amount and intensity of water movement. The leaching is related the type of soil. Leaching decreases as one goes from sand, to loam, to clay, to soil high in organic matter.

Decomposition and Metabolism

The soil contains animals and microorganisms that posses the ability to detoxify or bring about the decomposition of most organic herbicides. Such breakdown is possible through various biochemical mechanisms available to them. The more favorable the soil conditions are for the growth of soil organisms, the more quickly organic herbicides are decomposed.

Many herbicides are also broken down through a process of chemical degradation.

Volatility

Volatility refers to the vaporization of a compound. Plant damage can be caused by the volatization of certain herbicides. This is due to the vapors that are released by the herbicides. The volatization of a chemical may reduce the concentration of a chemical on the treated site, thereby making it less effective or almost non-effective. Some herbicides that are applied to the soil are sufficiently volatile that their effectiveness would be largely lost if not incorporated into the soil shortly after application. The higher the temperature the more likely a substance is to volatize.

Drift

Drift refers to the movement of spray droplets or vapor from one area to another. Drift is associated with the size of the spray droplets, wind speed and height of the sprayer above ground level. Drift problems can be avoided if certain precautions are followed.

1. Do not spray when there is a wind.
2. Use low pressure with a large nozzle to create a coarse spray droplet

3. Apply at slow speeds to reduce drift from turbulence.
4. Apply herbicide with spray nozzles as low to the ground as possible.

Safety in Using Herbicides

Any chemical is toxic to humans or other animals at a sufficiently high level of exposure. Concentrations of chemical and duration of exposure are important interacting factors. Some herbicides are fairly safe, but others are very toxic. All safety measures should be considered when using any herbicide.

Specific allowable herbicide residues are established by the U.S. Environmental Protection Agency for food, feed and livestock products. These residue tolerances are premised on the protection of human welfare. Registered herbicides and recommended application rates should be strictly observed to avoid the possibility of excessive residues.

Worker Protection Standard

Below is a *brief summary* of the Worker Protection Standard (WPS). The WPS is a federal regulation that is aimed at reducing the risk of pesticide exposures for employees of agricultural operations. Pesticide labels for all products that are used in agricultural production now refer to the WPS and, therefore, compliance with the entire regulation is required. Agricultural business owners and managers should familiarize themselves with these requirements by reading the "How To Comply Manual" or by going to EPA's website (http://www.epa.gov/oppfead1/safety. You may also direct any questions that you may have to the State of Connecticut, DEP, Pesticide Management Program by calling 860/424-3369.

Under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) it is unlawful for any person to use a pesticide in a manner inconsistent with its labeling. When the WPS is referenced on a pesticide label, users must comply with all of its requirements or be subject to enforcement action, which may include monetary penalties.

Basic Principles of the Worker Protection Standard

EPA's Worker Protection Standard (WPS) is intended to reduce the risk of pesticide poisonings and injuries among persons who are employed at farms, forests, nurseries or greenhouses. The WPS contains requirements for pesticide safety training, notification of pesticide applications, use of personal protective equipment, restricted entry intervals following pesticide application, decontamination supplies, and emergency medical assistance.

The WPS identifies almost all agricultural employees as agricultural workers, early-entry workers or pesticide handlers depending upon the duties they perform. They are distinguished as follows;

Agricultural Workers are those who perform hand labor tasks related to the planting, cultivation and harvesting of plants on farms or in greenhouses, nurseries, or forests. Workers include anyone employed for any type of compensation (including self-employed) doing tasks, such as carrying nursery stock, repotting plants, or planting, weeding, hoeing or watering, related to the production of agricultural plants on an agricultural establishment.

Workers do NOT include employees such as office employees, truck drivers, mechanics, and any other workers not engaged in worker/handler activities.

Early-Entry Workers are workers that, under limited circumstances, may be asked to enter a pesticide treated area before the expiration of the restricted entry interval to perform limited tasks. Employers must provide special protections to early entry workers such as additional training and instructions, decontamination sites and label specific personal protective equipment.

Pesticide Handlers are those who mix, load, assist with or apply agricultural pesticides; clean, maintain or repair equipment that is used pesticide applications; or perform other tasks that may bring them into direct contact with pesticides.

The WPS does not apply when pesticides are applied on an agricultural establishment in the following circumstances:

- For mosquito abatement, Mediterranean fruit fly eradication, or similar wide-area public pest control programs sponsored by governmental entities. The WPS does apply to cooperative programs in which the growers themselves make or arrange for pesticide applications.
- On livestock or other animals, or in or about animal premises.
- On plants grown for other than commercial or research purposes, such as home fruit and vegetable gardens, and home greenhouses.
- On plants that are in ornamental gardens, parks, and public or private lawns and grounds that are intended only for aesthetic purposes or climatic modification.
- By injection directly into agricultural plants. Direct injection does not include "hack and squirt," "frill and spray," chemigation, soil-incorporation, or soil-injection.
- In a manner not directly related to the production of agricultural plants, such as structural pest control, control of vegetation along rights-of-way and in other noncrop areas, and pasture and rangeland use.
- For control of vertebrate pests.
- As attractants or repellents in traps.
- On the harvested portions of agricultural plants or on harvested timber.
- For research uses of unregistered pesticides.

Summary of WPS Requirements

Protection During Applications

Pesticide handlers (applicators) are prohibited from applying a pesticide in a way that will expose workers or other persons. Workers are not allowed to enter areas where pesticides are being applied. In some circumstances, workers must remain outside of prescribed buffer zones that may be from 25 to 100 feet, depending upon where a pesticide is applied and the method of application, until the application has been completed.

Restricted-entry Intervals (REI)

Restricted-entry intervals are specified on all agricultural plant pesticide product labels. Usually REI's are 12, 24 or 72 hours, although some low toxicity products may have a zero hour REI. Workers are excluded from entering a pesticide treated area during the restricted entry interval.

Personal Protective Equipment
Personal protective equipment (PPE) that is specified on the pesticide label must be provided and maintained for handlers and early-entry workers. PPE must be inspected and cleaned prior to each use.

Notification of Workers
Workers must be notified about treated areas either orally, by posting of signs or both, as indicated on the pesticide label, in order to avoid inadvertent exposures. Workers that are on the premises at the start of the applications must be orally warned before the application takes place. Workers that are not on the premises at the start of the application must be orally warned at the beginning of their first work period if (1) the application is still taking place or (2) if the REI for the pesticide is still in effect.

Pesticide Safety Training
Specific training is required for all workers, early-entry workers and handlers and must be conducted in a language that they understand. Generally, certified private applicators, commercial supervisors or persons that have attended a state approved train the trainer session can train workers and handlers. Those that have been trained as "handlers" can also train workers. EPA has developed WPS training materials for workers and handlers that are available as booklets, flip charts and videotapes, some of which is available in languages other than English. The training must contain at least the concepts as described in the "How To Comply Manual - Criteria for Worker and Handler Training".

Central Posting

Agricultural employers must post specific information at a central location that is accessible to their employees. The information that is required to be posted is as follows:

- **Application list**, which must include the location and description of the area to be treated, the product name, EPA registration number, and active ingredients of the pesticide, the time and date the pesticide is scheduled to be applied and the REI.
- **Emergency information**, which must include the name, telephone number and address of the nearest emergency medical facility.
- A **pesticide safety poster**, which must be either the WPS safety poster developed by EPA or an equivalent poster as described in the "How To Comply Manual - Criteria for Pesticide Safety Poster"

Access to Labeling and Site-Specific Information
Handlers and workers must be informed of required pesticide label information. Central posting of recent pesticide applications is required.

Decontamination Supplies
Handlers and workers must have an ample supply of water, soap and towels for routine washing and emergency decontamination, and a change of clothes as specified in the regulation and the How to Comply Manual.

Emergency Assistance
Transportation must be made available to a medical care facility if there is a reason to believe that a worker or handler may have been poisoned or injured by a pesticide used on the agricultural establishment. Information must be provided to medical personnel about the pesticide to which the person may have been exposed.

Revisions of the Worker Protection Standard

The Environmental Protection Agency made several revisions to the WPS in April 1995. The revisions that are pertinent to Connecticut applicators are summarized below.

I. Training Requirements

As of January 1, 1996, employers must provide brief pesticide safety training to untrained agricultural workers before they enter pesticide treated areas. Employers must be able to verify compliance with this requirement. The brief pesticide safety training must consist of those components highlighted on the WPS safety poster and a statement to workers that complete Pesticide Safety Training will be provided before the end of the 6th day of entering a treated area. This differs from the original 1992 WPS, which allowed a 15-day grace period for complete WPS worker training until October 1997.

The basic pesticide safety information must include the following concepts:

- Pesticide may be on or in plants, soil, irrigation water, or drifting from nearby applications.
- Prevent pesticides from entering your body by:
  *Following directions and/or signs about keeping out of treated or restricted areas
  *Washing before eating, drinking, using chewing gum or tobacco, or using the toilet
  *Wearing work clothing that protects the body from pesticide residues
  *Washing/showering with soap and water, shampoo hair and put on clean clothes after work
  *Washing work clothes separately from other clothes before wearing them again
  *Washing immediately in the nearest clean water if pesticides are spilled or sprayed on the body and, as soon as possible, showering, shampooing, and changing into clean clothes.

- Further training will be provided before the 6th day that a worker enters any area on the agricultural establishment where within the last 30 days, a pesticide has been applied or a REI has been in effect.

To clarify: before working in an area treated with pesticides, an agricultural worker must receive basic pesticide training. Prior to day 6, he must receive complete worker training as described in the "How To Comply Manual." The complete training information is included in EPA's manual entitled, "Protect Yourself from Pesticides-A Guide for Agricultural Workers", or various EPA approved videotapes. Once a worker receives complete WPS training, he will not be required to be retrained for a period of 5 years.

Nothing in this exception changes the WPS training requirements for agricultural pesticide handlers.

II. Exception for Limited Contact Tasks/Early Entry Workers

Agricultural pesticide labels specify a restricted entry level (REI), usually ranging from 12 to 72 hours. The WPS had limited early entry worker activity in treated areas under an REI to 1 hour in a 24-hour period. EPA granted an exception to the WPS that would allow, under specified conditions, workers to enter pesticide treated areas during an REI to perform limited contact tasks that could not be foreseen and which, if delayed until the expiration of the REI, would cause significant economic loss. Some examples of limited contact tasks that qualify for the exception include: the operation and repair of weather monitoring and frost protection equipment; the repair of greenhouse heating, air conditioning and ventilation equipment; the repair of non-application field equipment; the maintenance and moving of beehives. Some examples of hand labor activities and other tasks which would not qualify for this exception include: harvesting; thinning; weeding; topping; planting; sucker removal; packing produce into containers in the field; operating, moving or repairing irrigation equipment; and performing the task of a crop advisor.

This exception increases the time workers will be able to remain in treated areas under an REI for early entry activities from 1 hour to 8 hours within a 24-hour period *providing the following conditions are met*:

1) The worker's contact with treated surfaces is minimal and is limited to the feet, lower legs, hands and forearms.

2) The pesticide product does not have a statement in the labeling requiring workers to be notified both orally and by posting;

3) Personal protective equipment for early entry is provided to the worker and must either conform with the label requirements or include at least coveralls, chemical resistant gloves, shoes plus socks, chemical resistant footwear, and

protective eyewear (if protective eyewear is required for handlers by the product labeling);

4) No hand labor such as hoeing, picking, pruning, etc. is performed;

5) The workers do not enter the treated area during the first 4 hours, and until applicable ventilation criteria have been met, and until any label specific inhalation exposure level has been reached;

6) Before early entry workers enter a treated area under an REI, the agricultural employer shall give them oral or written notification of the specifics of the exception to early entry as indicated on the pesticide label in a language the workers understand.

NOTE: Since this exception allows tasks to be performed during the REI, all persons engaged in the tasks under this exception must be trained as early entry workers as described in the How To Comply Manual or as a Handler prior to performing the tasks, in accordance with WPS.

III. Exception for Irrigation Tasks

EPA completed an exception to the WPS that allows early entry workers under specified conditions, to enter pesticide treated areas during a REI to perform irrigation tasks related to operating, moving or repairing irrigation or watering equipment. This exception extends the time that a trained early entry worker may remain in a pesticide treated area to perform irrigation tasks from one hour to 8 hours within a 24 hour period.

The terms of this exception further require that the need for the task could not have been foreseen and cannot be delayed until after the expiration of the REI. A task that cannot be delayed is one that, if not performed before the REI expires, would cause significant economic loss, and there are no alternative practices, which would prevent significant loss. (Discussions are currently underway with EPA to address watering needs in the greenhouse setting. At present, **this exception does not apply to routine watering needs in a greenhouse** since the need is not viewed as one that could not have been foreseen)

In addition to the above criteria, the terms of the exception for irrigation activities requires compliance with items 1 through 6 listed above for the limited contact exception.

IV. Reduced Restricted Entry Intervals for Low Risk Pesticides

The WPS established an interim minimum REI of 12 hours for all end use pesticide products for agricultural uses. However, EPA had been asked to

consider reducing the minimum 12-hour REI for certain lower toxicity products. EPA determined that the reduction of the REI for specific low risk pesticides can be accomplished without jeopardizing worker safety and would also promote the use of less toxic products over those with greater risks and longer REI's. Therefore, EPA established a regulation to reduce the REI on 114 lower toxicity products to 4 hours or, in some cases, zero hours. EPA has instructed registrants to revise the labels of affected products to meet certain criteria. Pesticide users should examine labels closely for stickers or other indications of a reduced REI in accordance with this regulation.

The affected lower risk pesticides generally consist of microbial pesticides, biochemical pesticides and certain conventional agricultural pesticides.

V. Warning Signs

EPA amended the WPS to modify the warning sign size and language requirement. The amendment allows the substitution of the language commonly spoken and read by workers for the Spanish portion of the warning sign. The sign must be in the same format required by WPS and it must be visible and legible. Use of alternative languages is optional and the use of Spanish/English is always acceptable.

The amendment also allows the use of smaller signs provided that the minimum letter size and posting distance requirements are observed. In nurseries and greenhouses, smaller signs may be used at any time. A small sign may be used on a forest or farm if the treated area is too small to accommodate the standard sign.

SPANISH

For more information on the scope of the WPS, consult the How to Comply Manual or on the Internet at www.epa.gov/pesticides/safety.