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Berry/Vegetable Times

January 2014

Calendar of Events

Hillsborough County Extension Office Pesticide License Testing. Third Tuesday of each Month. Starts at 9:00am. 5339 CR 579, Seffner. Bring a photo ID.

WPS Train the Trainer class. Wednesday, Jan 29, 2014. 9 am -12:30. Hillsborough County Extension Office, 5339 CR 579 Seffner. To register call Alicia at 813-744-5519 ext. 54134. Cost $25.00.

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Monitoring pests in strawberry

Hugh Smith, Entomology, UF/IFAS GCREC and Alicia Whidden, Hillsborough Co. Extension

Some growers in Hillsborough County have detected high numbers of thrips in flowers already this season. Samples examined at the entomology laboratory at GC REC have been exclusively Florida flower thrips (*Frankliniella bispinosa*). Florida flower thrips is not damaging at low levels and is suppressed by naturally occurring predators. Growers should keep an eye out for naturally occurring predators such as minute pirate bugs and lacewings as they monitor thrips populations. Naturally occurring predatory mites are also present in strawberry fields, and can help stop the build-up of thrips populations. Unlike the red predatory mites *Phytoseiulus persimilis* that are purchased and released for spider mite control, naturally occurring predatory mites tend to be glassy in appearance and are difficult to detect with the naked eye. In spite of the abundance of naturally occurring predators, sometimes thrips populations can increase and cause damage to the crop. Thrips feeding on ripening fruit causes a bronzing type damage (Figure 1).

Thrips were difficult to control for some strawberry

Figure 1. Thrips bronzing on strawberry caused by high densities of Florida flower thrips. Photo Hugh Smith.

growers in Hillsborough County last year. If we have another mild winter, we can anticipate more difficulties this season. In addition to developing on strawberry, thrips can become abundant in flowering weeds such as wild radish (*Raphanus raphanistrum*) and Spanish needle (*Bidens pilosa*) and migrate into strawberry fields. Sometimes it is unclear if thrips remain high in fields that have been sprayed because they have developed tolerance to the insecticides applied or because they are migrating in from habitat outside the field. Growers with fields adjacent to citrus or blueberries may be at an elevated risk for thrips damage, since Florida flower thrips and other thrips establish on these crops.

Western flower thrips (*Frankliniella occidentalis*) has been encountered regularly at low levels in Hillsborough County for almost ten years (See BVT Jan 2008), and sometimes cause problems. Western flower thrips and Florida flower thrips can only be distinguished using a microscope. Chilli thrips (*Scirtothrips dorsalis*) has also been a problem on strawberry in the area since 2008 (Figure 2). Chilli thrips are smaller than flower thrips, and are usually more abundant on leaves and petioles than in flowers. Early signs of chilli thrips damage include changes in the appearance of petioles, which can become tougher and change from green to tea colored. Select insecticides registered to manage thrips and other pests on strawberry can be found on pages 146-147 of the 2013 Vegetable Production Handbook (http://gcrec.ifas.ufl.edu/2013_VPH_web.pdf). Dow Agrosciences has requested that growers in Hillsborough County not use group 5 insecticides (Radiant, Entrust) on strawberry this season out of concern that resistant populations of thrips are developing. The Entomology lab at GCREC is carrying out thrips management trials on strawberry this season to evaluate both established materials and materials that are nearing registration.

Growers and crop consultants have

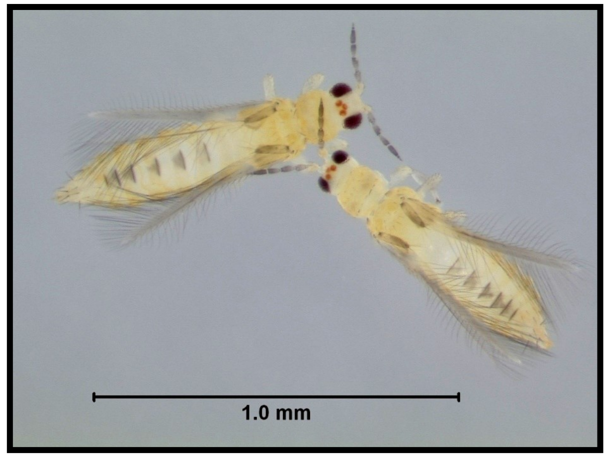


Figure 2. Chilli thrip. Photo Lyle Buss.

Figure 3. Spotted Wing Drosophila male. Photo Hannah Burrack, NC State, Bugwood.org

also begun monitoring for spotted wing drosophila (SWD -*Drosophila suzuki*) in strawberry and other berries this season (Figure 3). Female SWD have an especially robust ovipositor (egg-laying organ) that enables them to penetrate the skin of even green strawberries and lay eggs inside. In this way SWD is similar to tephritid fruit flies such as the Med fly or Caribbean fruit fly.

However SWD is much smaller than tephritid fruit flies. The size of the ovipositor on the female and the spotted wings on the male make it relatively simple to identify SWD from traps, once you know what you are looking for. Vinegar is commonly used to trap SWD (Figure 4). Some consultants have had better results using beer in traps. Vinegar and fermentation products like beer and dough will also attract and trap sap beetles. Sap beetles primarily lay eggs in ripe fruit, unlike SWD, which will also damage green fruit. Larvae of SWD and sap beetles are both small, whitish and wormlike. However SWD larvae have a tapered "pointy" head with a dark hook-like mouth on the end (Figure 5). Sap beetle larvae have a darkened head and scissor-like mouth parts (Figure 6). Distinguishing SWD larvae from sap beetle larvae with a hand lens in the field is not difficult. Growers and crop protection professionals needing assistance identifying pests and beneficials in strawberry should contact Alicia Whidden and Hugh Smith.

Figure 4. Spotted Wing Drosophila trap. Photo Hannah Burrack, NC State, Bugwood.org

Figure 5. Spotted Wing Drosophila larvae in raspberry. Photo Hannah Burrack, NC State, Bugwood.org

Figure 6. Sap beetle larvae in strawberry. Photo Hugh Smith

Please remember…
The use of any trade names in this publication is solely for the purpose of providing specific information. It is not a guarantee or warranty of the products named and does not signify that they are approved to the exclusion of others of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer's label.

Root necrosis caused by *Colletotrichum acutatum*

Natalia A. Peres and Jim Mertely, Plant Pathology, UF/IFAS GCREC

As most growers are aware, we experienced some issues at the beginning of this strawberry season with transplants that arrived infected with *Colletotrichum acutatum.* This fungus is widely known by growers as a cause of anthracnose fruit rot, but it can also affect other parts of the strawberry plant, including the roots, which occurred this season. Root necrosis was also an issue in the early 2000s, but severe problems had not been observed until recently.

C. acutatum frequently colonizes leaves and petioles of runner plants in the nursery. Symptoms may not be visible in the nursery environment, but if inoculum is allowed to build up and the weather is favorable, lesions may develop on the petioles (Figure 1). Little is known about how or when the pathogen spreads from colonized tissue above the ground to the root system below. However, *C. acutatum* grows freely in diseased tissues, and healthy plants may be contaminated by this inoculum during normal digging, trimming, and packing operations in the nursery.

Figure 1. Petiole lesions caused by *Colletotrichum acutatum*.

Early in the season, disease spread below ground is unlikely since the root systems are relatively isolated; however, above-ground spread does occur and may be facilitated by overhead irrigation during establishment. Even cultivars that are not highly susceptible to anthracnose fruit rot, such as Festival and Radiance, are susceptible to root necrosis.

Transplants with infected roots fail to establish after overhead irrigation is withdrawn. Few functional roots are found on infected plants even 1 to 2 weeks after transplant (Figure 2). Old structural roots are brown or black, whereas new roots develop brown lesions, die back from the tip, or fail to emerge from the crown. In late stages of the disease or when infections are severe, *C. acutatum* enters the crown, causes a basal crown rot, and eventually kills the plant (Figure 3). Surviving plants are often stunted, flower late, and produce a poor early crop (Figure 4). Infected plants may recover during the cool winter months and produce normally in February and March, if an outbreak of anthracnose fruit rot does not occur.

Figure 2. Plants affected by *Colletotrichum acutatum* have few functional roots .

Figure 3. Basal crown rot caused by *Colletotrichum acutatum*.

Figure 4. Stunted plants due to root necrosis caused by *Colletotrichum acutatum*.

Diseases caused by *C. acutatum* are best controlled by exclusion (not introducing the pathogen into the field). Therefore, transplants should be purchased from a reputable source and inspected for petiole lesions caused by *C. acutatum* (Figure 1). When the pathogen is present, pre-plant fungicide dips may be used to suppress disease development. In research trials conducted during 2003-04 and 2004-05 seasons, naturally infected runner plants were dipped for 5 minutes in Abound®, Switch® or Oxidate® just before planting. Abound® and Switch® were effective in reducing plant mortality but Switch was more effective in reducing plant colonization and increasing early and total yields. A similar trial is currently being conducted at GCREC with infected Florida Radiance plants. Results so far confirm the efficacy of Switch® in reducing plant mortality. Abound®, however, is not performing as well as in the past trials and this will be investigated further. Plants dipped in Actinovate® by itself also have reduced mortality and increased growth, but plants dipped in Actinovate plus Abound fare poorly. In a separate trial, infected transplants were not dipped, but are being sprayed weekly with different fungicides. To date, these treatments have not produced many differences in plant mortality but Captan applications seem to improve growth of the surviving plants.

With our current knowledge about this disease, the best and most economical disease management recommendation for growers who still have infected fields is to follow a strict schedule of weekly Captan applications. Plant mortality should slow down naturally as the season progresses (and temperatures decline) Hopefully, relatively inexpensive applications of Captan will promote sufficient plant growth and decent yields later this season.

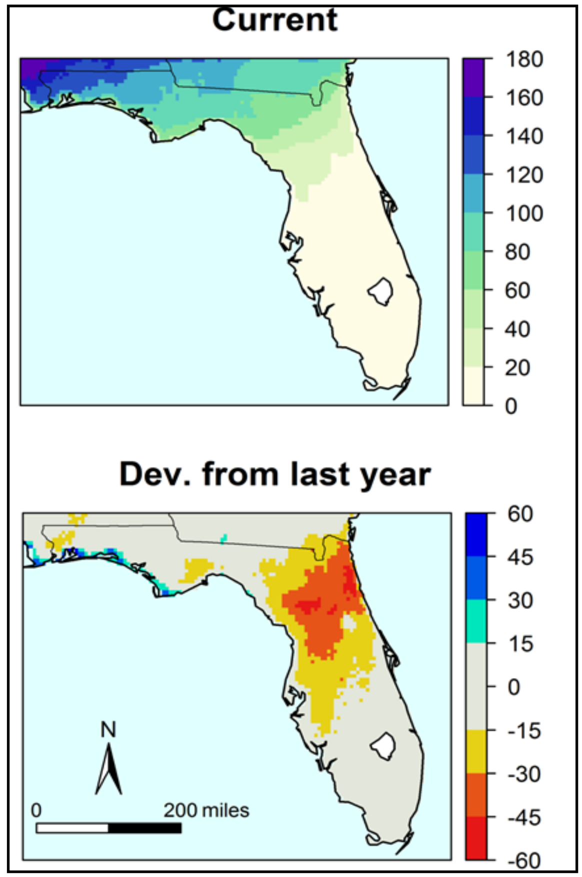
Neutral conditions expected to persist in the Pacific Ocean

Clyde Fraisse, Agricultural & Biological Engineering
UF/IFAS

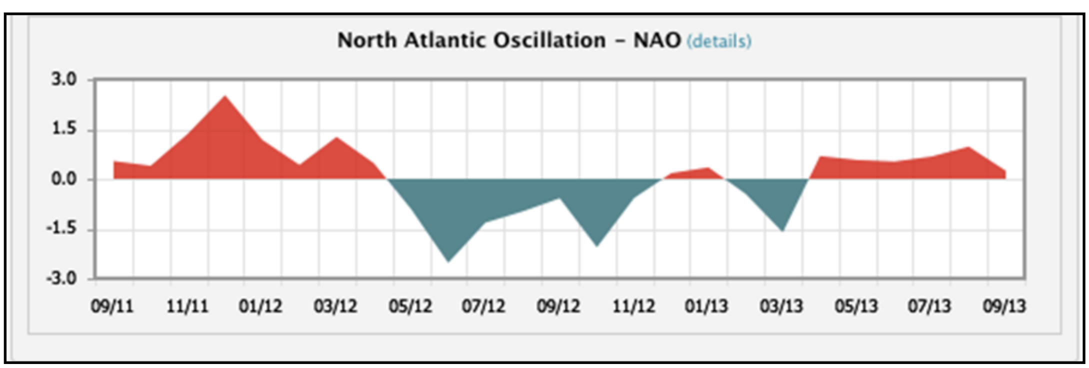
Average temperatures in Florida have been above normal resulting in low accumulation of chill hours across most of the state. Rainfall in November was variable, ranging from less than 0.5 inches in most of South Central Florida to over 8 inches in the southeastern region of the peninsula.

El Niño-Southern Oscillation (ENSO) neutral conditions continue, as reflected by near-average sea surface temperatures across much of the equatorial Pacific Ocean. Neutral conditions are expected to persist throughout the winter and spring. *During a neutral phase we can expect more variable weather patterns across the Southeast during the winter with swings between warmer, colder, wetter, and drier periods throughout the season. The likelihood of a severe freeze is also much greater than during either an El Niño or a La Niña event.* The neutral phase does not guarantee that we will experience damaging freezes, just that the odds are twice as likely than in other ENSO phases such as El Niño or a La Niña.

The North Atlantic Oscillation (NAO) is also an important driver of weather patterns in the Southeast. Strong positive phases of the NAO tend to be associated with above-average temperatures in the eastern United States and across northern Europe. Negative phases are associated with below average temperatures. Record cold temperatures observed in 2010 were associated with extreme negative NAO. Current NAO values can be tracked on AgroClimate.org.



Chill hours (32-45°F) by December 12, 2013. The number of hours observed this year in most of North Central Florida is below the hours observed at the same time last year. Chill hours can be tracked at: http://agroclimate.org/tools/Chill-Hours-Calculator/



North Atlantic Oscillation (NAO). Extreme negative (blue) phases are associated with below average temperatures in the Southeast. NAO is currently in a positive phase. NAO can be tracked at AgroClimate.org

Common Purslane (*Portulaca oleracea* L)

Nathan S. Boyd. Weed Science, UF/IFAS GCREC

Common purslane is an annual, succulent herb that occurs throughout much of Florida. It tends to grow along the ground but its growth habit can be more erect when it occurs with other plants. There are no hairs on the stems or leaves and both are often thick and fleshy. Leaves and stems are bright green to red (Figure 1). Leaf shape is variable but they connect directly to the stem without a petiole and tend to be spoon shaped. The small, yellow, flowers occur in clusters near the end of the stems. They have 4-6 petals and are only open in the morning (Figure 2). Multiple black seeds are produced in small roundish capsules with a pointed tip. When the seeds are mature the top of the capsule falls off like the lid on a jar leaving a cup-like container full of seeds (Figure 3).

Figure 1. Common purslane seedlings on the left and a young plant on the right.

Purslane seeds preferentially germinate in warm temperatures although it can occur throughout the year in Florida. It is a poor competitor with other plants but is a persistent problem due to its ability to produce thousands of seeds per plant in a relatively short period of time with the first seeds maturing within six weeks of emergence. The seeds readily germinate but can also persist in the soil for up to 15 years.

Figure 2. Common purslane flowers.

Figure 3. Small seed capsules.

Purslane is relatively drought tolerant. Shoot fragments are able to survive on the soil surface and will re-root when exposed to moisture. In fact, plants can flower and produce seeds even after they have been pulled from the soil. This characteristic enables purslane to persist and spread following cultivation.

There are many management options for purslane. It is a poor competitor and dense plantings can inhibit its growth. Cultivation and hand removal are options but due to its ability to survive following fragmentation, intensive cultivation is needed to reduce the population. Hand pulled plants should be removed from the field to reduce seed inputs. It is also susceptible to a wide range of herbicides including Aim, Gramoxone, Chateau, Devrinol, glyphosate, and Goal.

Dominus®, the new 'fumigant' on the block.

Dr. Gary Vallad, Associate Professor of Plant Pathology

This fall a new fumigant received approval from the US EPA with registration in Florida expected in early 2014. Dominus® was developed by Isagro and is a liquid formulation containing 96% allyl isothiocyanate with broad-spectrum activity against weeds, soilborne pests and pathogens. Allyl isothiocyanate, commonly known as oil of mustard, is the same organosulfur compound responsible for the pungency of many brassica species, such as mustard and horseradish, and was first recognized as a biopesticidal ingredient by the EPA in 1962. This makes Dominus® a novel biopesticide-based product for the pre-plant treatment of soils; and with USDA approval a possible candidate for use in organic production under the National Organic Program. Due to these favorable attributes, Dominus® is expected to have far fewer label restrictions compared to other commercially available fumigants; such as a shorter entry restricted period of 48 hours, no limit on the acreage that can be treated daily, a short tarp perforation and planting interval of 10 days, a minimal buffer distance of 25 ft regardless of application rate or acreage, and no requirement for a Fumigant Management Plan. Dominus® can be either shank-injected directly to the soil or applied as a diluted product through drip irrigation using conventional equipment.

In recent studies at the University of Florida, Gulf Coast Research and Education Center, the performance of Dominus® was comparable to a PicChlor 60 (shank applications) or

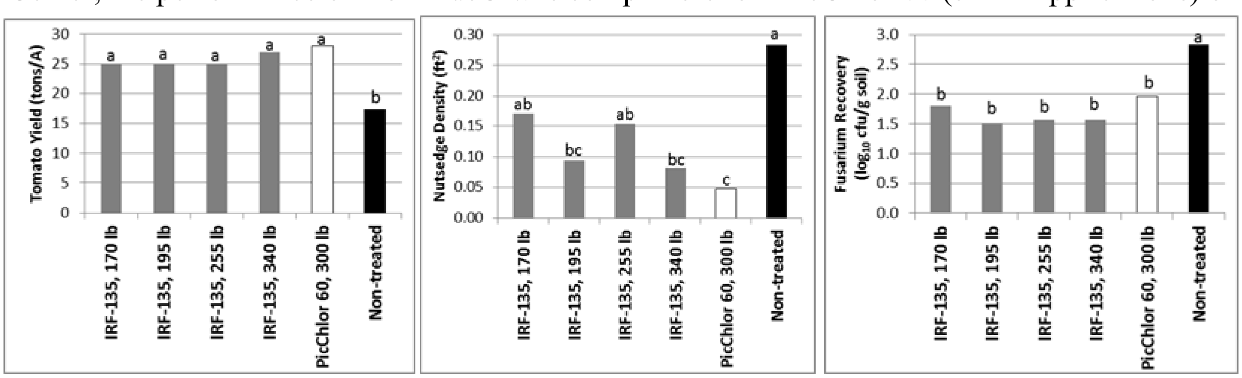


Figure 1. The effect of shank-applied IRF-135 (Dominus®) compared to a PicChlor 60 standard and a non-treated control on total tomato yield, nutsedge density and the recovery of total *Fusarium oxysporum* from plots (left to right), averaged across TIF and VIF plastic mulch treatments in the spring of 2012. Treatments with the same letter are not statistically different.

Kpam (drip application) standard in field sites with low to moderate weed, soilborne disease and nematode pressure, (Figures 1 to 4). However, applications of Dominus® through the drip irrigation were more effective than shank applications for managing nutsedge and soilborne pathogens. Additional trials and grower demonstrations are planned for 2014 to further refine recommendations for growers. Growers interested in additional information or interested in hosting potential demonstration sites for future trials are encouraged to contact me, Dr. Vallad, at the research center (gvallad@ufl.edu; 813-633-4121).

Figure 2. The effect of shank-applied IRF-135 (Dominus®) compared to a PicChlor 60 standard and a non-treated control on total tomato yield and the incidence of Fusarium crown rot (left to right), averaged across TIF and VIF plastic mulch treatments in the fall of 2012. Treatments with the same letter are not statistically different.

Figure 3. The effect of a drip-applied IRF-135 (Dominus®) compared to a Kpam (metam potassium) standard and a non-treated control on total tomato yield, nutsedge density and the recovery of total *Fusarium oxysporum* from plots (left to right), averaged across TIF and VIF plastic mulch treatments in the spring of 2012. Treatments with the same letter are not statistically different.

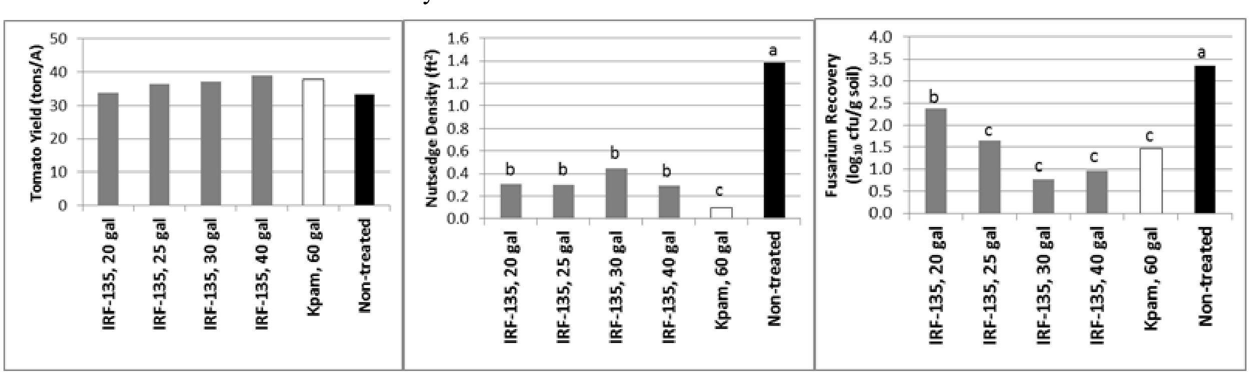


Figure 4. The effect of a drip-applied IRF-135 (Dominus®) compared to a Kpam (metam potassium) standard and a non-treated control on total tomato yield, nutsedge density and the recovery of total *Fusarium oxysporum* from plots (left to right), averaged across TIF and VIF plastic mulch treatments in the fall of 2012. Treatments with the same letter are not statistically different.

Structures for Protected Culture for Vegetable and Small Fruit Crops

(Source: Publication HS1224, EDIS, available at http://edis.ifas.ufl.edu/pdffiles/HS/HS122400.pdf)

Bielinski M. Santos, Gary E. Vallad and Emmanuel A. Torres-Quezada, UF/IFAS GCREC

Classification of protective structures

A protective structure is defined as any structure designed to modify the environment in which plants are grown. Protective structures, such as greenhouses, screen houses, and tunnels, are known worldwide as production systems for high-quality vegetable and fruit crops. Protective structures increase crop yield and quality by altering environmental factors, such as light, temperature, air humidity, wind, and/or pest pressure. Manipulation of these environmental factors depends on the specific properties of the materials used on the roofs and sides of structures, as well as on the structure height, shape, and position. For instance, greenhouses in regions located in northern latitudes, such as Canada and the Netherlands where season extension during the winter months is critical, possess glass roofs and sides to preserve heat and maximize penetration of solar irradiation. However, in greenhouses and screen houses in tropical and subtropical climates, structures are made of flexible solid or porous plastic sheets that often reduce internal heat accumulation and favor passive ventilation.

Protective structures are classified in two main groups, according to their roof types: a) greenhouses or nonporous roof structures and b) screen/shade houses or porous-roof structures (Figure 1). A porous roof cover is generally defined as a material that greatly restricts water and gas penetration through it. This does not include ventilation windows and openings on top of the structure. Examples of this type of roof include glass, Plexiglass, and multilayer polyethylene sheets. Nonporous roof examples are saran nets and screen sheets.

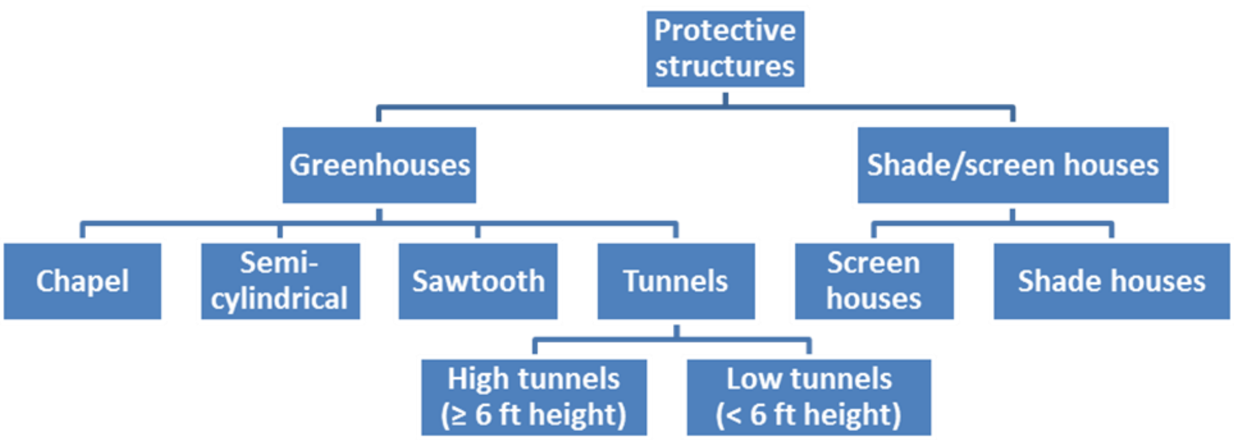


Figure 1. Protective structure classification according to roof type.
Credits: B. M. Santos and E. A. Torres-Quezada

Shade houses and screen houses are the predominant types of porous-roof structures. The main difference between them is the color and mesh of their nets. Shade houses are usually made of black, red, or blue covers, and they are designed to protect the crop from intense sunlight while decreasing temperature and air humidity under the structure (Figure 2). Screen houses protect crops from high winds and prevent entry of mites, thrips, and aphids. They are usually covered with white nets. The level of protection a screen house provides against arthropod pests is related to the mesh of the net used in the structure. Some disadvantages of screen houses are low air movement and high temperatures. The use of screen houses in subtropical and tropical areas may be limited during the rainy season because of the high incidence of physiological disorders and propagation of disease-causing pathogens. Both shade houses and screen houses have very low initial costs (< \$0.50/ft^2) and maintenance.

Figure 2. Shade houses for vegetable and small fruit production. Credits: B. M. Santos

Greenhouses come in a variety of designs for vegetable and small fruit production, and are classified according to their shape and height.

Chapel
This permanent structure has a roof with two tilted surfaces, between 25^o and 45^o, and is oriented according to wind speed and rainfall. It has either active or passive ventilation through the roof and sides. It's made of wood or steel and ranges in height from 12 to 20 ft (Figure 3a). Multi-chapel units are composed of single units attached to each other by rain gutters.

Semi-cylindrical
This permanent structure is usually made of steel and is as tall as the chapel type (Figure 3b). It has semi-circular or semi-oval rooves supported on sides as low as 6 ft high. This type of structure may have active or passive ventilation through the roof and sides.

Sawtooth
This permanent structure has one-side rooves tilted between 25^o and 45^o with one window for ventilation opposite to the direction of the predominant winds. It is designed to maximize the recirculation of the air from inside to outside. The structure is made of wood or steel and ranges in height from 13 to 20 ft.

Tunnels
Tunnels are the low-cost version of greenhouses. They are nonpermanent structures with passive ventilation through the sides and ends and have reduced construction and maintenance costs. These structures can be moved from one place to another, which allows for rotating to new soils and avoiding pests, disease build-up, and nutrient depletion. The structure's height directly influences air and soil temperatures under plastic roof covers. Tunnels can be classified as low (< 6 ft high) or high (≥ 6 ft high).

Low tunnels (also known as microtunnels) are small, simple, easily installed, and inexpensive. They are covered with a fine net or plastic film that provides temporary protection for the crop. Low tunnels are generally used to protect crops during initial growth stages, against adverse climatic conditions, and to exclude certain diseases and insects (Figure 4a). They are usually constructed along the crop row with flexible arches or hoops made of plastic or metal to support the net or plastic film. They can be ventilated by moving the cover to the sides and securing it with hooks or ropes. Their height usually restricts personnel movement and machinery under the roof, but they can cover more than one crop row.

High tunnels are passively ventilated structures built with metal (e.g., galvanized steel or iron), plastic (e.g., polyvynil chloride [PVC] pipes), or wood, which is usually covered with one or more layers of plastic film and anti-insect screen (Figure 4b). Their height is generally between 10 and 16 ft, and they are recommended for indeterminate-growth cultivars, which cannot be grown under low tunnels. Their height also allows for personnel and large agricultural equipment, unlike low tunnels.

Figures 3a and 3b. Multi-chapel (top) and semi-cylindrical (bottom) greenhouse units with passive ventilation on roofs. Credits: B.M. Santos

Figures 4a and 4b. Low (top) and high (bottom) tunnels for vegetable and small fruit production
Credits: B.M. Santos

Additional considerations for applying pesticides within protective structures

As mandated by the U.S. Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), it is unlawful to use any registered pesticide in a manner inconsistent with its labeling. Any language on the label that specifically prohibits or limits pesticide usage in a greenhouse environment must be followed. However, protective structures are quite diverse, and so growers must be mindful of what constitutes a greenhouse within state and federal laws. While the classification described here based on rooftops is a practical means for classifying production structures, many of these structures would not fall under the definition of a greenhouse as interpreted by the U.S. Environmental Protection Agency (US-EPA) for pesticide labeling. A greenhouse is defined within the Workers Protection Standard (40 CFR 170.3) as "…any operation engaged in the production of agricultural plants inside any structure or space that is enclosed with nonporous covering and that is of sufficient size to permit worker entry." Per the US-EPA interpretation of this definition (WPS 40 CFR Parts 156 & 170 Interpretive Policy), a structure is not considered a greenhouse with regard to pesticide applications if the structure is covered with a porous covering or has a nonporous roof with porous sidewalls. For the purpose of pesticide applications, structures that feature nonporous sides/panels for a significant portion of the structure that can be either removed, opened, or moved up or down would not be considered greenhouses as long as they are "open" and remain open during the pesticide application and during any applicable reentry interval. These removable openings do not include windows or doors (WPS 40 CFR Parts 156 & 170 Interpretive Policy).