Pest and Disease Best Management Practices

INTRODUCTION

Pests and diseases can pose a serious threat the marketability of your crops yet if properly managed, this risk can be significantly minimized. A pest is any organism that competes, injures, spreads disease, or annoys humans, animals, plants, and structures whereas a disease is any impairment with the normal state of plant that affects its structure and function. There are many preventative measures that can be taken to reduce the risk of pest infestation and disease. In cases where the pest or disease has gotten out of control, there are mechanical, cultural, biological and chemical controls that can be used.

Mechanical Controls are hands-on methods that include exclusion, destruction, or removal.

Cultural Controls are mechanical controls applied at specific times during particular stages in a pest's lifecycle to take advantage the pest's weaknesses.

Biological Controls use the release of a pest's natural enemies to kill pests. Biological controls include predators, parasitoids, and pathogens. Predators, such as lady beetles and lacewings, consume a large number of prey during their lifetime, eventually eliminating your plants' pests. Parasitoids at their immature stage, develop on or in the pest host, ultimately killing the host. Pathogens are disease-causing organisms, such as bacteria and fungi, that will kill or debilitate their pest host without harming your crop.[1] You can purchase biological controls from distributors such as Arbico-Organics or BioBest.

Chemical Controls are commonly referred to as pesticides and require careful application and use. All farmers must abide by the Worker Protection Standard. For general use pesticides, farmers do not need a pesticide license, but do need to follow label and directions. Depending on the pesticide, it may be registered by the EPA, listed under the Organic Materials Review Institute (OMRI) through the USDA, or listed under Section 25(b) which labels the pesticide as minimum risk and exempts it from registration. Regardless of its classification, it is important to read the pesticide label for the product identification information, safety information, environmental information, and directions for use, including the restricted entry interval (REI), personal protective equipment (PPE), and general use precautions. Most chemical controls are applied via a sprayer or fogger. You can read more on how to use a sprayer to manage pest and disease from Bright Agrotech.

[1] http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74140.html

Farming in the Leafy Green Machine presents both unique opportunities and challenges when controlling pests and diseases. With the use of hydroponics, your crops are not susceptible to many of the pests and diseases commonly found in soil. In addition, the enclosed nature of the shipping container enables you to control what enters your farm, thus making exclusion one of the best preventative methods in avoiding pests and diseases. However, because it is an enclosed and relatively small space, you must be mindful of your exposure to any chemical applications.

PREVENTATIVE PEST AND DISEASE CONTROL

Exclusion: The easiest way to avoid pest infestation is to prevent them from entering your farm. Use pest screens on the intake and exhaust fans and limit the time the door is open to the farm. Installing an air curtain above the door can also reduce risk of pests entering the farm.

Cleanliness: By keeping your farm space clean of debris and old plant matter, you reduce the risk of both diseases and pests. Make sure you dispose of dead plant matter from pruning, transplanting, and harvesting. Crawling insects may lay eggs, feed off of, or hide in old plant matter.

Observation: By keeping close attention to your plants, you can identify any onset of pests or disease infestation before the problem spreads to other plants. It is easiest to treat a disease or pest problem in its earliest stages.

-Schedule a weekly walk-through to observe the health of your plants and record your findings in a note book or ipad. You may even want to use a magnifying glass to take a closer look at your plants.

-Use sticky cards to help monitor pests that may be affecting your crops. Hang the sticky cards near your plants and check to see if they capture pests like whiteflies or thrips.

Plant health: Healthy plants that have sufficient lighting, water, and nutrients are less likely to fall prey to disease and pests. Also, identifying and removing unhealthy or weak plants can help avoid future problems with disease and pests. Weaker plants are more susceptible to diseases and pests and once infected, can spread to other healthier plants.

Humidity Control: Reducing humidity by maintaining adequate air circulation both throughout the farm and between plants can prevent diseases from developing. In the Leafy Green Machine, humidity is regulated using the exhaust fans.

Crop Spacing: Proper spacing allows airflow between plants and prevents humid microclimates that prevent disease growth from forming. Additionally, when plants are grown very close to one another, they create “plant bridges” that allow pests to easily move from one plant to the next, eventually infesting the entire crop. Spacing crops appropriately helps prevent pests from quickly spreading.

Companion Planting: Interplanting companion plants can either naturally repel pests to deter a pest infestation or attract pests to deter them from marketable crops. For example, strongly scented crops, such as garlic, onions, basil, and lavender are known to repel some pests such as aphids and whiteflies. Planting crops such as nasturtiums will attract aphids away from your other crops; the pests can them be removed from the targeted crop by hand, using an insecticidal soap, or removing the whole plant from the farm.

Resistant plant varieties: Selecting plant varieties that are bred for pest and disease resistance is a great first step to limiting your crops' susceptibility.

REACTIVE PEST CONTROL

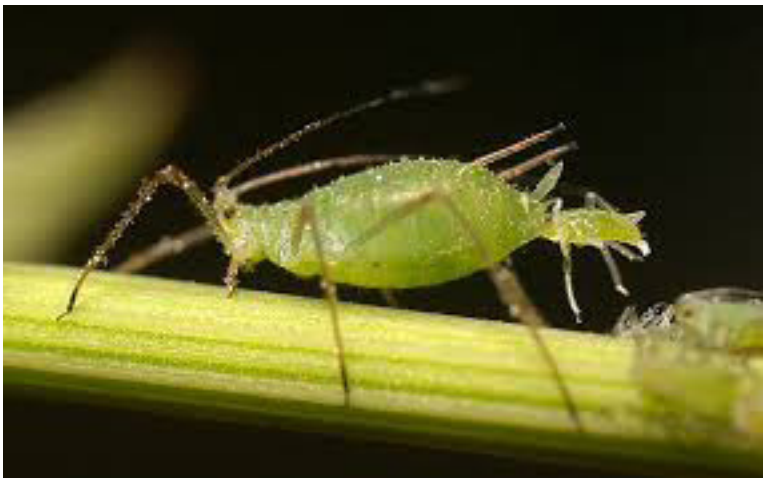
The General Procedure:

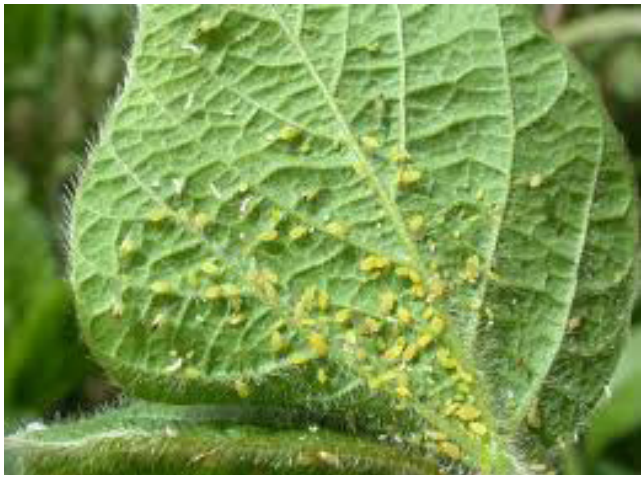
Step 1: Identify the pest. Before you can effectively treat a pest, you must correctly identify it. Use the resources found in this packet, online, and at your local extension school to aid in your identification.

Step 2: Depending on the plant damage you can choose to either remove the infested plants altogether or to salvage them by applying a chemical control.

Step 3: Introduce a biological control to wipe out the remaining population of the pest and to provide baseline protection towards future pest infestations.

Aphids





Aphids use sucking-piercing mouthparts to feed on plant juices, which will aesthetically damage plants or introduce plant pathogens. Usually aphids can be found clustered together on the underside of plant leaves. They can also cause the leaves to yellow or stunt the growth of plants.

Affected Crops: kale, lettuce, bok choy, other greens

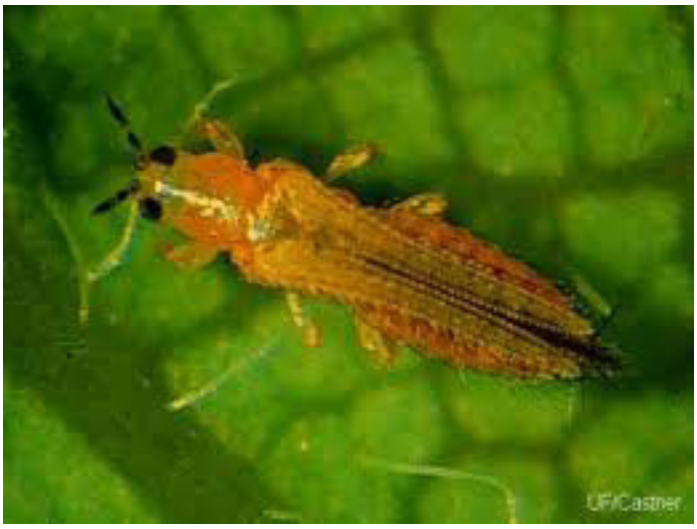
Recommended Controls:

Mechanical control - Remove infested and damaged crops from the farm.

Biological controls - Introduce predatory insects, such as lady beetles (adalia bipunctata), parasitic wasps (aphid ius colemani) or lacewings (chrysopa carnea) to consume the aphids eating your crops.

Chemical controls - Apply insecticidal oils and soaps such as PyGanic, neem oil, or mycotrol.

Thrips



Thrips feed on the bud, newly expanded leaves, and other young tissue of the plant by sucking up sap. They are tiny insects, less than an eighth of an inch long, slender in shape with fringed wings. If infected, the leaves and stems may appear dried out with tiny pale spots, papery or distorted, and you may find discoloration, flecking, or silvering of the leaf surface.

Affected crops: flowering plants, chives

Recommended Controls:

Mechanical control - Remove infested and damaged crops from the farm.

Biological control - Introduce predatory insects such as thrips predator (amblyseius cucumeris), lacewings (chrysopa carnea), minute pirate bug (orius insidiosus), predatory mites (amblyseius sqirskii and amblysei us degenerans), or predatory nematodes (steinernema feltiae) to consume the thrips eating your crop.

Chemical control - Apply sprays with the active ingredient spinosad and insecticides such as Botaniguard, Neem Oil, insecticidal soaps such as Safer, and pyrethrins such as Pyganic; fogging application works best for these treatments.

Whiteflies

Whiteflies feed by sucking sap out of leaves, stems, and branches stunting, yellowing, and causing premature leaf dropping. Whiteflies generally reside in groups on the underside of leaves. Adult whiteflies have yellowish bodies with white wings, whereas in their immature stage, they are wingless.

Affected crops: brassicas, cucumbers

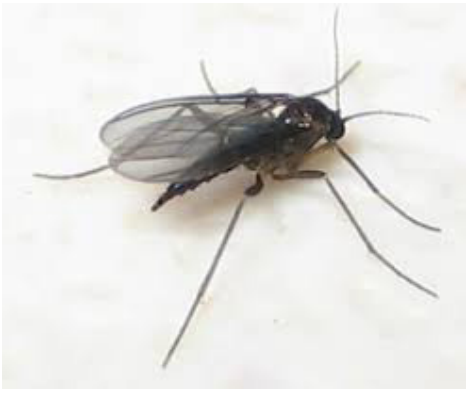
Recommended Control:

Mechanical control - Remove infested and damaged crops from the farm.

Biological controls - Introduce whitefly parasitoid (encarsia formosa; eretmocerus eremicus), whitefly predator (delphastus catalinea), predatory mite (amblyseius swirskii), or green lacewings (chrysopa car nea) to manage whitefly population.

Chemical controls - Apply insecticides with the active ingredients azadirahtin such as AzaGuard; Beauveria bassiana, such as Botaniguard; and Pyethrins such as Pyganic.

Fungus Gnats



Fungus gnats are small flies with long slender antennae and long legs. Thier larvae will feed on plant roots causing plant stunting, root damage, and wilting. Adults gnats, however, are harmless. While fungus gnat larvae generally live in soil, there is still the risk of them inhabiting the grow medium in the farm.

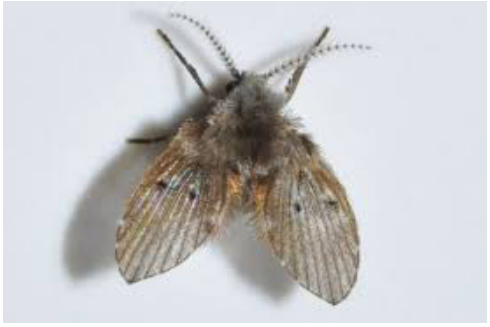
Recommended Control:

Mechanical control - Avoid overwatering and/or spillage onto the floor as fungus gnats are attracted to moist areas; use sticky traps to catch mature fungus gnats and raw potato chunks to attract and catch their larvae.

Biological control - Introduce predatory mites (hypoaspis miles), predatory nematodes (steinernema nema todes), rove beetle (atheta coriaria).

Chemical control - Apply insecticide containing pyrethrin, such as Pyganic.

Drain Flies



Drain flies, also known as moth flies, are about 1/8 inch in length and have fine hairs covering their wings. They lay eggs in organic slime that can build up in drains. They do not damage plants but can be a nuisance to work around.

Recommended Controls:

Mechanical control - Preventatively, keep the drains in the farm clean and free of slime buildup. If an infestation does occur, clean the drain with a bristle brush and an enzyme or bacterial drain cleaner (although there are home remedies for cleaning drains, such as bleach and vinegar solutions, these will not kill drain fly eggs)..

REACTIVE DISEASE CONTROL

The General Procedure:

Step 1: Identify the disease. Before you can effectively treat a disease, you must correctly identify it. Use the re sources found in this packet, online and at your local extension school to aid in your identification.

Step 2: Correct any climate conditions that may have supported the onset of the disease. These often include high humidity levels and high temperatures.

Step 3: Proceed with the mechanical, cultural and chemical controls outlined below.

Powdery Mildew

Powdery mildew occurs in hot, moist conditions and can be identified by yellow patches on the leaves and white powder covering selective leaves. It will reduce plant's growing cycle and cause the plant to be less productive.

Affected Crops: artichokes, tomatoes, peppers, onions, and lettuce

Source: fungus developing from hot, moist climates

Recommended Controls:

Cultural controls - Remove infected plants to prevent the disease from spreading and to provide adequate and ample air flow between crops.

Chemical controls - Apply serenade sprays or horticultural oils, such as Neem Oil, Jojoba Oil, or Sunspray Ultra-Fine Spray Oil to control powdery mildew. Additionally, any spray that makes the leaf surface pH more basic will help control powdery mildew.

Pythium

Also referred to as water mold, pythium exists in water and can lead to damping off in seedlings and root rot in mature plants. [2]

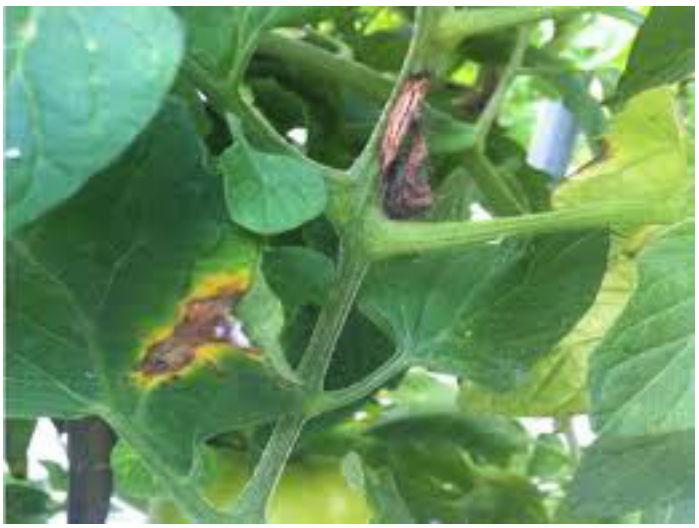
Source: Pythium can be introduced through your water supply or carried by pests, such as fungus gnats.

Recommended Controls:

Cultural controls - Drain, clean and disinfect the water tanks and irrigation lines with a hydrogen peroxide or peroxyacetic acid solution. Prune infected crops to provide ample air circulation.

Chemical controls - Apply fungicides such as Mycontrol.

Grey Mold (Botrytis)



Grey mold is a fungal disease that spreads in damp, cool to mild weather. It can be identified by its grayish color and soft mushy spot on leaves, stems, flowers, and fruit.[3]

Source: Grey mold feeds off of wounded or dying plant parts.

Recommended Controls:

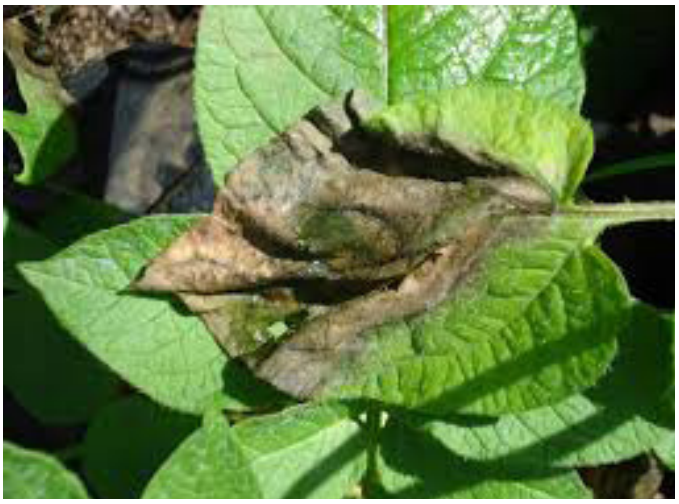
Mechanical controls - Remove wounded, dying and/or infected plants to reduce the risk of disease spread ing and to improve air flow between crops.

Chemical controls - Apply a copper or sulfur based fungicide or Mycontrol.

2. http://www.agf.gov.bc.ca/cropprot/pythium.htm

3. http://www.planetnatural.com/pest-problem-solver/plant-disease/gray-mold/

Blight



Blight can be caused by a variety of diseases and appears as small dark spots on the leaf or fruit. The spots appear to be greasy and turn from brown to black. Applying too much nitrogen at the beginning of the growing cycle can worsen the disease. The disease can also spread in damp, cool conditions.

Source: Blight can be caused by a variety of other diseases.

Recommended Controls:

Cultural and mechanical controls - It is nearly impossible to remove or control blight once it has infected plants.

Chemical controls - Apply a fungicide, such as Serenade, to help prevent disease spreading.

Resources:

State extension school for trainings, resources, and testing labs.

"Disease Control Packet" by Bright Agrotech

"Pest Control Packet" by Bright Agrotech

Integrated Pest Management Blog Post from Bright Agrotech

"Resource Guide for Organic Insect and Disease Management" from Cornell University

Crop Data Management Systems Database for data and information on labels