Identification and Management of Pumpkin Insects and Diseases

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There have been some very important changes in pumpkin and cucurbit pest management since we sat at this conference in 2003. We use to worry about managing the following important insects and diseases: striped cucumber beetles, bacterial wilt, powdery mildew, black rot/gummy stem blight, scab, and Phytophthora. As if that wasn’t an impressive enough list to worry about, the pest complex or lineup has expanded, and now includes a couple of heavy hitters like Plectosporium blight and the early occurrence of downy mildew, that absolutely must be included in your management plan. There are also other threats on the horizon that seem to be gaining importance in the last few years, these include things like Fusarium crown and fruit rot and Cucurbit Yellow Vine Disease, which is vectored by the squash bug. You could also run into trouble with relatively minor pests like Alternaria, angular, or bacterial leaf spot, Sclerotinia white mold, squash beetle, melon aphids, and viruses. What I’m going to try to do in this talk, is to show you what many of these pest look like, so that you will hopefully recognize them and be able to react in a timely fashion if they occur on your farm. I will also review pest management practices and help you build an effective spray schedule for the expanded pest complex.

We’ll start at the beginning. Adult cucumber beetles damage cucurbit crops primarily by feeding directly on the cotyledons, foliage, and stems of the newly emerged seedlings, thereby reducing plant stands, and also by transmitting the pathogen (Erwinia tracheiphia) which causes bacterial wilt disease. The bacterial wilt pathogen survives through the winter in the hind gut of the cucumber beetle and spreads when the beetle defecates in feeding wounds. Over 10% of the beetle population may harbor and vector the bacteria. Seedlings need to be protected until the plants reach at least the 3 to 5 true-leaf stage of development. Protecting older plants generally does not reduce plant death due to bacterial wilt or direct feeding, but blossom or fruit feeding and excessive defoliation on more mature plants may delay growth, reduce yield or render fruit unmarketable. Successfully controlling large colonizing beetle populations through June will generally eliminate problems with this pest later in the season. On occasion, high populations of beetles late in the season may start to damage fruit or handles and require treatment.

Technid flies and Brachonid wasps can parasitize up to 70% of the adult beetles but generally do not provide commercial level control of the population early in the season. Rotating your cucurbit crop to a distant field at least ½ mile away can help reduce the beetle population. A trap crop of Blue Hubbard, or another Cucubita maxima variety, can be planted on all four sides of the main cucurbit crop, and sprayed when the beetles first arrive to protect squash, cucumber and melon plantings from beetles and wilt. However, perimeter trap cropping is less reliable with pumpkins, but can work if the pumpkin planting is delayed until late June and/or beetle populations are low to moderate.
Floating row covers can also be used to exclude the beetles from plants, but must be removed by bloom to allow bees to pollinate the crop. Planting on black plastic mulch reduces the survival of beetle larvae by up to 50%. Kaolin clay (Surround) or pyrethrum can be used to repel or reduce beetle problems, but should be combined with other cultural techniques to help lower populations. Finally, foliar sprays such as carbaryl (Sevin) and synthetic pyrethroids (i.e. Asana), or systemics such as imidicloprid (Admire), usually provide control of both beetles and wilt. Plantings should be monitored for reoccurrence of beetle populations to see if reapplication is warranted. Wilting plants should be removed from the field early in the season to help minimize the number of beetles that carry the wilt organism and secondary spread to new plants.

In non-rotated fields, squash beetle populations may accumulate and feed directly on the rind of the fruit before harvest and on rare occasion may require treatment. Both larvae and adult beetles will feed on cucurbit plant foliage, but defoliation is considered of minor importance. Insecticides or the early-season use of row covers will control these beetles.

Another occasional late season pest is the melon aphid. Melon aphid populations accumulate quickly on the lowers side of leaves, especially during prolonged periods of dry weather. Heavy feeding can cause leaves and vines to collapse or produce marketability problems, as their waste (honeydew) and cast skins are difficult and/or impractical to wash off of the fruit. This aphid species is particularly prone to develop resistance to insecticides. Newer insecticides such as Fulfill are still effective, but should not be used on a routine basis, only to protect fruit from honeydew near harvest. Aphids also vector many different viruses to cucurbit plants, which can affect vine growth and the shape and color of fruit at harvest. Controlling aphids with insecticides will not provide effective control of viruses and will only hasten resistance and render insecticides ineffective. Horticultural oils may reduce the transmission of viruses if good under leaf coverage can be obtained, populations are relatively low, and they are reapplied frequently (twice each week). Reflective aluminum, blue or even black mulches have also been shown to reduce aphid infestations.

The squash vine borer is another insect that is present in all cucurbit plantings and may damage certain squash varieties (summer squash), but rarely damages pumpkins. Adults lay eggs mainly on lowers sections of vines between mid-June and August. Pheromone traps can be used to monitor adult flights and time insecticide applications in susceptible crops. Larvae bore into stems and vines, injuring or killing runners or entire plants and may even severe the stem from the ground. Pumpkin plants put down adventitious roots from the nodes along the vine which seem to compensate for SVB injury. Pumpkin fruit size and number are not affected by vine tunneling. Deep plowing (moldboard plowing) buries overwintering larvae deep in the soil and will reduce SVB numbers over time. Pesticides that control cucumber beetles will generally provide control of SVB also, as will spinosad (SpinTor and Entrust).

Plectosporium blight, caused by the fungus *Plectosporium tabacinum*, was initially detected in Tennessee in 1988 and has since spread to most states east of the Mississippi River. It wiped out half the pumpkin crop in Illinois in 2000 and was first detected on a couple of farms in Massachusetts that same year. In 2003, it was found on over a dozen farms throughout Connecticut and Massachusetts. With the second wet season in a row in 2004, Plectosporium spread to all farms I checked between Long Island Sound and Burlington, VT. Crop losses in
Connecticut on no- or low-spray fields in 2004 ranged between 50% and 100%. Connecticut experienced an extreme drought in 2005, and most growers did not have a problem with this disease. A few pumpkin fields out near the NY/MA borders, where they had slightly more rain, experienced infections on vines and handles (but not fruit) even with regular fungicide applications. This was especially true of fields that were not rotated.

Plectosporium blight is known to cause damage to a wide variety of cucurbit crops in Europe and Asia, but the strain present in the U.S. seems to primarily damage pumpkins, summer squash, zucchini and a few varieties of gourds. This same species of fungus also causes a new disease called russet (not rust) on snap beans. It has caused complete loss of some snap bean fields in the Mid-Atlantic States when harvest is preceded by heavy rainfall. This may or may not be the same strain that causes the disease on cucurbits.

Plectosporium is a soil-borne fungus, but also winters on crop residue. It has not been reported as seed-borne. White lesions occur on vines, fruit and sometimes leaves. Spores are produced on the lesions and are carried on the wind. Observation of disease spread in Connecticut indicates that spores are carried long distances on storm fronts and infect many fields over large areas simultaneously. Infection is favored by wet weather, but is not suppose to be a problem in dry seasons.

Disease management tactics for Plectosporium include a 3 year crop rotation, planting at sites with good air circulation to encourage rapid drying, scouting fields for disease, making timely fungicide applications, and plowing under crop residue after harvest. There are no known resistant varieties. Certain varieties such as Sorcerer, Gold Standard and sugar pumpkins seem to be less susceptible than others grown in the same field.

Last year I recommended applying fungicides for this disease when it was first observed during weekly scouting trips, when the fruit were the size of grapefruit, or when powdery mildew first occurred. Even with very little summer rain, this proved to be too late in the wetter western portion of the state in 2005. Some pathologists recommend initiating fungicide applications at fruit set, which is what I will be recommending in CT next season. I will discuss the efficacy of different fungicides after we talk about several other important diseases that must all be considered when designing a spray program for pumpkins.

Another disease that we now have to plan into our management plan for pumpkins is downy mildew. This disease is not new, but there is a new twist to it that allows it to be much more destructive in our area. Downy mildew overwinters on living hosts in the south and use to reach New England by September every 4 to 6 years. Since it only attacks the foliage, we never use to worry much about this disease on pumpkins, because if the foliage goes down in September it only helps the fruit to color and mature. However, recently downy mildew has begun to arrive in our area in late July (2004) or early August (2005). Rumors on the web have attributed this to the fact that NJ growers may be bringing up infected transplants from FL, thus the disease only has to travel from NJ instead of up the entire East Coast. If this is true, then it will be necessary to include fungicides that are effective against downy mildew in our August spray schedule every year to help protect the foliage, size the fruit, and preserve yields. A better strategy is to
scout your cucurbit plantings weekly, and adjust your fungicide program to include effective downy mildew control when the disease first appears.

To do this you will need to be able to recognize the disease. Downy mildew first appears as pale indistinct yellow spots on the upper leaf surface. As the leaf area around the spots dies, the damaged area is contained by small veins. The enlarged brown dead spots become sharply angled giving the leaf a mosaic appearance. If it progresses unchecked, leaves die and denuded stalks or petioles can be seen sticking up all across the field. The disease is favored by wet, humid conditions. If detected early, effective fungicides can control this disease.

Experience on cucumbers and other crops over the last couple of years has shown that some of the highly recommended materials for downy mildew control (e.g. Bravo and Cabrio) have had no effect on the strain(s) of downy mildew that has reached New England. In CT, even “resistant” cucumber varieties sprayed with these materials in a timely fashion have died in one or two weeks. One material that has shown the ability to stop downy mildew in its tracks is Ridomil Gold Bravo. Other systemic materials that seem to control this disease include phosphorus acid products such as ProPhyt, Phostrol or Fosphite. These may be cheaper alternatives to Ridomil and provide something to rotate to after making an initial application with Ridomil Gold Bravo when the disease first occurs. Another possible product to use for the first application against downy mildew would be Curzate. Curzate can stop the initial infection process but only works for 1 or 2 days. As mentioned earlier, the object will be to control downy mildew through August, and then stop spraying for it in September when it will not damage our pumpkin crops.

Before I talk about powdery mildew, I’d like to spend a couple of minutes on resistance management. A good resistance management program is important with any pesticide, but it is particularly important with systemic fungicides where resistance problems can occur within a single year with overuse. To slow the development of resistance and preserve the useful life of these important tools in pumpkin pest management we recommend the following. 1) Start spraying for mildews when the disease first occurs, not preventatively, and not after it has spread all over the field. 2) Use only a single application per season from each systemic group. 3) Use a high rate for the DMI group (Procure and Nova). 4) Apply systemics with a contact fungicide. 6) Use a high pressure boom sprayer and at least 40 gallons of water per acre for better leaf coverage. 7) Use only protectant fungicides early in the season, before powdery mildew occurs, and late in the season after applying a single application from each systemic fungicide group or chemical family. 8) Don’t try to get complete control of powdery mildew. The object is to push disease infection and development as far back into the season as possible to maximize yields and profits, rather than let the disease start spreading through the crop early.

If you don’t practice resistance management, you have nobody but yourself to blame if these fungicides no longer work in a year or two, and your neighboring farmers should also be blaming you for their crop failures too. We all need to take a long-term approach to pumpkin production and realize that the objective is not to just have a great crop for this year, but rather to make a good living from this crop every year. It will be much easier to accomplish that goal if we have effective fungicides to help us.
Powdery mildew is spread on the wind from Southern states where it overwinters on living hosts. It is favored by dense plant growth, low light conditions and high humidity. Infection generally starts, and is more severe, on the undersurface of leaves and on older leaves than on upper leaf surfaces and younger leaves. It can cause premature leaf and plant death, sunscald, loose and desiccated handles, and predispose the fruit to black rot.

The main management practices for powdery mildew include reducing plant density, using resistant varieties, scouting, and the use of fungicides, especially systemic fungicides. Reducing plant density in turn decreases humidity and increases light in the plant canopy making the plants less susceptible to infection. Powdery mildew resistant varieties are less susceptible to the disease than other varieties, and may make it possible to lengthen spray intervals and reduce pesticide use. Two resistant pumpkin varieties that found favor with CT growers in 2005 were Gladiator and Hercules.

Growers should scout the lower side of 50 crown leaves on a weekly basis to determine when powdery mildew sprays should begin. Since powder mildew infections usually start on the underside of the leaves, and spraying the bottom of pumpkin leaves is very difficult, systemic fungicides are usually more effective at combating the spread of this disease. Because diseases spread so fast within a field, the best strategy is to use the most effective fungicide first, to delay the initial infection process, lower overall spore production and delay and reduce secondary infection cycles. Late in the season, after using one shot of each effective systemic fungicide group, it is best to switch to a protectant or combination of protectant fungicides to maintain control until harvest, while preserving the useful life of the systemic materials for future years. The most effective systemic materials we have include Pristine, which contains boscodil and pyraclostrobin (Cabrio), and the DMI group, Procure and Nova. The most effective protectants for powdery mildew have been sulfur or horticultural oil. Sulfur only controls powdery mildew. It should always be used with other broad-spectrum protectants such as Bravo, copper, or maneb to help stop fruit rot diseases (Plectosporium, black rot, scab, etc.). Do not apply sulfur if temperatures exceed 90 degrees F, before/with/after oil applications, or to melons due to potential phytotoxicity problems.

So what should an effective spray schedule look like? We should be starting at fruit set with the most effective non-systemic material for Plectosporium blight. That would be Bravo or another effective protectant. However, copper and maneb products have not proven as effective at protecting the handles as Bravo, so should only be used when the weather is dry and does not favor disease development. When powdery mildew is first detected we should use a combination of systemic and protectant fungicides. During August when downy mildew arrives we should include Ridomil Gold Bravo and/or a phosphorus acid product. Finally, in September we should be protecting the fruit from late season rots with protectants until at least mid-September. Sprays should be applied on a 7-10 day schedule depending upon weather conditions. Organic grower may rely on a combination of copper and sulfur or copper and oil.
**Possible pumpkin spray schedule for 2006**

<table>
<thead>
<tr>
<th>Crop/disease development</th>
<th>Application</th>
<th>Product(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>seedling (beetles/wilt)</td>
<td>1</td>
<td>Sevin</td>
</tr>
<tr>
<td>fruit set (Plectosporium)</td>
<td>2-3</td>
<td>Bravo</td>
</tr>
<tr>
<td>powdery mildew detected</td>
<td>4</td>
<td>Pristine + copper</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Procure (full rate) + Bravo</td>
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<tr>
<td>downy mildew detected</td>
<td>6</td>
<td>Ridomil Gold Bravo + sulfur</td>
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<tr>
<td></td>
<td>7</td>
<td>ProPhyt + maneb + sulfur</td>
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<tr>
<td>fruit coloring</td>
<td>8</td>
<td>Bravo + sulfur</td>
</tr>
<tr>
<td>windrow fruit</td>
<td>9</td>
<td>Bravo</td>
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