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TOBACCO

CONTROLLING KENTUCKY'S MOST DESTRUCTIVE TOBACCO DISEASE - BLACK SHANK

by William Nesmith

SITUATION: Black shank causes more damage to burley and dark tobaccos in Kentucky than any other infectious disease. Although blue mold causes much more damage in some individual seasons, black shank takes a major toll every year. Statewide annual losses from black shank range from 1 to 5% of crop value. Where rotation has been abandoned, individual field losses exceeding 50% of the yield potential are not uncommon, even with resistant varieties and fungicides.

Controls are available, but the options are not compatible with industry wishes. Growers often desire to crop tobacco continuously in the same field, while trying to stop black shank with a single tool. Unfortunately, no chemical alone stops the disease, and no variety is immune to black shank - despite advertisements to the contrary. Crop rotation, the single most effective tool, is an expensive control option on most Kentucky farms, because the effective alternatives provide low economic returns. Further complicating the issue is that certain government disaster and insurance programs can be manipulated such that the short term economics favor having uncontrolled black shank.

Of fundamental importance is the need to understand that once a site has become infested with an abundance of the black shank causal agent, it will not be eliminated by normal farming practices. Instead, the aim should be to manage the field in ways that keep the population of the pathogen below damaging levels. This usually means a significant change in the production approach. Furthermore, it should be appreciated that some of the popular and recommended practices used to grow tobacco in the absence of black shank, will actually enhance black shank development once the pathogen is present at the site. Controlling black shank requires a mind-set that one is dealing with a strong, multi-faceted pathogen and each control option has limitations. Consequently, several controls options must be integrated together into a black shank management plan for each particular field on the farm.

THE PATHOGEN: Black shank is caused by a soil-inhabiting microbe called *Phytophthora parasitica var. nicotianae*. It is a classic polycyclic disease, with many infection cycles occurring within the same season. Inoculum density of less than one spore / gram of soil is capable of causing severe losses. It produces multiple spore stages that give it great potential to attack quickly (sometimes completing the life cycle within 48-72 hours), and the ability to persist without a host for several years. The swimming spores, which require warm moist conditions (free-water), locate the infection site and cause most of the infections after they encyst on the roots or stem. This stage can and does penetrate tissue directly, but wounding of the roots or stem make their task much

easier. Consequently, other root and stem diseases and injuries caused by physical, environmental, and chemical means must be controlled, too. This organism is a very capable and destructive pathogen by itself, but it is even more destructive when the host has been weakened by other factors. Once infection has occurred, the plant provides sufficient moisture for pathogen growth, and about any stress to the plant can greatly enhance disease progress and severity. Therefore, black shank is often operating in a complex with other factors.

At least two races of black shank occur in Kentucky and additional races also exists, based on current research. However, there are many strains of the pathogen within these races operating within the state and region. So as new resistance genes are deployed against them, expect new races to be described.

Race 0 is the original race and historically has been the most common in Kentucky, but Race 1 was found in almost equal numbers in the 1999 survey. The root systems of L8-hybrids have a very high level of resistance to race 0. However, the L8-hybrids are susceptible to other races of black shank. Varieties with general resistance (horizontal to both races, often called Florida-301 type resistance), will maintain both races of the pathogen in the soil, and high populations of either race can result in severe stunting or death to plants with general resistance. Consequently, continuous cropping of resistant varieties in the same field year after year results in a very high disease potential due to both an increasing population of the pathogen plus one that is becoming more virulent - more aggressive. Most of the resistance is in the root system, and once infection has advanced to the stem/stalk, death usually follows quickly in all varieties.

CONTROL: Below is a review of the black shank controls. Rigorous sanitation, rotation to non-host crops, resistant varieties, and a regimen of control chemicals should be integrated into a management plan (4R's Program), but production practices that reduce a conducive environment are also important.

ROTATION should be the foundation of the black shank management plan. Inadequate crop rotation is a major reason that black shank continues to increase in importance in Kentucky. This is a key practice in reducing the population of the black shank pathogen between crops. Rotation starves it, allowing a rapid decline in the pathogen's population while also reducing the aggressiveness of it. About any crop other than tobacco grown on the site will reduce the population, but not eliminate the fungus. The longer out of tobacco the lower the population of the fungus. However, crops growing in high soil pH (such as alfalfa) allow slower decline in the population.

Rotation to grass sods usually results in the fastest decline, based on a number of tests conducted by the University of Kentucky over many decades. A long term rotation - no less than 3 years and preferably 5 years or more - is the best way to reduce the initial population in any particular field. The longer the rotation, the smaller the pathogen population in later crops. However, even short term rotations help control black shank, and can be coupled with resistant varieties and fungicides into a successful program. Long-term rotation may not completely free the soil of the pathogen.

RESISTANT VARIETIES are an important tool in black shank control, but growers often expect too much from the varieties. No available variety is immune to black shank. Instead, the varieties possess various levels of resistance to the disease, ranging from very susceptible to medium resistance. Unlike with flue-cured tobacco, there are no burley varieties with high resistance to both races, and even less resistance is available in dark types. The level of resistance may vary by race of the pathogen, also. Those varieties crossed with L8, will have high resistance to race 0 (often scored as 10 in the variety tables) while those with Florida 301-resistance will have some resistance to both races (ranging from 1 to 6 scores on a 0 to 10 scale). Understand that planting a variety with a level 6 resistance, means that 40% loss should be expected on heavily infested sites if no other controls are added. The fungus actually increases on the roots of all tobacco varieties - including resistant varieties, so varieties alone will not control black shank.

The variety needs to be matched to the black shank potential of the site! Predicting the potential is not easy, however, because so many factors are involved. For example, if a variety with medium resistance is placed on a site with high potential for black shank (repeated cropping to resistant variety with increasing levels of black shank) under high soil pH, the grower should expect losses approaching 50-60% of the yield potential, assuming no other control measures are included. In contrast, planting that same variety on a site that has had the disease potential lowered by 1 to 2 years of rotation, could result in little loss.

CHEMICAL CONTROLS alone will not adequately control black shank, but they are a valuable aid in controlling black shank when coupled with other practices. Two types of chemicals are available; preplant soil fumigation and soil-applied fungicides. Few growers in Kentucky use the preplant soil fumigants, but they are a valuable tool in the management of black shank and other soilborne diseases. Best results have occurred in Kentucky tests on sites with serious problems with black shank when the fumigant, Chloropicrin, has been applied as a broadcast treatment, rather than in-row. However, in addition to the fumigant, resistant varieties and soil fungicides are still needed. The fumigant is not a substitute for crop rotation, but it can be of great assistance with short term rotations, especially if one need to use varieties that are not immune to black root rot, or where nematodes are also present.

The fungicide Ridomil 2E (containing metalaxyl) was available from 1980 until recently for the control of black shank. However, it is no longer manufactured and little is still available. Now, the soil fungicides available are Ridomil Gold 4EC and Ultra Flourish 2EC. They contain the same active ingredient, mefanoxam, but the rate in Ridomil Gold is twice that in Ultra Flourish. When used at equal rates of active ingredient, these two fungicides have perform equally in many side-by-side test about Kentucky. However, they are not a cure--all for black shank. They should be coupled with rotation and a resistant variety for satisfactory results. Some benefit can be achieved from using them with susceptible varieties under low disease pressure.

These fungicides are labeled for use in the soil as preplant, cultivation, and layby applications. It is important that these fungicides be in the root zone as well as near the stem for control of black shank. The rate of fungicide and number of applications needed are dependent upon the disease severity. Under moderate to heavy disease pressure, multiple applications (split applications) are needed to keep them available to the plant, rather than a single high rate early in the season. Foliar applications will not control black shank. The rates for burley and dark tobacco are higher than those for flue-cured tobacco, so read labels carefully. The total rate of Ridomil Gold EC is 3 pts / season / acre. Best results have usually occurred in my tests with 1 pt preplant incorporated within 5 days of transplanting, followed by a second 1-pt application at an early cultivation (nozzles positioned to spray to the side and under the plants and covered with soil by the cultivator) , and a third 1-pt application made at the final cultivation (layby) . The applications methods for Ultra Flourish are the same, but the rates are qt + qt + qt. The importance of the preplant application depends on whether infection is occurring early in the plant's life, weather, and fumigation. In dry seasons like that of 1999, the preplant applications provided little added benefit in most tests, unless the field was irrigated prior to, or shortly after, setting; while in wet seasons like that of 2000, the preplant application was critical. Which option is best depends on the level of disease pressure that develops and when it develops during the growing season, plus the susceptibility of the variety used. Obviously, the higher the disease pressure the higher the rate required.

In most cases, correctly timed, split applications have given better control than preplant only. Rescue applications are not specifically labeled but neither are they specifically prohibited for black shank control. Growers should not rely on rescue options for control, because the results are very erratic and seasonally dependent. Sometimes rescue applications result in marked
improvement in plant appearance even when a significant yield response does not occur. Usually, rescue treatments on susceptible varieties do not improve yield sufficiently to pay for the chemical application, based on a large number of on-farm tests about the Commonwealth. However, there have been studies where marked benefit have been received, mainly in seasons when it was dry early and wet late. Rescue treatments made on resistant varieties have been more
successful, but are still inferior to preventative use in 90% of our test plots.

DRAINAGE is an important part of black shank control. This pathogen is a water mold and it is also waterborne. Many fields could be helped by taking steps to improve surface and internal drainage. Prevention of standing water is especially important. Also, be very careful with excessive irrigation in black shank fields. Hot spots often develop around guns and line couplings. Sometimes black shank severity is increased by adding manure / muck because the water-holding capacity of the site has been increased, which may favor the plant, but unfortunately, it also favors the disease.

SANITATION should be implemented regardless of whether one is on a farm with black shank or farming one without the disease. Many conceptually sound rotational plans fail in the execution phase because the sites become recontaminated because of poor sanitation. The aim of good sanitation is to avoid introducing black shank on farms without it, and to reduce moving it about the farms where it already exists.

The black shank fungus can be moved on infested plants, in contaminated water or contaminated soil. As a result there are hundreds of ways it could be spread. Here are just a few sanitation questions to think about:

· What did you do with tobacco stalks and barn trash from black shank infested fields?
· Did the pathogen come free-of-charge with the transplants?
· Could the irrigation and transplant water be contaminated?
· Is the equipment being used on your crop and farm contaminated?
· Did you graze livestock on the cover crop of black shank infested fields?

SOIL pH is an important aspect of black shank. The disease occurs in both acid and alkaline soils, but black shank is favored by high soil pH! This is more complicated than just simple pH, however. Higher calcium, magnesium, and phosphorus levels, correlate with greater black shank severity. The exact nature of this relationship is not fully understood. Evidence indicates that the fungus declines faster in acid soils, so crops that maintain high soil pH have less value in the rotation.

OTHER DISEASES must be controlled, because plants stressed by any means usually are more susceptible to black shank. Especially important are the root and stem diseases Pythium, black root rot, soreshin, and Fusarium wilt.

CORN

DISEASE UPDATE ON CORN
by Paul Vincelli

Rainfall data available from the UK Agricultural Weather Center indicate that the entire state has received below-normal rainfall for the past 30 days. The generally warm, dry weather has kept corn seed and seedling diseases to a minimum.

Producers have used the dry weather to seed the corn crop ahead of schedule. As of April 29, 75% of the corn crop was in the ground, as compared to 43% for the five-year average. In Kentucky, several diseases–notably gray leaf spot and the virus complex–are typically a greater risk in late-seeded crops than crops seeded in a timely way or early. This fact plus the generally dry conditions prevailing thus far mean that disease activity and disease risk are on the low side at this time.

Now let's just hope for rain when the crop needs it.

TIMING OF POSTEMERGENCE HERBICIDES RELATIVE TO CORN GROWTH
James R. Martin, Extension Weed Scientist

The size of corn is often a critical factor in determining when it is safe to apply postemergence herbicides. Labels of postemergence herbicides often use plant height or growth stage (or both) when discussing timing of applications relative to corn growth. While this may sound simple, there is come confusion on how to determine height or growth stage of corn with respect to herbicide applications.

A common method for determining corn height is done by using free-standing plants. When checking individual plants, measure from the soil surface to the arch of the uppermost leaf that is more than 50 % emerged. Because of the variability among corn plants in the same field, it is better to get an average from several plants than relying on just one plant.

A temptation for some folks is to measure from the soil surface to the tip of outstretched leaves. The measurements by stretching leaves upward and measuring to the uppermost leaf tip often leads to a greater height than intended by the herbicide label.

The leaf collar method is often used for determining proper timing and method of application of many postemergence herbicides. Staging corn plants in their vegetative growth stage is usually done by counting the number of leaves that have visible collars. The collar is the part of the leaf that joins the leaf blade and leaf sheath and occurs as a discolored line. Collars are not evident until the leaves are well developed and emerged from the whorl; consequently, as you progress up the plant, count only leaves with visible collars and not the uppermost ones that are still in the whorl. For example, a plant may appear to have 5 leaves, but after close examination, it has may have only three leaves with visible collars and would be in growth stage V3.

The first true leaf that emerges during seedling development is characteristically oval-shaped and is the reference point for counting leaves. Once plants reach stage V5 (5 leaves with visible collars), the leaf and ear shoot initiation will usually be complete and a small tassel is initiated in the stem apex tip (i.e. growing point). During tassel initiation, corn will be approximately 8 inches tall and the growing point will be just at or beneath the soil surface. Once plants reach V6, the growing point and tassel will be above the soil surface and the stalk elongation will be rapid. The growth of the stalk and nodal roots will eventually result in the tearing and deterioration of the lowest leaves, thus making it difficult to accurately determine the growth stage.

Staging corn plants that are beyond V6 is possible but may require some practice to become efficient. Dig a plant and cut the stalk lengthwise through the root area. Check for the first elongated internode, which is usually about one centimeter (0.4 inch) in length. The first node above this internode is generally connected to the 5th leaf. Once the 5th leaf has been determined, then use it as the reference point for counting to the uppermost visible leaf collar.

The use of drop nozzles can limit the risk of injury from certain herbicides, especially as the corn canopy develops. Directed applications help in some instances by keeping the herbicide from being intercepted in the top of the canopy where it can be funneled into the whorl and increase exposure to the growing point. This is particularly a problem with certain sulfonyluera herbicides. In cases involving contact herbicides such as Gramoxone Extra, the directed sprays must be fairly precise to limit the amount of contact with the corn plants.

The recommended timings for several postemergence herbicides used in field corn are summarized in the following table. Always check the product label for specific directions.

Table 1. Timing of Postemergence Herbicides Relative to Corn Growth.	
	Recommended Ranges or Maximum Corn Heights / Growth Stages

Herbicide	Broadcast	Directed
Accent	Up to 20" tall or 6 collars.	Between 20" to 36" tall. Do not apply when corn exceeds 30" tall or has 10 or more collars.
Accent Gold	Up to12" tall or 6 collars, whichever is more restrictive.	
Aim	Up to 8 leaf collar.	
Atrazine	Up to 12" tall.	
Banvel or Clarity	1pt / A rate: Fifth leaf stage or 8" tall whichever is more restrictive.	Use directed application if: 1) Corn leaves limit spray coverage of weeds. 2) Sensitive plants are nearby. 3) Tank mixing with 2,4-D.
	0.5 pt / A rate: 8 to 36" tall, if 6 leaf is emerging, or 15 days before tassel emergence.	
Basis Gold	Up to12" tall.	
Beacon	4" to 20" tall.	After corn is 20" tall or > 6 collars (whichever occurs first). Apply before tassel emergence.
Buctril	Prior to tassel emergence.	
Celebrity	Up to 20" tall or 6 collars, whichever occurs first.	Between 20" to 36" tall corn.
Celebrity Plus	4" to 20" tall.	
2,4-D	< 8" tall.	> 8" tall and before tassel emergence.
Distinct	6 oz / A rate: 4" to 10" tall.	
	4 oz / A rate: 10" to 24" tall.	
Exceed	Between 4"and 30" tall.	To limit injury apply as a directed spray when field corn is 20" to 30" tall or exhibits more than 6 collars V6 (whichever occurs first).
Gramoxone Max	Do not apply broadcast overtop corn	Apply only as a directed treatment after smallest corn is 10" tall.
Hornet	Spike stage up to 20" tall or V6, whichever occurs first..	20 tall (or >6collars) up to 36" tall.
Liberty (LL- corn)	Up to 20" tall or 7 collars whichever comes first.	24 to 36" tall.
Liberty Atz (LL- corn)	Up to 12" tall.	
Lightning (Clearfield-corn)	Up to 20" tall.	Use drops if >20" tall. Do not apply within 45 days of harvest.
Marksman	Through fifth leaf stage or 8" tall, whichever occurs first.	
Permit	Spike through layby.	
Roundup Ultra (RR-corn)	Through V8 stage or 30" tall whichever occurs first.	
Roundup ReadyMaster ATZ (RR-corn)	Up to 12" tall corn	

Spirit	Between 4" to 24" tall.	To limit injury apply as a directed spray when field corn is 20" to 24" tall or exhibits more than 6 collars V6 (whichever occurs first).

DELAYED PREEMERGENCE HERBICIDE APPLICATIONS FOR CORN
by J. D. Green

Sometimes application of a soil-active herbicide treatment may be delayed due to weather conditions and other factors. In these situations the crop may have emerged before a soil residual herbicide can be applied. The following table outlines the maximum corn and weed size for use of soil-applied herbicide products in corn. Many of these soil-applied herbicides do not control emerged weeds; thus, to obtain effective weed control a postemergence herbicide may also be needed. Consult the product label for specific guidelines, labeled tank mixtures, precautions, or other limitations.

Table 1. MAXIMUM Corn and Weed Sizes for Soil-Applied Herbicides.

HERBICIDE	CORN SIZE	WEED SIZE
Atrazine	12 inches	1.5 inches
Axiom	before corn emerges	before emergence
Axiom AT	before corn emerges	before emergence
Balance *or* Balance PRO	before corn emerges	before emergence
Bicep II Magnum	5 inches	2-leaf stage
Bullet	5 inches	1.5 inches
Degree	11 inches	before emergence
Degree Xtra	11 inches	2-leaf stage
Dual II Magnum	5 inches	before emergence
Frontier *or* Outlook	12 inches	before emergence
FulTime	11 inches	before emergence
Guardsman *or* LeadOff	12 inches	1.5 inches
Harness	11 inches	before emergence
Harness Xtra	11 inches	2-leaf stage
Prowl	Spike through layby growth stage of corn OR limitation of post tank mix partner	before emergence
Princep	before corn emerges	before emergence
Python	2 inches	before emergence
Surpass EC *or* TopNotch	11 inches	before emergence

WHEAT

WHEAT DISEASE UPDATE
by Don Hershman

With wheat in the flowering stage and beyond in west Kentucky and in late heading in eastern, the stage is set for perhaps the lightest disease year since I came here 17 years ago. Of course the main reason for this is the dry weather which has prevailed across the Commonwealth this spring. However, I believe the cold spells this winter also reduced fungal populations significantly. Similarly, weather conditions appear to have reduced insect vectors that transmit virus diseases.

The bottom line so far is that diseases are very minimal, state-wide, at present. This can change quickly, but as of now I am optimistic. If we can make it through flowering without significantly warm, wet weather we will also escape the head scab "bullet". This would be a major hurdle to get over on the way to an excellent wheat crop. Keep your fingers crossed that the crop receives just enough moisture for good grain fill but not enough to encourage head and foliage diseases.
I will keep you informed as new developments occur.

ARMYWORMS IN WHEAT
by Doug Johnson

There have been reports of cutworms and some armyworms in corn and armyworms in Bermuda grass in Tennessee. We have been reporting flights of armyworm, as monitored by traps at the UK-REC, in the Kentucky Pest News for about a month now. Our traps captured a large number of armyworm moths during the weeks of April 13 and April 30; captures have since declined. These catches are the largest since 1998, and the timing puts the worm population at its maximum about now. Trap captures are not a direct indication of worm pressure. However, I have also received a few reports in the last couple of days of infestations that definitely require control. As your wheat or other small grain reach reproductive stages, you should look out for armyworm feeding. The "Flag" and "F1" leaves are by far the most important to protect from armyworm damage

Armyworm outbreaks are rare in Kentucky but armyworms are NOT. Armyworms are most likely in every Kentucky small grain field every year. However, they are preyed upon by a large number of natural enemies. In most years the armyworm populations do not reach economic thresholds. BUT, just like the stock markets "past performance does not automatically predict

future events". So you have to go look. However, spraying out of hand just because armyworm might be around makes no economic sense, especially when grain prices are so low. Both need and timing are important in obtaining good economic return on an armyworm control application.

Scout for armyworms from Mid-April through harvest. Luxuriant or lodged vegetation in low wet areas is especially susceptible to attack. Cool, wet springs favor armyworm development. Look for armyworms early in the morning or late in the evening if the days are clear and sunny. Armyworms do not like direct sunlight. You may want to look for feeding damage up on the leaves, but most often you will find the worms at the base of the plant where it is cool, damp and dark.

Larvae are greenish brown with a narrow, mid-dorsal stripe and two orange stripes along each side. The yellowish head is honeycombed with dark lines. Armyworms are about 1-1/2 inches long when full grown. This is NOT fall armyworm. They will appear later in the year.

Armyworms are primarily leaf feeders. However, they will feed on awns and tender kernels and may clip off the seed head. Infestations are more common in barley than in wheat. Armyworms may feed on oats, rye and some forage.

Scout each field at least once a week. Sample the entire field; check five locations per 50 acres of field size. First, check field margins and lodged grain. If armyworms are present begin surveying in the standing grain. Armyworms feed during late afternoon, night and early morning. They may be on the ground when you are in the field.

Enter at least 30 paces into the field before sampling. Pick the sample spots randomly. Look at the leaves for signs of chewing damage. Armyworms feed from the edge of the leaf in towards the mid rib. Examine the ground for dark fecal droppings. During the day armyworms usually hide under surface litter or in soil cracks. Note average larval length. Walk to the remaining locations and repeat the process.

Record the number of worms present in each four square foot area sampled. Note the average length of the armyworms in each four square foot area. The Economic Threshold: is an average of 16, 1/2 to 3/4 inch long armyworms per four square foot sample.

Worms longer than one inch have completed most of their feeding. If the grain is nearly mature and no head clipping has occurred, then controls are not advised. Warm spring weather favors **parasite and disease** development. Note the percentage of worms parasitized or diseased on the form.

Armyworms are not particularly hard to kill providing the wheat is not lodged. Additionally, watch for armyworm damage in any corn planted into small grain, and corn near small grain fields.

From information on sampling and control see: ID-125 Wheat Management in Kentucky, IPM-4 Kentucky IPM scout manual for Small Grains, and ENT-47 Insecticide Recommendations for Small Grains - 2001.

VEGETABLES

EARLY SEASON VEGETABLE INSECT MANAGEMENT
by Ric Bessin

Early in the season it is important to get the seedlings and vegetable transplants off to a good start. There are a few early season insects that need to be managed to ensure healthy stands. One insect that attacks a wide range of vegetables and row crops is black cutworm. Western Tennessee growers have been experiencing large infestation of cutworms this spring. This insect will attack a wide range of crops, so all producers should monitor for this insect regularly.

Cole crops (Cabbage, Broccoli, Cauliflower)
Striped flea beetles, imported cabbageworm and diamondback moth larvae are the pests that attack the spring crop. With flea beetles on seedling plants, less than 4 to 5 true leaves, use a threshold of an average of two beetles per plant when deciding whether or not to spray. A threshold of 15 percent infested plants can be used with worms until either head-fill or crown formation, then the threshold drops to 5 percent infested plants. While the type of mixture of worms it is not important when deciding if to spray, the types of worms will determine which insecticides are used.

Sweet Corn
Corn flea beetles and cutworms are the two primary pests that will attack seedling corn. Use 3 percent cut plants with cutworms actively feeding as the guideline for treating cutworms. Flea beetles can transmit the bacterium that causes Stewart's Wilt, so wilt resistant cultivars may be needed in years following mild winters. Otherwise the threshold for direct feeding by corn flea beetles is 50 percent of the plants with leaf scars and some leaves turning white.

Tomatoes and Peppers
Tobacco and potato flea beetles will attack both tomato and pepper plants. Usually, the plants will quickly outgrow moderate damage. Occasionally, serious damage can occur to plants less than six inches. Use 4or more beetles per plant and plants less than 6 inches as the guideline for treatment. Colorado potato beetle can also do serious damage to tomato plants less than 8 inches. Use 10 beetles per 20 plants as the guideline for treatment

when the plants are less than 8 inches.

Eggplant and Potato
As with tomato, flea beetles and Colorado potato beetle are serious early season pests of potato and eggplant. Use the same threshold for tomatoes above. Resistant to insecticides continues to be a serious problem for Colorado potato beetle. Because of this, producers should not use insecticides with the same mode of action for consecutive generations of this insect. Often local populations of this insect may be resistant to one group of insecticides, and in other areas they may be resistant to others. For this reason, what works well in one county may not work at all in another.

Squashes, Cucumbers and Melons
Striped and spotted cucumber beetles can attack cucurbit crops anytime after seedling or transplanting. Cucumber beetles also transmit the bacterium that causes bacterial wilt. For this reason, cucurbuit crops must be treated for cucumber beetles as soon as they are planted. With bacterial wilt susceptible crops, cucumber beetles need to be effectively controlled through the start of flowering. Keep in mind that cucurbits are insect pollinated, so measures need to be taken to control the beetles and avoid hurting pollinators. One method to avoid injuring pollinators during bloom is to spray in the early evening after pollinators have quit. The flowers that are open will be closed the next day and new blooms free of insecticide on the inner surface will be open the following day.

SHADE TREES & ORNAMENTALS

ARE WOOD CHIPS A SOURCE OF TREE DISEASES?
by John Hartman

This time of year, we see mulch applied to woody plants in many landscapes. Properly applied, mulches can be beneficial to tree growth. During routine tree maintenance and tree removal operations, Kentucky arborists generate large quantities of wood chips that may be used for mulch. Frequently, trees that are disposed of in this way are diseased, having died from Verticillium wilt, bacterial leaf scorch, and other maladies. County Extension Agents and Master Gardeners have posed the question: Do gardeners using these wood chips as mulch for woody plants in their gardens run the risk of transmitting diseases to their healthy trees? Research results suggest that while theoretically possible, disease transmission to woody plants is not likely under typical landscape conditions.

Bacterial leaf scorch. The bacterial leaf scorch pathogen, *Xylella fastidiosa*, lives in xylem fluids of the wood of the tree. It is vectored by leaf-feeding leafhoppers. The leafhopper vectors would not be likely to feed on wood chips. Even if they did, it is likely that xylem tissues of wood chips would be invaded by saprophytic microbes and the pathogen would not survive.
Verticillium wilt. The Verticillium wilt fungus attacks ash, catalpa, golden rain tree, katsura tree, maple, redbud, tulip poplar, and many others. The causal fungus, *Verticillium dahliae,* lives in soil and infects plants through roots. In a University of Minnesota study, attempts to transmit the disease from fresh infected maple chips to healthy maple seedlings via mulch failed, but vegetable plants became infected when the wood chips were used as garden mulch. It was found that storing infected wood chips in a pile for a week greatly decreased their levels of *Verticillium*.

Pine wilt disease. The pinewood nematode, *Bursaphelenchus xylophilus,* affects Austrian and Scots pines in Kentucky and is vectored by longhorned beetles. In a University of Vermont study, the nematode was shown to move from fresh infected pine wood chips to young Scots pine. The chips had been incorporated into the soil during transplanting or piled against a wounded trunk. These would be considered unusual landscape practices, so normally transmission would not occur. The pinewood nematode cannot move from tree to tree on its own, and the pine sawyer beetle vector does not colonize wood chips. In any case, it is probably a good idea to compost fresh chips from pine wilt-infested trees for at least one month before using them as mulch around susceptible pine species.

Dutch elm disease. The fungus that causes this important vascular wilt disease, *Ophiostoma ulmi*, is spread by bark beetles. The beetles are apparently not attracted to wood chips, so the risk of transmitting Dutch elm disease from chips is likely to be very small. It is not known how long *O. ulmi* survives in infected wood chips or if it can spread to healthy trees via wounds when infected chips are piled against the trunk. The fungus would not likely survive in composted wood chips.

Oak wilt. For disease spread, the oak wilt fungus produces sticky spores in a fungal mat just under the bark of infected trees and insects, birds, or other vectors carry the spores to fresh wounds. It is unlikely that infected wood chips would provide an environment suitable for fungal mat and spore production.

Conclusion. Transmission of tree diseases from disease-infested mulch appears unlikely under normal landscape conditions, but more research is needed. Composted mulch should be free of pathogens. Ohio State University research shows that temperatures in large piles of mulches are sufficient to kill pathogens of woody plants. Piles need to be turned 2-3 times to expose all portions to high temperatures and the material must be moist enough (45-60% moisture) to support high microbial activity and heat output. Composting in small, moistened backyard piles (4-5 ft tall) is also generally sufficient to destroy most plant pathogens, even though temperatures don't get as high. Pathogen demise may be caused by parasitism and production of antibiotic compounds by other microbes.

MAPLE PETIOLE BORER AND LEAF DROP
By Lee Townsend

A sudden drop of many sugar maple leaves may be due to injury by a small wasp larva that burrows in leaf petioles (stems). The stems usually break at a darkened area near the leaf blade. Usually infestations are limited to sugar maples and only about 25% to 30% of the leaves fall to the ground. While spectacular, the leaf drop has little effect on tree health. Buildups of scales or aphids, or drought stress can cause leaf loss but these typically occur later in the year. Leaf drop due to borers is seen earlier in the season and the leaf blades may still be green. Leaves from trees stressed by sucking insects or drought usually have turned yellow before they drop. Splitting the petiole carefully near the leaf blade should reveal the larva or the tunnel.

There is one generation each year. Infestations begin as the adults, small wasps about 1/6" long, appear in May and lay their eggs in petioles near the leaf blades. Legless, white grubs with distinct light brown heads hatch from the eggs and tunnel inside the leaf stem for 20 to 30 days. The weakened stem breaks and the leaf floats to the ground.

The borer larvae generally remain in the portion of the stem left on the tree. About 10 days after leaf drop, the rest of the stem falls to the ground. The mature larva, about 1/3" long, leaves the stem through a hole in the side and burrows into the soil. It will change to the pupal stage and remain in the soil until the following spring.

Maple petiole borer infestations are infrequent and unpredictable. Also they do not appear to harm tree health so insecticidal control is not recommended. In addition, probably preventive treatments, applied well before leaf drop, would be necessary. It may be possible to reduce future infestations by picking up and destroying infested stems, the short sections without leaves, about 7 to 10 days after the first leaves fall. This sanitation program needs to be continued throughout the leaf drop period and must include all infested trees in the vicinity to be most successful. Raking and disposing of the leaves will not reduce the population because the insects are not in that portion.

DIAGNOSTIC LAB HIGHLIGHTS
by Julie Beale and Paul Bachi

Tobacco samples are filling the lab benches in the Diagnostic labs: last week we diagnosed samples with Sclerotinia collar rot, Pythium root rot, target spot, blackleg (Erwinia), cold and frost injury, fertilizer burn, and numerous cases of transplant shock (plugs transplanted into float trays). We have also seen corn with stinkbug and seed corn maggot injury; wheat with wheat spindle streak mosaic virus; and alfalfa with cold injury; and peppers (greenhouse) with Fusarium stem rot.

We are beginning to see many cases of fireblight on apple, crabapple and pear--from both orchards and landscapes. Some clients who have been concerned about fireblight have submitted samples showing freeze injury instead. Symptoms can occasionally be confusing, but confirmation of fireblight is easily accomplished through microscopic examination of symptomatic tissues. Other disease problems in the landscape have included anthracnose on maple, black knot on plum and cherry, and twig blight (Kabatina) on juniper. We have seen winter/freeze injury on numerous hosts, including lilac, apple, magnolia, barberry, boxwood, holly, Leyland cypress, and persimmon.

INSECT TRAP COUNTS

Princeton, April 27-May 4, 2001

Black Cutworm	2
True Armyworm	13
European Corn Borer	2
Corn Earworm	5

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