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TOBACCO

CHEMICAL OPTIONS FOR DISEASE CONTROL IN BURLEY AND DARK TOBACCO TRANSPLANT PRODUCTION SYSTEMS - 2002 CROP

by William Nesmith

An adequate supply of healthy transplants is an important first step to having a successful tobacco crop in 2002. Infectious diseases can be a limiting factor to successful transplant production; moreover, diseased transplants can serve as important sources of pathogen introduction into the field and community. Recent studies have also demonstrated that diseased transplants, compared to healthy transplants, are predisposed to much more severe attacks in the field from root and stem pathogens. In one study, for example, black shank activity in a resistant variety was increased from 24% incidence to 83% when Pythium infected transplants were set into black shank infested soil.

Use of chemicals alone is not the key to disease control in transplant production. Instead, what is needed is a management approach that carefully incorporates cultural and chemical tools. Control of transplant diseases is achieved through rigorous sanitation measures, careful manipulation/management of the production environment, accurate and timely fertilization, insect vector control, avoiding plant stresses, and timely and thorough application of disease controlling pesticides. Both the incidence and severity of diseases in seedling production can be greatly reduced through preventive spray programs. Even where a chemical is labeled for rescue treatments, I urge it be used in a preventive manner. Why? Because a wound remains if infection occurs, and that wound may serve as an infection site for other diseases, especially when it involves the root and lower stem. Moreover, transplants are too valuable, transplant diseases too explosive, and achieving pesticide coverage too difficult to rely on rescue approaches.

Tobacco transplant production in Kentucky occurs in three systems: outdoor-float-beds, greenhouses, and traditional ground beds. The following infectious diseases have given growers problems in the past: Bacterial diseases: angular leaf spot/wildfire and bacterial soft rot/blackleg; Fungal diseases: anthracnose, blue mold, black shank, black root rot, frogeye, Fusarium wilt and root rot, Botrytis blight, Collar Rot (Sclerotinia), and blights, root rots, and damping-off caused by either Pythium or Rhizoctonia; and, Virus diseases: Tobacco Mosaic Virus (TMV), Cucumber Mosaic (CMV), Tomato Spotted Wilt/Impatiens Necrotic Spot, and the Poty-Virus Complex of etch, vein mottling, and PVY. Labeled

chemicals are now available to help with many of the fungal diseases.

Unfortunately, labeled materials are not available for all diseases or for use in all transplant production systems; therefore, growers will need to read and follow labels carefully to avoid problems. Please be aware that, despite common usage in some communities, there is **not** labeling to support using the following chemicals in tobacco transplant systems in Kentucky: Actigard*, Acrobat MZ*, Acrobat 50 WP*, Benlate, Banrot, Captan, Chipco, Maxim, Ridomil Gold*, Rovral, Quadris, Tilt, or Terraclor. Some of these products have labeling to directly prohibit use in transplant production systems; some of these products (those followed with *) are labeled for field use, however.

Below is a review of the preventive fungicide and bactericide treatments labeled for use in Kentucky for control of tobacco transplant diseases as of March 15, 2002. All these uses have proved effective as labeled. A few others are labeled that have not proven effective in our trials, and they are not included. Please be aware that many of the labeled chemicals will cause stunting or other phytotoxic reactions to the tobacco plant even when used as labeled. The production systems in use are so conducive to diseases that these phyto risks appear to be acceptable when weighed against the damage the diseases can cause without controls in place. The labels specifically warn of the risks and also advise on steps that should be taken to minimize those risks. I have recently reviewed these labels and data and believe only the following materials and uses are labeled and effective for the sites and diseases mentioned.

* FERBAM (FERBAM GRANUFLO) is labeled for use in outdoor beds, greenhouses, and float systems in Kentucky, but greenhouse use is not on the label in several other tobacco producing states. This is a very important fungicide for disease control in small seedlings because the risk of phyto is very low, especially at the low rates. It is labeled for prevention of blue mold and Botrytis blight, but will assist in reducing several other fungal diseases. The labeled rate in all transplant production systems (beds, floats, and greenhouses) is 1.5 - 3.0 lbs / 100 gallons of water (1 to 3 tablespoons / gallon). Use the lower rates when plants are small and higher rates as plants become larger. Spray preventively twice weekly starting when seedlings have the first true leaf or immediately after plugging with the plug-and- transfer system. Apply as a fine spray to the point of run-off, using 3 gallons of spray material per 1000 sq ft when seedlings are small, increasing gradually to 6 to 12 gallons as plants increase in size and the canopy increases. The label has specific restrictions to avoid contamination of the float-water. We have not observed phyto with this fungicide at these rates, but it does leave a dark residue on the seedlings. Some other formulations of ferbam have national labels for plant beds that allow higher rates of Ferbam to be used, but those labels do not include greenhouse or float beds.

* MANCOZEB (DITHANE DF OR DITHANE DF RAINSHIELD) is another very important preventive fungicide once the plants are large enough to tolerate it. Use it against anthracnose and blue mold, and to suppress damping off diseases caused by Rhizoctonia, Fusarium, and Alternaria. It can be used in all tobacco transplant production systems, but higher rates are needed outdoors. Apply it as a fine spray at high pressure just to the point of run-off, but be careful not to saturate the root zone on small seedlings. For float and greenhouse systems use at 0.5 lbs / 100 gallons of water (one teaspoon / gallon). Spray preventively on a 5-7 day schedule starting no earlier than when seedling leaves are about the size of a dime and continue until transplanting to the field. Use 3 gallons of spray material per 1000 sq. ft. while plants are small, but increase gradually to 6 to 12 gallons as plant size and canopy increase. As plants become larger and more tolerant of the material, you need to use sufficient water to wet the base of the stems with run-off to increase the potential for control of damping off and stem rots. Avoid contamination of the float-water and root zone during applications. In outdoor beds, use 1 lb / 100 gallons of water (2-3 teaspoons / gallon), applying 3 to 5 gallons per 1000 sq ft of bed.

*Etridiazole (TERRAMASTER 35WP and Terramaster 4EC) is a very important tool for controlling Pythium root rot and damping off in float systems. The float system provides a near ideal environment for Pythium to develop once introduced into the system, and now labeled controls are available. There are phyto issues involved and it is essential that etridiazole-containing products be uniformly distributed in the float water to achieve control and to minimize phytotoxicity. Two formulations are available this season, Terramaster 35WP has a state label that expires December 31, 2002 and Terramaster 4EC has a national label. The EC formulation is much easier to measure and use. Both are labeled for use in greenhouse and outdoor float systems, but **are NOT** labeled for use in any other transplant production systems. In our experiments, etridizaole has provided a very high level of control of Pythium root rot, and it reduces algae levels, but it has not provided adequate control of Phytophthora in our systems. Terramaster 35 WP is labeled at 2 oz / 100 gallons of float bed water, but 1 oz / 100 gallons gives acceptable control with less phyto potential when disease pressure is low. These applications should be made directly to the float water. Be sure to follow label directions as to making the premix-slurry and thoroughly distribute it in the water. Preventive applications should be made two to three weeks after seeding, or a week after

plugging with the plug and transfer system. If additional applications are needed, make a second application no later than eight weeks after seeding. Terramaster 4EC is labeled preventively at 1 fl.oz. / 100 gallons of float water, starting no sooner than 2 weeks after seeding, with sequential applications at 0.9 fl. oz. at three week-intervals for a maximum of three applications per crop. Terramaster is also labeled as a rescue treatment at higher rates (see label), and is highly effective, but I urge it be used as a preventive treatment rather than letting the fungus damage the root system and then trying to stop it. Wounded roots are prime targets for opportunistic pathogens in the field - black shank, soreshin, and Fusarium root rot. Some have reported problems with early-flowering associated with this chemical, but I have not been able to reproduce those effects in any of the several studies we have conducted, including rates several fold above the labeled rates. We have observed phyto in the form of reduced roots, white veins, and slower development in every study conducted, including at rates below the effective rates. However, the phyto we have observed in our studies is considered acceptable when compared to the serious damage Pythium is capable of producing.

* STREPTOMYCIN (AGRIMYCIN 17, AGRI-STREP, etc.) is labeled for use in outdoor plant beds. Greenhouse and float bed use is not on the label, however, nor are these sites specifically prohibited on the label. Therefore, growers may elect to use Streptomycin in these systems, but accept that product liability protection may not be provided, because the manufactures have not elected to include greenhouse and float beds on their labels even with our encouragement. The labeled rate for outdoor beds is 100 to 200 ppm (1- 2 teaspoons / gallon), using 3 to 5 gallons of material per 1000 sq ft of bed. Control of angular leaf spot, wildfire, and blue mold are on the label, but most strains of blue mold are not controlled by this treatment. Streptomycin-resistant strains of the angular leaf spot pathogen are present in Kentucky, and it is not highly effective with bacterial soft rots. Sprays can begin as early as the two-leaf stage and should be repeated weekly until transplanting for control of bacterial leaf spots, such as angular leaf spot. Yellowing and stunting can occur if high rates are used. Efficacy is improved if applications are made under conditions that allow for slow drying.

*MILK (Whole or skim at 5 gals /100 gallons water or dried milk at 5 lbs / 100 gallons water per 100 sq. yds. of plants) can be used to reduce the spread of Tobacco Mosaic Virus while handling transplants. Spray plants within 24 hrs of handling them. This treatment has also been used successfully prior to clipping of large plants, but it can be very messy unless the system drys well following the application. It should be combined with washing the hands at 15 minute intervals either in the clean milk solution or a phosphate detergent. This treatment is needed only if TMV susceptible varieties are being used or mixed resistant and susceptible varieties are in the same operation.

* BORDEAUX MIXTURE (1 lb bluestone copper sulfate + 2 lbs fresh hydrated lime mixture per 25 gallons of water) is labeled for ground beds as a drench to the soil when the plants have emerged and again 10 days later. This treatment will control algae and aid in the control of diseases caused by bacteria (wild fire, angular leaf spot, and blackleg), and assist in Pythium and blue mold control. Follow the label EXACTLY as to mixing instructions, because Bordeaux mixture can be toxic to tobacco seedlings. Constant agitation is required during application to avoid injury and to achieve control. Do not apply this mixture to large seedlings. The main target is actually the soil rather than the tobacco plant.

CORN

SOUTHWESTERN CORN BORER SPRING SURVEY

by Ric Bessin, Lee Townsend, Wayne Mattingly, and Mike Smith

Southwestern corn borers spend the winter as larvae in galleries at the base of corn stalks. Stubble in cornfields can be checked during early spring for damaged plants and surviving borers. This can provide an indication of what the first generation may be like for 2002. A survey of southwestern corn borer damage and larval survival was conducted in Caldwell, Daviess and Henderson counties on March 14 and 15. These counties were selected because of the past infestation history. The purpose was to estimate the extent of SWCB damage, as evidenced by basal stalk girdling. In addition, we wanted to estimate the survival of the overwintering larvae in the crowns of these damaged plants. In each county, three to five non-Bt corn fields were evaluated. Within each field, 10 to 12 groups of 10 plants were examined for girdling damage and presence of live SWCB larvae. An additional 50 damaged plants were examined for the presence of live SWCB larvae.

2001 SWCB Spring Survey Results

	Damaged plants (%)	Live SWCB per girdled stalk (%)
Daviess Co.		
Farm #1	6.0	1.9
Farm #2	5.0	19.2
Farm #3	5.0	8.5

Farm #4	28.0	6.0
Farm #5	5.0	1.9
Henderson Co.		
Farm #1	10.8	1.4
Farm #2	15.8	1.7
Farm #3	10.8	1.7
Farm #4	13.3	0.0
Farm #5	9.2	17.4
Caldwell Co.		
Farm #1	17.0	4.0
Farm #2	8.0	4.0
Farm #3	19.0	4.0

This is the fourth year that we have conducted such a survey. In comparison to the previous winters, we had the lowest levels of girdled plants and survival of overwintering larvae. Fewer girdled stalks were to be expected, because planting conditions in April 2001 were excellent. This allowed growers to get their corn crop in the ground on time and enabled early harvest. Delayed harvest allows SWCB time to migrate to the bottom of the stalk and girdle the plant. Early planted corn may also be less attractive for late-season egg laying.

Observed levels of survival in the girdled crowns was surprising. Survival this spring is less than what would have expected considering the relatively mild winter. Of the girdled crowns sampled this spring, a large proportion had evidence of bird activity with the larva having been removed. Relatively few crowns had dead larva remaining in the overwintering chamber. The number of live SWCB larvae per stalk is a small fraction of what we estimated in other years. This survey indicates that there are potentially fewer SWCB moths to begin the season as compared with the past three years.

Year	Girdled stalks (%)	Survival / girdled stalk (%)	Overall Survival / stalk (%)
2002	11.78	5.31	0.63
2001	40.58	9.66	3.92
2000	20.73	26.85	5.57
1999	35.89	10.14	3.64

Keep in mind that overwintering survival is just one of the variables that will, in part, determine the potential for SWCB problems in 2002. Historically, the date of planting of individual fields has been a key variable contributing to the potential for late season SWCB damage. Although early season numbers seem to be very low, favorable conditions, may allow SWCB numbers to rebound by the second and third generations. Typically, fields planted after May 10 have an increased potential for this type of damage.

What we can conclude:

- Despite a mild winter, we found low survival levels of SWCB larvae in each of the counties surveyed.
- Birds seem to feed heavily on SWCB larvae during the winter.
- Winter conditions were not sufficient to eliminate SWCB larvae.
- We expect low first generation SWCB pressure for those areas surveyed.
- Date of planting is still important. Corn planted after May 10 could be at risk to late season SWCB activity.

SOYBEANS

SOYBEAN DISEASES CONTROL: ARE WE MISSING OPPORTUNITIES, PART III

Root and lower stem diseases

by Don Hershman

With the exception of soybean cyst nematode and soybean sudden death syndrome discussed in the first two parts of this series, root and lower stem diseases of soybean are not usually a serious concern in Kentucky. There are exceptions, but these disease situations tend to occur sporadically.

All fields are subject to seed and seedling disease caused by *Pythium ultimum* and / or *Rhizoctonia solani*. These pathogens are present in every soybean field to one degree or another. However, both pathogens require rather specific conditions before serious crop damage occurs. *P.ultimum*, for example, is a "water mold" that kills and / or damages seed and young seedlings when soils are cool and wet, and seed / seedlings are stressed. Very early planting dates, especially when no-till practices are used; planting marginal quality seed, and the combination of below-normal temperatures and above-normal moisture following planting, encourage *Pythium* diseases. Having said this, I have not seen a field during my 18-year tenure in Kentucky that had to be replanted due to *Pythium*.

Rhizoctonia usually attacks stressed seedlings. I have seen widespread *Rhizoctonia* lesions on plants in a field a few times in 18 years. However, in each instance there was an

overriding herbicide injury or stress problem. Even then the plants usually "outgrew" the *Rhizoctonia* problem and it was debatable whether or not crop yields were negatively impacted by the disease. Soybean plants have a tremendous ability to compensate for early damage. This favorable characteristic probably plays a major role in negating the negative impact of *Rhizoctonia* and other chronic disease situations.

Perhaps the most serious seed and seedling problems arise when marginal-quality seed, infected by the pod and stem blight fungi (*Phomopsis* spp.), is planted. Infected seeds have two strikes against them before they are even planted. Then, if the seed encounter stressful conditions once planted, serious stand problems can result. Treating seed with a variety of different fungicides can help to an extent, but few producers consider treating soybean seed with fungicides due to fear of getting "stuck" with treated seed. The best option is to plant high-germ, high-vigor seed. This is critical when planting saved seed. If you are considering planting seed you harvested last year, I would greatly encourage you have it properly cleaned and tested for germination at a qualified seed testing laboratory.

Charcoal rot is a severe problem during years when moisture stress is an issue, particularly late in the season. When late-season drought conditions exist, I have seen fields where 100% of plants were affected by charcoal rot. Of course, in those instances, the drought was the main problem and farmers had already written off the crop. In 2001, there were many fields on the fringe of having a serious problem with charcoal rot due to inadequate soil moisture. In those fields, diseased plants could be found under tree lines (i.e., tree roots competing for soil moisture), in compacted areas, and in areas where soil was "thin" due to underlying bedrock and / or hardpan. Conserving soil moisture through no-tillage or timely irrigation is the only proactive means of managing charcoal rot. All soybean varieties are susceptible to the disease and crop rotation is of little value. Fortunately, most soybean fields in most years get and retain adequate soil moisture and simply escape charcoal rot.

Every once in a great while I see a field that is heavily damaged by Phytophthora root rot (PRR). However, the Phytophthora fungus is finicky and infection is favored by cool, wet conditions and soils with a high organic matter content. These conditions are frequently met in the upper mid-west, but not in Kentucky. Interestingly enough, research I conducted in the mid-1990's determined that *Phytophthora sojae*, the cause of PRR, is very widespread in Kentucky soils. Similarly, many soybean varieties we plant are susceptible. The take-home message here is that the soil environment....a component of the disease triangle.....is what usually keeps Kentucky soybean fields free of PRR. However, for fields with a rare historical problem with PRR, successful management can be achieved by planting certain resistant varieties or by planting "field tolerant" varieties protected early with a fungicide effective against *P. sojae* (e.g., metalaxyl).

Southern stem blight is a rather exotic disease in Kentucky soybean even though the disease is very common in home gardens. The disease organism, *Sclerotium rolfsii*, is heavily influenced by soil organic matter content. The rather low organic content of most agricultural soils in Kentucky may explain the rare and sporadic occurrence of southern stem blight here. All soybean varieties are susceptible to the disease.

In part IV of this series, I will discuss foliar, pod and stem diseases caused by fungi and bacteria.

FRUIT CROPS

BEGIN TREE FRUIT DISEASE CONTROL MEASURES NOW
by John Hartman

Stone fruits. Apricots are in flower and peaches are just beginning to bloom in some Kentucky orchards. It is too late to apply sprays for control of peach leaf curl disease. Fungicides applied from now through petal fall are intended to prevent the blossom blight phase of brown rot disease. Growers should apply fungicides now to prevent brown rot.

Pome fruits. Most apples and pears are still at the stage of silver tip, but some that are farther along are beginning to show green leaf tips on swelling buds. Fire blight was a serious problem in many Kentucky orchards last year. By now, last year's fire blight strikes should have been pruned out. Before green tissue begins to emerge, apples and pears will benefit from an application of fixed copper bactericide. Follow up with streptomycin applied during bloom. Primary scab infections can begin as soon as green tissue begins to emerge from the bud. It is very important to control primary apple scab, so fungicide applications must begin now. There are many effective fungicides and fungicide combinations for growers to choose from.

Disease management advice. Commercial growers should be consulting U.K. Cooperative Extension Publication ID-92, Kentucky Commercial Tree Fruit Spray Guide 2002, available at County Extension Offices statewide. Backyard growers should use ID-21, Disease and Insect Control Programs for Home Grown Fruit in Kentucky Including Organic Alternatives.

SHADE TREES & ORNAMENTALS

BOTRYOSPHAERIA CANKER, A COMMON PROBLEM OF WOODY ORNAMENTALS
by John Hartman

This article is adapted from a plant health newsletter article written by Ann Gould and Richard Buckley, plant pathologists at Rutgers University.

Botryosphaeria canker, caused by the fungus *Botryosphaeria dothidea, is* a common canker disease affecting many different kinds of woody plants. Affected woody plants include many ornamental species as well as fruit and nut crops (listed below). The fungus *B. dothidea is* an opportunistic pathogen that attacks trees and shrubs wounded or weakened by environmental stresses such as drought or winter injury. The disease can result in a branch dieback that may kill trees or severely reduce their aesthetic value.

Symptoms. Botryosphaeria canker symptoms vary with the species and age of the host and the severity of the predisposing stress. The fungus kills bark and sapwood tissue, causing areas of dead tissue called cankers to form. Cankers range from small, elliptical lesions that coalesce into large diffuse areas of blighted tissue, to large, elongate cankers delimited by callus tissue. Affected bark becomes darkened, rough, and may peel away. Multiple cankers of various sizes often develop on branch tissue, growing slowly until the limb is girdled and killed. Foliage on affected branches may fail to emerge in the spring, or may suddenly wilt and die in summer. The entire plant may be killed once the canker moves from the branch into the main stem.

Disease Cycle. *B. dothidea* survives the winter in tiny pycnidia (fruiting bodies, or structures that produce spores) embedded near the surface of cankered tissue. Infections occur when spores called conidia are splashed by rain to susceptible tissue from these fruiting bodies. Spore dispersal can occur during most of the year, but is most extensive during late spring and early summer. Infection occurs when fungal spores penetrate wounds or other openings in the bark. Pruning wounds, cracks, leaf scars, sunscald lesions, winter-injured areas, and senescent branches are all good entry sites for the fungus. It is possible that the fungus exists in some plants as a latent pathogen, capable of attacking from the inside any time the plant is weakened. Symptom development can take anywhere from 3 months to a year.

Control. An integrated approach to control most canker diseases, including Botryosphaeria canker, begins with the selection of disease-free planting material. Be sure to choose top quality material from a reputable dealer so that the disease is not moved into the landscape. Always inspect plant material thoroughly before planting. Most healthy, vigorous plants are resistant to Botryosphaeria canker. Environmental stress, however, can readily predispose plants to attack. Healthy trees and shrubs can resist infection and will readily slow or prevent spread of the disease throughout the branch. When planting new trees and shrubs, choose a site that is suitable to the horticultural requirements of the species. For example, planting sun-loving plants in shady locations or placing plants outside their natural range can predispose these plants to canker disease. With older, established trees, maintain or improve plant vigor with proper pruning, fertilization, and irrigation. Since drought stress predisposes trees to canker development, watering trees during times of drought is particularly important.

Since *B. dothidea is* an opportunistic fungus that infects stressed plants through existing openings, it is important to protect plants by carefully avoiding all unnecessary wounding. Closely monitor and control insects, mites, and disease problems. Through careful monitoring and early detection, Botryosphaeria canker can sometimes be eradicated before a significant reduction in the aesthetic value of the plant occurs. Branches with symptoms of canker should be promptly pruned during dry weather at least 6 to 8 inches below affected tissue. If possible, remove the branch from the tree by properly cutting the limb at the branch collar, not flush to the trunk. To prevent the spread of this disease on pruning tools, surface sterilize tools between cuts with 70% denatured alcohol, lysol, or 10% bleach. Since the fungus can persist and sporulate in dead plant material for extended periods, branches cut from diseased trees should be taken from the site and, if possible, chipped and composted. Fungicides or wound paints have not proven to be an effective control of most canker diseases and are not recommended.

Common hosts of Botryosphaeria canker. Apple, ash, basswood, birch, blueberry, brambles, buckeye, camellia, camphor tree, carissa, catalpa, chinaberry, cotoneaster, crabapple, dogwood, Douglas-fir, elm, firethorn, fringe tree, fuchsia, grapevine, sweet gum, hawthorn, hibiscus, hickory, holly, hop hornbeam, horse-chestnut, juniper, katsura tree, mountain ash, mountain laurel, linden, black locust, honey locust, magnolia, maple, mimosa, mulberry, oak, Russian olive, peach, pear, pecan, photinia, pieris, pine, plane tree, poplar, privet, quince, redbud, rhododendron, rose, spice bush, sumac, sycamore, tree-of-heaven, tulip tree, tung-oil tree, viburnum, walnut, waxmyrtle, willow, and yellowwood.

PERIODICAL CICADAS DUE IN WEST KENTUCKY

By D. W. Johnson, L. Townsend, and R. E. McNiel, Horticulture

Brood XXIII of the periodical cicada is due to emerge west of I-65 in Kentucky this year. This is a 13-year brood so the last emergence occurred in 1989. Adults will be active from April through June. There are two aspects of periodical cicada damage. The most obvious occurs as females lay their eggs in small branches. A second, delayed effect can occur as the nymphs feed on sap that they remove from the roots during their long life below ground..

Egg laying injury occurs when female cicadas slit the bark on pencil-sized twigs and lay their eggs inside the wounds. They prefer grapevines and oak, hickory, apple, peach and pear trees. This results in "flagging," or breaking of peripheral twigs on small trees or shrubs. Young trees may be fatally harmed by severe flagging. More mature trees and shrubs usually survive even dense emergences of cicadas and continue to grow during subsequent years. This can be difficult to believe in the month or so following a large emergence because many deciduous trees will turn brown due to breakage and death of peripheral twigs.

Cicada damage can easily destroy the current year's growth so increased pruning is required to get rid of damaged areas. The most serious consequence for nursery plantings will be the injury to usable living branches which provide the basic structure for the plant. These wounds cause a weak point so branches that are gathered together and tied during harvest and shipment are broken very easily. In order to have quality trees to harvest in a production nursery, one may have to remove 1 to 2 years of growth in order to develop usable branches on a finished product. This may mean that the trees near the end of their production cycle may be rendered useless as a marketable crop during the fall after emergence or during the next year.

Below ground feeding by large numbers of nymphs can cause long-term damage. Once they have burrowed into the ground and reached the roots, no control method is available. During the first five years, feeding by the nymphs probably will not be noticeable. However for years 6 to 13 of the life cycle, cicada nymphs may be extremely destructive to plants, especially those that bear fruit. In general, cicada damage will not be of any importance on fully grown shade trees, although the current year's growth may be reduced.

Because egg laying is the real danger from these insects, consider emergence as the signal to begin protecting plants. A week or so after emergence, females are ready to lay eggs. Plants can be protected in three ways: covering, spraying and pruning.

Small trees can be covered with a protective netting cheesecloth. Be sure to secure the bottom around the trunk. This covering will have to stay on for the next four to six weeks or until egg laying is complete.

Insecticides can be used to reduce damage by cicadas but several applications may be needed. Dursban (chlorpyrifos) and Sevin (carbaryl) are labeled specifically for periodical cicada control. Several synthetic pyrethroid insecticides are labeled for landscape trees and shrubs. Often, these insecticides have a repellent effect that causes insects to leave treated surfaces shortly after landing on them. The following examples do not list the periodical cicada but are broad spectrum products that are effective against a wide range of insects - Astro (permethrin), Decathlon 20 WP or Tempo (cyfluthrin), DeltaGard T&O (deltamethrin), and Scimitar (*lambda* cyhalothrin). Several of these are available only to commercial applicators.

Nurseries under a routine spray schedule should be sprayed according to intensity of the outbreak, which can range from a few cicadas in some areas to massive numbers in other areas. During low level outbreaks application may be needed twice a week. During massive outbreaks, damage will potentially occur even with daily applications. Continued cicada flight to landscapes and nurseries from surrounding woods keeps reinfestation pressure high for several weeks. Control is most effective when the insects are hit directly with spray droplets. Residual control must rely on cicadas sitting on treated surfaces long enough to absorb the insecticide. This can delay or reduce action on the insect.

The following are some of the products available to homeowners: Lawn and Garden Insect Killer (cyfluthrin) and Ortho Bug B Gone Spray (esfenvalerate). Spectracide Bug Stop Multipurpose Insect Control Concentrate and Total Pest Control Outdoor Formula contain (permethrin). Be sure to read the product label closely because many of these products are not labeled for fruiting plants and trees that are bearing.

A third alternative is to prune out egg-laying wounds before eggs hatch, especially in fruit orchards where juveniles feeding on roots may decrease fruit production. Although this is a time-consuming process, it may be a viable alternative considering the production life and long-term value of fruit trees.

EASTERN TENT CATERPILLAR EGG

HATCH IN CENTRAL TENNESSEE AND WEST KY
by Lee Townsend

Frank Hale and Alan Windham of the Tennessee Cooperative Extension Service reported the start of ETC egg hatch on black cherry trees in south Nashville on March 14. Leaves are just beginning to expand on the trees there. Doug Johnson reported fresh hatch of one of the masses that he is watching in Princeton. It is premature to consider an insecticide application at this time.

The rate of ETC egg hatch is strongly affected by temperature. At a constant temperature of 77 F, 90% of the eggs should hatch in about 8 days. At 50 F, it takes about 30 days for 90% of the eggs to hatch. An unseasonably warm spell over the next 10 days or so with temperatures in the low 70's will favor egg hatch and result in most of the caterpillars out and feeding in a relatively uniform group. However, a period of days with highs in the low 50's or below should prolong egg hatch over a much longer period.
This should be taken into account when planning insecticide applications. Allow tents to develop rather than treating as soon as the first larvae are seen. Both egg hatch and caterpillar growth will be slower during cool temperatures.

ETC larvae tend to leave their tents and feed at three relatively predictable times during the day - about 6 am, 3 pm, and 8 pm. Nearly 80% of their feeding activity occurs during the darkness near dawn and dusk. The morning and evening activity periods tend to be about twice as long as the one in the afternoon. These feeding times are very synchronized when the caterpillars are small and begin to be come less organized as they get older.

This behavior provides 2 advantages to them: 1) they are active when the risk of being eaten by birds is reduced and 2) they can digest their food and empty their gut in their tents during the warmer part of the day and leave it with an empty stomach when it is time to feed again.

This behavior can be used to advantage in timing an insecticide application immediately before ETC begin a major feeding spurt. An afternoon application, weather permitting, should be an effective strategy for 2 reasons. 1) ETC larvae spend a lot of time feeding at dusk and around dawn, so the insecticide residue will be "fresh". 2) Bt insecticides (DiPel, etc.) are broken down rapidly by sunlight. This application time reduces the exposure of the residue to UV light prior to feeding periods.

HOUSEHOLD

GET READY FOR TERMITE SEASON
by Mike Potter

Termite season has begun in Kentucky. During the next several weeks, you'll probably spend more time responding to termite calls than to any other pest problem. To complicate matters, the public has little understanding of termites, and what should be done if their home is infested. This column will help you answer their questions.

Q: Why be concerned about termites?
A: Termites cause billions of dollars in damage each year. They primarily feed on wood, but may also damage paper, books, foam board insulation, and even swimming pool liners and filtration systems. Termites may injure living trees and shrubs, but usually are a secondary invader of woody plants already in a state of decline. While a structure may become infested at any time, presence of termites is of particular importance when buying or selling a home since a termite inspection / infestation report is normally a condition of sale. Besides the monetary impact, thousands of winged termites emerging inside one's home is an emotionally trying experience — in a recent attitudinal survey, 93 percent of Kentuckians indicated concern about the possibility of finding termites in their home.

Q: Why are there so many termite calls during March - May?
A: Spring is typically when large numbers of winged termites, known as "swarmers," emerge. In nature, termites swarm to disperse and start new colonies. Triggered by warmer temperatures and rainfall, the winged termites emerge from the colony and fly into the air. The swarmers then drop to the ground, shed their wings, pair off with a mate, and attempt to begin a new colony in the soil. Very few swarmers emerging outdoors survive to start new colonies. Termite swarmers emerging indoors are incapable of eating wood, seldom survive, and are best removed with a vacuum cleaner. They do, however, indicate that an infestation is present.

Q: **How will I know if my home is infested?**
A: The discovery of winged termites inside a home almost always indicates an infestation warranting treatment. Termites can be differentiated from winged ants by their straight antennae, uniform waist and wings of equal size. (Ants have elbowed antennae, constricted waists and forewings that are longer than the hind wings.) Termite swarmers emerging from tree stumps, woodpiles, and other locations out in the yard are not necessarily cause for concern, and do not necessarily mean that the house is infested. On the other hand, if winged termites are seen emerging from the base of a foundation wall or adjoining porches and patios, there's a good chance the house is

infested also and treatment may be warranted.

Another indication of a termite problem is pencil-wide mud foraging tubes extending over foundation walls, support piers, sill plates, etc. Termites construct these mud "shelter" tubes as they travel between their underground colonies and the structure. Termite-damaged wood is usually hollowed out along the grain, *with bits of dried mud or soil lining the feeding galleries.* Wood damaged by moisture or other types of insects (e.g., carpenter ants) will not have this appearance.

Oftentimes there will be no sign of the termites themselves – small, creamy-white insects with an ant-like appearance. An infestation can go undetected for years, hidden behind drywall, paneling, floor coverings, insulation, and other obstructions. Termite feeding and the resultant damage can even progress undetected in wood that is exposed, because the outer surface is usually left intact. Confirmation of infestation often requires the keen eye of an experienced termite inspector. However, even the most experienced inspector can overlook damage which is hidden.

Q: **Can I treat the house myself?**
A: Ridding a home of termites requires special skills. A knowledge of building construction is needed to identify the critical areas where termites are likely to enter. Many of these potential points of entry are hidden and difficult to access. Termite control also utilizes specialized equipment such as masonry drills, pumps, large-capacity tanks, and soil treatment rods. A typical treatment may involve hundreds of gallons of a liquid pesticide, known as a *termiticide,* injected into the ground alongside the foundation, beneath concrete slabs, and within foundation walls. In short, termite treatment is usually a job for professionals. A possible exception would be if a mailbox post, sandbox or other small wooden object not attached to the house was infested. "Do-it-yourself" termite baits (see bait discussion below) sold at retail stores or bought over the internet by homeowners will seldom eradicate an existing termite problem.

Q: **How do I choose a pest control company? Why is there such a difference in price?**
A: These are complex questions. The company should be licensed by the Kentucky Department of Agriculture. Membership in the Kentucky Pest Control Association and/or National Pest Management Association suggest the company is an established firm with access to technical and training information needed to do the job correctly. As with any service company, references are invaluable. Consider calling at least 2-3 companies. Requesting inspections and estimates from more than one company will substantiate the extent of your termite problem and allow you to compare services. Companies offer different types of warranties or service agreements. Most offer retreatment of localized areas if the termites return. In some cases, no warranty/service agreement may be offered if construction elements such as wells, cisterns, subslab heating ducts, drainage systems, or inaccessible crawl spaces make it impossible to treat in accordance with industry standards.

Take your time when selecting a company. Termites damage wood slowly; the amount of damage caused by taking an additional day, week, or month to make an informed decision is insignificant. Avoid firms that try to pressure you into signing a contract immediately with "specials" or scare tactics. Ultimately, the quality of a termite job depends less on the person who sells the job than on the individual who does the work. A safe and effective treatment requires an experienced technician, not someone who was hired a few weeks ago.

Q: Which treatment methods and products are most effective?
A: Another complex and difficult question. There are two general categories of termite treatment, liquids and baits. Liquid termiticide applications have been around for decades. Their purpose is to provide an effective, long-lasting chemical barrier around and beneath a structure which termites cannot breach. Most of the products used in recent years have been *repellent* rather than lethal to termites foraging in the soil. Two newer materials, Premise® (imidacloprid) and Termidor® (fipronil), are *non-repellent*. Consequently, termites freely tunnel into the treatment zone and are killed. For reasons too complex to explain in this article, the non-repellent products, Premise and Termidor, are proving somewhat more reliable in their ability to resolve termite problems in the first attempt. *All* registered termiticides (both repellent and non-repellent) can be effective, however, and homeowners should not base their purchasing decision on product alone.

The other broad treatment category is baiting. Termite baits consist of paper, cardboard, or other "termite-friendly" food, combined with a slow-acting substance lethal to termites. Some bait materials are installed below ground out in the yard, whereas others are placed inside the structure, affixed to active termite shelter tubes. Foraging termites consume the bait and share it with their nest mates, resulting in a gradual decline in termite numbers. On some properties, baits may constitute the only form of treatment; on others, they may be supplemented with either a partial or complete liquid application to the soil.

Termite baiting is a very complex subject. A detailed discussion of the considerations in having your home

treated with baits versus liquids is provided in entomology extension publications, *ENT-65: Termite Baits: A Guide for Homeowners, and Entfact-644: Consumer Update: Termite Baits.*

Regardless of which product or approach is selected, it's important to have an experienced technician, backed by a responsible pest control firm.

Q: **Does the entire house need to be treated... or can they just "spot treat" areas where I see termites?**
A: Subterranean termite colonies may contain hundreds of thousands of individuals foraging in many different directions. For the homeowner, localized or "spot" treatments are generally a gamble except in cases of retreatment. Most reputable pest control firms will not warranty spot treatments, since it's likely that termites will eventually find other points of entry into the structure.

Beginning this year, some companies may offer to do a somewhat more extensive "partial" termite treatment using one of the non-repellent liquid termiticides, Termidor or Premise. Typically, this will involve an exterior application along the foundation around the entire perimeter of the building, and spot-treatment of infested or high-risk interior areas. If the homeowner is considering such a treatment, they should inquire whether it will be accompanied by a service agreement in case termites return. (Service renewal agreements usually state that if termites return, the company will return and retreat the affected area(s) at no additional charge provided the renewal agreement is maintained.) While such treatments may be effective, it's a bit of a gamble to purchase a termite treatment without an ongoing service agreement (see final question below).

Q: **How long will a treatment last?**
A: All registered liquid termiticides are supposed to control termites for at least five years when applied according to label directions. The *actual* length of control on a given structure will depend on such factors as thoroughness of the application, prevailing environmental conditions, and density of termites in the area. If termites swarm again and continue to be a problem the year after treatment, it's usually not from degradation of the termiticide – but because termites have found an untreated gap in the chemical barrier.

Q: Will the termite chemical harm my family or pets?
A: Termiticides are tested extensively for adverse effects on health. Before a product can be used, numerous studies are conducted by the manufacturer and independently evaluated by the U.S. Environmental Protection Agency. Based on the current body of knowledge, these registered termiticides pose no significant hazard to humans, pets or the environment when applied according to label directions. Despite the negligible health risk from a properly performed termite treatment, people with lingering concerns should consult their physician. Clients who are still apprehensive my want to consider having their home treated with baits.

Q: Have I been "cheated" if termites continue to infest my house after treatment?
A: Not necessarily. Unlike other services such as plumbing or electrical work, termite control involves living creatures. The best treatments performed by knowledgeable firms may fail at times, because termites are able to find their way through tiny, untreated gaps in the soil. While the *intent* is to establish a continuous, impenetrable chemical barrier in the soil, this is all but impossible to achieve in actual practice. In the case of baits, it may take several months for termites to initially find the installations in the soil, and several months more to achieve control.

The key in termite control is to hire a reputable pest control firm employing experienced, conscientious technicians. Companies will usually return and retreat affected area(s) at no additional charge provided the service agreement is purchased and maintained.

DIAGNOSTIC LAB HIGHLIGHTS
by Julie Beale and Paul Bachi

Recent samples in the Diagnostic Laboratory have included powdery mildew causing fruit distortion on greenhouse strawberry; Botrytis blight on greenhouse-grown bedding plants; black root rot on holly in the landscape; and Dothistroma needle blight on Austrian and Mugo pines.