

PLANT PATHOLOGY FACT SHEET

# 2012 FUNGICIDE GUIDE FOR BURLEY AND DARK TOBACCO

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## CHEMICALS LABELED FOR DISEASE MANAGEMENT IN KENTUCKY, 2012

### TRANSPLANT PRODUCTION

Perhaps the biggest development for managing seedling diseases has been the release of a 24(c) label that permits the use of Quadris in transplant production. The Quadris 24(c) is valid through December, 2012 and allows one application of the fungicide to seedlings in greenhouses or outdoor float beds. Ferbam was re-registered for use in 2011; however, the fungicide was sold by Taminco to another manufacturer, and tobacco uses were subsequently dropped from the Ferbam label. Existing stocks of tobacco-labeled Ferbam can be used, however.

The few fungicides registered for use on tobacco transplants can be very effective tools against *Pythium* root rot, blue mold, and target spot/damping-off when used along with good management practices. Sanitation, in particular, should be relied on first to manage float-bed diseases, especially those for which no fungicides are available.

#### Pythium Root Rot

*Terramaster 4EC*. Good-to-excellent control of *Pythium* root rot is possible with Terramaster 4EC, but only if the material is applied preventively to float water. Make the first application 2-3 weeks after seeding, or when roots first enter the water. A second treatment can be made 3 weeks after the first, and a final application (if needed) can be made two weeks after the second treatment. Do not apply more than 3.8 fl oz per 100 gal of float water per crop of seedlings, and do not treat any later than 5 days before transplanting. Make sure that the product is mixed thoroughly in float bays to minimize the risk of plant injury. "Rescue" applications of Terramaster (see table for rates) in systems with active disease will halt further development of disease and symptomatic seedlings will likely recover. Keep in mind that the risk of plant injury can increase for these rescue treatments because higher rates of chemical are used. Also, recuperating plants may still be affected by *Pythium*, making them more susceptible to black shank and *Fusarium* wilt. We also know that the number of useable transplants tends to be lower for rescue treatments than for preventive applications of Terramaster. Terramaster will burn the roots of tobacco seedlings, but plants quickly recover. Stress from root burn is minimized if this product is applied when roots first enter the float water, and is greatest if the fungicide is applied to seedlings with extensive root systems. Severe root burn can lead to stunting and delayed development of seedlings – a great reason to begin applications of Terramaster early.

#### Damping-Off, Target Spot, Blue Mold, and Bacterial Soft Rot (Blackleg)

*Dithane DF, Manzate ProStick and Penncozeb 75DF*. Mancozeb is a widely used fungicide that is labeled for target spot, damping-off (*Rhizoctonia*), and blue mold. Note that three mancozeb fungicides now have 24(c), or Special Local Need labels for use on tobacco in float beds and in the field. In addition to Dithane DF, Manzate ProStick and Penncozeb 75DF can be used on tobacco in Kentucky. Mancozeb provides reasonable control of target spot, and because it is a protectant-type fungicide (not systemic, and has no curative activity), it should be applied at the first signs of disease at the latest (see table for rates). Use 3 gal of spray material per 1000 sq. ft., applied as a fine spray to improve coverage on foliage, while plants are small, and increase gradually to 6 to 12 gal as plants grow to transplantable size. Be sure sufficient water is used to wet the base of the stems to increase the control potential of damping off. Avoid

contamination of the float water during treatment. Do not apply this fungicide to plants smaller than dime-size to avoid damage. Producers with a history of problems with target spot should consider routine application of mancozeb, beginning when plants are dime-sized and continuing on a 5-7 day schedule, depending upon age of transplants and weather conditions. Apply mancozeb more frequently to rapidly growing plants, if conditions are warm, humid and overcast, or if disease is present. For control of blue mold, mancozeb must be in place before plants become infected. Because of the fast-moving, explosive nature of blue mold in the float system, applications made after the first signs of disease have little chance of controlling the disease. Consult with your county Extension office, local media outlets, or University of Kentucky Extension specialists for guidance on when to treat for blue mold. You can also visit the Kentucky Tobacco Disease Information Page (<http://www.uky.edu/Ag/kpn/kyblue/kyblue.htm>) or the North American Plant Disease Forecast Center (<http://www.ces.ncsu.edu/depts/pp/bluemold>) for current reports on blue mold and other diseases.

*Quadris 2.08SC.* Effective through December 31, 2012, growers will be able to make ONE application of Quadris per crop of transplants. The rate is 6 fl oz/A, which is the equivalent of 0.14 fl oz (4 cc) of product per thousand square feet of float bed (roughly 400 trays), applied in a recommended volume of 5 gallons – enough to get good leaf coverage. For best control of disease, we recommend making the Quadris application before symptoms are seen (or when they first appear at the very latest) and at a time when the plants would be the most susceptible to target spot. Generally, target spot becomes active in Kentucky in late April or early May. To get ahead of the disease, a good strategy would be to apply Quadris after the 1st or 2nd clipping. After making the Quadris treatment, producers should switch back to mancozeb until plants are set in the field. This is critical to stay in compliance with the label, and to minimize the risk of resistance developing. In cases where target spot is severe on float plants, a follow up application of Quadris may be needed at about 5-6 weeks after setting to suppress the disease in the field. Quadris is most likely compatible with products like mancozeb or Orthene, but it would be advisable not to mix Quadris and agricultural streptomycin to avoid potential injury. In terms of resistance to rain and weathering, we can expect Quadris to be fairly rain fast if it can dry for a couple of hours after treatment. It's important that growers who use Quadris in the greenhouse have a copy of the 24(c) label in their possession. It is equally important to remember that the greenhouse application counts toward the seasonal limit (4-5 applications) allowed on tobacco.

*Other products.* Aliette WDG, agricultural streptomycin, and milk may also be used in transplant production. Aliette or streptomycin should be applied to plants dime-sized or larger in a manner similar to Dithane DF for protection against blue mold, while milk can be applied to seedlings to reduce the potential for mechanical spread of tobacco mosaic virus (see Table 1 for rates). Streptomycin also suppresses bacterial soft rot (blackleg) when used preventively. Do not allow Aliette or streptomycin to contaminate float water, as serious injury to plants can occur. Keep in mind, too, that products that specifically prohibit use in greenhouses cannot be applied to tobacco in the float system. Only products labeled for tobacco can be used—do not apply products intended for greenhouse ornamentals or bedding plants to tobacco. Follow all label directions and take special care to protect workers from exposure to pesticides.

## **FIELD PRODUCTION**

### **Blue Mold, Target Spot, and Frogeye**

*Quadris 2.08SC*. Quadris is the only labeled option for management of frogeye and target spot, and is also a good blue mold fungicide. Research carried out at the University of Kentucky has shown that where target spot has been historically severe, 1-2 applications of Quadris made at 8 fl oz/A and beginning when plants are between 24-36 inches tall, will provide significant control of target spot. Early applications prevent buildup of the target spot pathogen, suppressing disease later in the season. In areas with heavier disease pressure, an additional late-season application may be required to protect tobacco between topping and harvest. Where disease severity is low, a single application made early (before the canopy closes between rows – usually around layby) can be as effective against target spot as three applications made at 2-3 week intervals. Quadris is recommended to any grower facing losses from target spot.

Quadris is a protectant fungicide, and has limited systemic activity. As such, this product should be applied before disease begins or, at the latest, when symptoms first appear. Good coverage is critical to getting good disease control with Quadris. Quadris can be applied up to the day of harvest, making this material a good option for post-topping control of leaf spotting diseases; however, only one application of Quadris can be made after topping due to a lack of fungicides that can be alternated with Quadris at this crop stage. It's also important to remember that Quadris should not be tank-mixed with EC-type pesticides or certain flowable products (such as liquid Dipel) to avoid severe crop injury.

*Forum SC, mancozeb (Dithane DF, Manzate ProStick, and Penncozeb 75DF), Aliette WDG, and Actigard*. Forum is a liquid formulation of dimethomorph, the active ingredient found in Acrobat (discontinued), used for control of blue mold. According to the Forum label, this product must be tank-mixed with another blue mold fungicide for management of resistance.

Actigard is one of the best options for blue mold. This is a systemic product that functions by inducing plant defenses and is thus not a true fungicide. Coverage is not as critical with Actigard as with other fungicides, so this product may be applied with standard “over-the-top” type equipment and will still give good control of blue mold. Activation of host defenses takes several days for full protection, so Actigard should be applied 4-5 days before tobacco is exposed to the blue mold pathogen. If infection threatens before the 4-5 day activation period, Actigard can be tank-mixed with another fungicide to protect plants during this critical time. A second application made 10 days after the first has been shown to provide good protection against blue mold up to topping time. Do not apply Actigard to burley tobacco until plants are greater than 18 inches tall (12 inches for dark tobacco) to avoid serious injury. Do not apply Actigard to crops that are stressed from environmental factors such as drought. Use another fungicide if blue mold threatens tobacco smaller than the recommended height to protect until Actigard can be applied.

Aliette WDG has a label on tobacco for control of blue mold only. For field use, apply 2.5-4 lb/A of Aliette in a minimum of 20 gal/A of water on newly transplanted tobacco. Increase the spray volume by 20 gal/A for each week of growth until 100 gal/A is reached. The first application of Aliette should be made immediately after transplanting and subsequent sprays can be made on a 7-to10-day schedule. Aliette should not be tank-mixed with copper compounds, surfactants, or foliar fertilizers and the pH of the spray solution should not be less than 6.0. Our results suggest that this product is not as effective as other options for blue mold.

Although soil-applied fungicides like Ridomil Gold, Ultra Flourish, and MetaStar list blue mold on their labels, these products should not be used to manage the disease. Resistance is

widespread in populations of the blue mold pathogen to mefenoxam, the active ingredient found in Ridomil Gold and Ultra Flourish, and metalaxyl, found in MetaStar.

## **Black Shank**

**Ridomil Gold, Ultra Flourish, and MetaStar.** For suppression of black shank, use products containing mefenoxam or metalaxyl in conjunction with resistant varieties (4 or higher on the rating scale to both races of the black shank pathogen) and crop rotation. Refer to UK Cooperative Extension Publication No. ID-160, the 2011-2012 Kentucky & Tennessee Tobacco Production Guide (<http://www.ca.uky.edu/agc/pubs/id/id160/id160.pdf>) for detailed descriptions of burley and dark tobacco varieties. In most cases, mefenoxam and metalaxyl will not provide acceptable control of black shank if applied to varieties with little or no resistance to black shank. Good soil moisture is needed for best performance of these products against black shank because uptake by roots is required for best control of disease.

*Broadcast applications.* Where black shank has been severe, consider making a pre-plant application at 1-3 pt/A of Ridomil Gold, 1-3 qt of Ultra Flourish, or 4-6 qt of MetaStar 2E per acre prior to transplanting. Use a volume of water or fertilizer sufficient for good soil coverage and incorporate into the top 2-4 inches of soil by disking or irrigation. Under light-to-moderate disease pressure, apply mefenoxam within 1-2 weeks of transplanting. For extended control of black shank, make a supplemental application (1 pt of Ridomil, 1 qt of Ultra Flourish, or 2 qt of MetaStar) of fungicide at layby OR at 1st cultivation and again at layby. These applications should be directed toward the soil and incorporated immediately by cultivation. Avoid “over-the-top” applications of mefenoxam or metalaxyl later in the season. This use is not permitted, plus any chemical intercepted by tobacco leaves will not be taken up by the roots, thereby reducing the effectiveness of the treatment.

*Transplant-water applications.* Producers can also apply 4-6 fl oz/A as a transplant-water (setter-water) treatment. This use is covered under a 24(c) label that is valid through the end of 2013, and pertains specifically to Ridomil Gold SL; other products such as Ridomil Gold EC or generic formulations of mefenoxam or metalaxyl cannot be used in transplant water. When opting for this application method, growers should do so only where good management practices are employed and must have a copy of the 24(c) label in their possession at the time of treatment. In fields with a history of black shank, be sure to plant a tobacco variety with moderate-to-high resistance to the disease. In fields with a poor rotation history, or where severe black shank has occurred in the previous 1-2 years, setter-water application of Ridomil Gold SL will not provide acceptable control of disease. In these situations, the standard broadcast application of 1 pt/A prior to planting is recommended. If a setter-water treatment of Ridomil is used in a high-risk field, be sure to treat at the 8 fl oz/A rate and consider supplemental, soil-directed applications of Ridomil Gold at 1<sup>st</sup> or 2<sup>nd</sup> cultivation. Severe plant injury may occur when Ridomil is used in setter water during very hot and dry conditions, or if a transplant-water volume of less than 200 gal/A is used to set plants.

## **Bacterial Diseases**

*Agricultural streptomycin.* Agri-Mycin 17 and Firewall can be used to manage angular leaf spot. Begin applications when symptoms appear and continue while weather conditions favor disease development (warm and rainy weather). Hollow stalk, another bacterial disease, cannot be managed with chemicals. Instead, make sure that crops are not over-fertilized. Minimize mechanical and chemical wounding during topping and sucker control operations, and don't top during rainy or overcast conditions, or if plants are wet.

## Virus Diseases

Chemical control of virus diseases is not possible. Host resistance can be effective against certain virus diseases of tobacco. Refer to ID-160 for more information. Control of insect vectors gives variable (and unpredictable) levels of control of aphid-transmitted viruses (potyviruses) or tomato spotted wilt virus (TSWV), which is transmitted by thrips. Weed control in and around fields can be helpful, as weeds serve as reservoirs of certain plant viruses (and also fungi and bacteria); don't plant tobacco near vegetables for the same reason. Tobacco surrounded by, or planted adjacent to corn, soybeans, or other small grains will have less problems with aphid-transmitted diseases, as the insects "lose" the virus as they feed on small grains before moving onto tobacco. Plant-to-plant spread of tobacco mosaic virus (TMV) can be reduced by avoiding the use of tobacco when handling plants (greenhouse and field) and by washing hands in a solution of milk.

## Fumigants

Several fumigants are registered for use on tobacco for pre-plant suppression of soilborne pathogens and nematodes in Kentucky, but should be considered a measure of last resort. Nematodes have not been a serious problem in Kentucky, and the use of products such as Telone C-17 or C-35 is not warranted under most circumstances due to high material costs and expensive custom application. Chloropicrin used as a pre-plant soil treatment will reduce populations of *Phytophthora nicotianae*, *Rhizoctonia*, *Fusarium*, *Pythium*, and *Thielaviopsis*, giving fair control of disease. As with soil nematicides, chloropicrin is expensive and must be applied with specialized equipment and will not be an economically viable choice for most producers.

## USE FUNGICIDES CORRECTLY

Timely and accurate application of fungicides is essential for best performance. The following are some general guidelines for successful use of fungicides to manage diseases of tobacco.

- Apply fungicides preventively or at the latest when first symptoms of disease appear. Most products labeled for tobacco are protectants and must be in place before the arrival of the pathogen to suppress infection. Applications made after a disease has become established will take longer to bring the epidemic under control, or may not be successful. This is especially true for blue mold. Begin fungicide applications for blue mold control when the disease is forecasted to threaten your area or has been found nearby. Contact your county Extension agent for disease advisories, or visit the KY Tobacco Disease Information Page (<http://www.uky.edu/Aq/kpn/kyblue/kyblue.htm>). Maintain recommended application intervals while disease threatens or the weather favors disease. Applying fungicides with a specific mode of action, such as Quadris, when high levels of disease are present can lead to the development of resistance in certain plant pathogens.
- Use an application volume that gives the best coverage of plants. This amount will change as the crop grows, but in general use 20 gallons per acre early (when plants are small) and increase to as much as 100 gallons per acre for applications made at topping or afterward. Spray pressure should be between 40 and 100 psi, and use hollow-cone nozzles for best effect. As the crop grows, configure your sprayer, if possible, with one

nozzle centered over the row and multiple nozzles on drop extensions to get good coverage in the lower canopy.

- Calibrate your sprayer for accurate delivery. This will ensure the crop receives neither too little fungicide (poor disease control) nor too much chemical (extra cost, potential injury, and possible violation of the label). Clean nozzles regularly, and change them as they become worn. This is an extra expense that will pay for itself in the long run.

The following tables list labeled chemicals that are available to growers in Kentucky for use in the production of burley and dark tobacco in 2012. As always, read all product labels carefully and follow all directions provided by the manufacturers. Each product has specific use directions that should be followed to minimize the risk of injury to the crop and applicator, and to maximize the effectiveness of the product. The following summary is provided as a general set of guidelines to aid in product selection but is not intended to replace product labels. For additional information on diseases and recommendations for their control, refer to the 2011-2012 Kentucky-Tennessee Tobacco Production Guide (ID-160). This publication is available at your local CES office or online at <http://www.ca.uky.edu/agc/pubs/id/id160/id160.pdf>.

**Table 1. Guide to Chemicals Available for Control of Tobacco Diseases 2012 – Transplant Production**

Product(s)	Product rate		Target diseases	Label notes
	Per application <sup>a</sup>	Per season		
Agricultural Streptomycin Agri-Mycin 17 Firewall	0.5-1 lb/100 gal H <sub>2</sub> O (½-1 tbsp./gal)	no limit	Wildfire blue mold	Apply in 3-5 gal/1000 sq. ft. Will also help suppress blackleg (bacterial soft rot) when applied in enough water to wet stems.
Aliette WDG	1 lb/100 gal H <sub>2</sub> O (1 tbsp./gal)	1.2 lb per 1000 sq. ft.	blue mold	Apply 3 gal of solution per 1000 sq. ft. on small plants; increase to a maximum of 12 gal as plants grow.
Dithane DF Manzate ProStick Penncozeb 75DF	0.5 lb/100 gal H <sub>2</sub> O (1.5 tsp./gal)	no limit	blue mold anthracnose damping-off	Apply 3-12 gallons/1000 sq. ft. as a fine spray. Begin when plants are dime-sized or larger, and continue on a 5-7 day schedule until transplanting.

<sup>a</sup>Rate range of product. In general, use higher rates when disease pressure is high. Refer to product label for application information, restrictions, and warnings.

Table 1 (cont'd). Guide to Chemicals Available for Control of Tobacco Diseases 2012 – Transplant Production

Product(s)	Product rate		Target diseases	Label notes
	Per application <sup>a</sup>	Per season		
Milk				
<i>Whole/Skim</i>	5 gal/100 gal H <sub>2</sub> O (¾ cup/gal)	no limit	tobacco mosaic virus (plant-to-plant spread).	Apply to plants at least 24 h prior to handling. Mix will treat 100 sq. yd.
<i>Dry</i>	5 lb/100 gal H <sub>2</sub> O (5 tbsp./gal)	no limit		For washing hands, add 1 pt of milk to 1 gal of water, dip hands every 20 minutes while handling plants.
Quadris 2.08SC	0.14 fl oz/5 gal H <sub>2</sub> O (4 cc/5 gal)	1 application	target spot	Apply <b>once</b> to plants before disease onset or when symptoms first appear. Use 0.14 fl oz per 1000 sq. ft. of bed. Application counts toward seasonal limit in field.
Terramaster 4EC	1-1.4 fl oz/ 100 gal H <sub>2</sub> O	3.8 fl oz	damping-off ( <i>Pythium</i> spp.) root rot ( <i>Pythium</i> spp.)	Apply to float-bed water no earlier than 2 weeks after seeding. Additional applications can be made at 3-week intervals. Use high rate for curative treatments; begin no sooner than 3 weeks after seeding. Do not apply later than 5 weeks before transplanting.

<sup>a</sup>Rate range of product. In general, use higher rates when disease pressure is high. Refer to product label for application information, restrictions, and warnings.

Table 2. Guide to Chemicals Available for Control of Tobacco Diseases 2012 – Soilborne Diseases (Field)

Product(s)	Product rate		Target diseases	Label notes
	Per application <sup>a</sup>	Per season		
<i>Fumigants</i>				
Chloropicrin	60-100 lb/A (broadcast)	--	black root rot black shank	Inject to 8-in. depth. Apply when soil temperatures are >55 °F and moisture levels are adequate.
Chlor-O-Pic	150-500 lb/A (broadcast)	--	damping-off nematodes	Apply a minimum of 3 weeks before setting transplants.
Telone C-17	10.8-17.1 gal/A (broadcast)	--	bacterial wilt black root rot	Inject to 8-in. depth. Apply when soil temperatures are >55 °F and moisture levels are adequate.
Telone C-35	13-20.5 gal/A (broadcast)	--	black shank nematodes	Apply a minimum of 3 weeks before setting transplants.
<i>Non-fumigants</i>				
Ridomil Gold SL <sup>b</sup>		3 pt	black shank	
<i>transplant (setter) water</i>	4-8 fl oz			Apply in a minimum volume of 200 gal/A. Follow up application at layby and/or 1 <sup>st</sup> cultivation may be needed. Setter-water application approved only for Ridomil Gold.
<i>pre-plant only</i>	1-3 pt			Incorporate after application.
<i>pre-plant + layby</i>	1 pt + 1 pt			
<i>pre-plant + 1<sup>st</sup> cultivation + layby</i>	1 pt + 1 pt + 1 pt			
Ultra Flourish <sup>b</sup>		3 qt.	black shank	Incorporate after application.
<i>pre-plant only</i>	1-3 qt			
<i>pre-plant + layby</i>	1 qt + 1 qt			
<i>pre-plant + 1<sup>st</sup> cultivation + layby</i>	1 qt + 1 qt + 1 qt			
Ultra Flourish		6 qt	black shank	Incorporate after application.
<i>pre-plant only</i>	4-6 qt			
<i>pre-plant + layby</i>	2 qt + 2 qt			
<i>pre-plant + 1<sup>st</sup> cultivation + layby</i>	2 qt + 2 qt + 2 qt			

<sup>a</sup>Rate range of product **PER ACRE**. In general, use higher rates when disease pressure is high. Refer to product label for application information, restrictions, and warnings.

<sup>b</sup>First application of Ridomil Gold or Ultra Flourish can be made as late as 1<sup>st</sup> cultivation. Use of a variety with good resistance to black shank is recommended when using this application schedule. If needed, a follow-up application of fungicide can be made at layby.

**Table 3. Guide to Chemicals Available for Control of Tobacco Diseases 2012 – Foliar Diseases (Field)**

Chemical	Product rate		PHI <sup>b</sup> (days)	Target diseases	Label notes
	Per application <sup>a</sup>	Per season			
Agricultural streptomycin	100-200 ppm	no limit	0	wildfire	
Agri-Mycin 17	(4-8 oz/50 gal H <sub>2</sub> O)			blue mold	
Firewall					
Acrobat 50WP	2-8 oz	32 oz	0	blue mold	Increase rate and app. volume as crop size increases. Acrobat must be tank-mixed with another fungicide.
Actigard 50WG	0.5 oz	1.5 oz (3 apps.)	21	blue mold	Begin applications when plants are >18 inches in height <sup>c</sup> . Make up to 3 applications on a 10-day schedule. Apply in a minimum of 20 gal/A.
Dithane DF Manzate ProStick Penncozeb 75DF	1.5-2 lb	no limit	30	blue mold	Apply on weekly schedule; discontinue sprays when blue mold threat no longer exists.
Aliette WDG	2.5-4 lb	20 lb	3	blue mold	Make first application immediately after transplanting; continue on a 7-10 day schedule. Use a minimum spray volume of 20 gal/A; increase by 20 gal/A weekly to a maximum of 100 gal/A.
Forum SC	2-8 fl oz	30 fl oz	0	blue mold	See notes for Acrobat
Quadris 2.08SC	6-12 fl oz	32 fl oz	0	target spot frog-eye blue mold	Begin sprays at 1 <sup>st</sup> signs of disease. Continue on a 7-14 day schedule (use a shorter interval if weather favors disease. Do not make back to back sprays. Alternate with a different product labeled for tobacco. Can be applied up to the day of harvest; however, make only one application after topping.

<sup>a</sup>Rate range of product *PER ACRE*. In general, use higher rates when disease pressure is high. Refer to product label for application information, restrictions, and warnings.

<sup>b</sup>Pre-harvest interval

<sup>c</sup>Actigard can be applied to dark tobacco varieties at the 12-inch stage.

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