

TOBACCO DISEASE CONTROL

Paul Bertrand

Disease control in tobacco involves an integrated program of numerous practices. Useful practices include crop rotation, root and stalk destruction, nitrogen management, plant spacing, varieties, and chemicals.

CROP ROTATION

Crop rotation is a particularly useful practice in dealing with pathogens that live in the soil. Rotation causes pathogen populations to decline naturally in the absence of suitable food sources. The longer tobacco can stay out of a field, the more beneficial the program will be. In general, small grains and forage grasses are the best overall crops to rotate with tobacco. In the case of root-knot nematodes, selection of the best rotational crop depends upon which root-knot species are present. Cotton is a good choice where Javanese and/or peanut root-knot is present, but a poor choice where high levels of Southern root-knot are present. Corn, though always better than continuous tobacco, is not always ideal due to variation in how corn varieties respond to different nematode populations. Soybeans vary greatly in susceptibility to root-knot nematodes and it is fairly easy to select a variety that would be more beneficial in a particular case. As with other diseases, small grains and forage grasses work well. In most cases, even native weeds would be better than continuous tobacco.

NITROGEN MANAGEMENT

Excess nitrogen causes a nightmare of sucker problems and favors several diseases. Use the full amount of nitrogen needed to produce a top quality crop, but not a bit more. Even small amounts of excess nitrogen can result in a significant, usually negative response in tobacco.

PLANT SPACING

A field spacing of about 20-22 inches between plants has been shown to produce the best tobacco. Tighter spacing puts more plants per acre and restricts air movement between plants. Restricted air movement slows drying and increases suitable pathogen habitat by favoring both infection and spread of diseases. Increasing plant population by decreasing in-row spacing to compensate for loss from tomato spotted wilt virus is not recommended. Following such a practice would lead to increased sucker control problems every year and increased losses from blue mold, target spot, angular leafspot and hollow stalk in wet years. Reduced plant spacing will also lead to more rapid and extensive spread of tobacco mosaic virus.

EARLY STALK AND ROOT DESTRUCTION

This practice, also known in North Carolina as R-9-P for reduce nine pests, is very important. Root and stalk destruction as soon as possible after harvest reduces overwintering populations of pathogens infesting these plant parts. The root destruction part of the program also eliminates fall and winter suckers which feed infested roots and serve as sources for build-up of foliar diseases. Blue mold and viruses can carry over during a mild winter in these suckers.

The four steps involved in a good root and stalk destruction program are outlined below:

- 1) Cut stalks into small pieces with a rotary or flail mower as soon as possible after harvest.
- 2) Plow or harrow the stubble immediately after stalk cutting. Be sure to pull roots completely out of the soil.
- 3) Cross harrow the field two to three weeks after Step 2.
- 4) When roots are fully dried out and dead, plant a winter cover crop to reduce soil erosion.

VARIETIES

Resistant varieties are useful for control of some tobacco diseases. Growers should not rely on the same variety for disease control year after year. Pathogens can adapt through build up of initially minor species or races and in time overcome any variety. This has been clearly demonstrated for black shank and root-knot nematodes. Rotating varieties is a good idea and should slow down loss of resistance to black shank. Table 4 in the Variety Section of this book lists common tobacco varieties and their disease resistance properties.

Table 1. Common Tobacco Diseases and Various Control Practices

Disease	Rotation	Root & Stalk Destruction	Nitrogen Management	Plant Spacing	Varieties	Chemicals
Root-Knot	Yes	Yes	--	--	Yes	Yes
Black Shank	Yes	Yes	--	--	Yes	Yes
Blue Mold	--	Yes	Yes	Yes	--	Yes
Brown Spot	Yes	--	Yes	Yes	--	--
Fusarium Wilt	Yes	Yes	--	--	Yes	Yes**
Soreshin	--	--	--	--	--	--
Target Spot	--	--	--	Yes	--	--
Angular Leafspot	Yes	Yes	Yes	Yes	--	Yes*
Granville Wilt	Yes	Yes	--	--	Yes	Yes
Hollow Stalk	--	--	--	Yes	--	--
Tobacco Mosaic	Yes	Yes	Yes	Yes	Yes	--
Tobacco Etch	--	Yes	--	--	--	--
Potato Virus Y	--	Yes	--	--	Yes	--
Tomato Spotted Wilt Virus	--	--	--	--	--	Yes

Yes= Useful in control, though may not give total control;

-- = Not known to be useful in control.

Yes* = Recommended in some areas, but should not be relied upon in all situations.

Yes** = Nematode control practices reduce Fusarium Wilt.

BLUE MOLD

Blue mold caused by *Peronospora tabacina* is spread by spores carried long distances by wind. Ideal conditions for blue mold would be night temperatures above 50 ° F, day temperatures about 70 ° F along with fog, rain or dew to keep leaves wet.

Long distance spore movements are tracked by the North Carolina Blue Mold Forecast System. This system can give up to 48 hours warning of blue mold spore movement. This information can be accessed via the world wide web at: <http://www.ces.ncsu.edu/depts/pp/bluemold/>

These forecasts may be used to trigger treatment or intense scouting depending on the level of risk each individual wishes to assume. These forecasts are useful to predict first movement of blue mold into an area. Once blue mold is present, local weather conditions should be used to make further treat/don't treat decisions.

A second web based system is available to locate blue mold activity in Georgia. <http://www.georgiabluemoldreporter.com>

Table 2. Blue Mold Control

Chemical and Formulation	Rate Per Acre Per Application	Remarks
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FORUM™ fungicide 2 - 8 oz

Select Forum rate and spray volume/acre from table below. To be effective Forum requires total plant coverage.

FORUM™ fungicide must be applied as a tank mix with another fungicide that has a different mode of action (**non-group 15** fungicides)

Weeks of Growth After Transplant	Rate of FORUM™ fungicide (oz of Product)	Water Output (Gallons/Acre)
Recently Transplanted to 3 weeks after transplanting.	2	20
3-4 weeks after transplanting (Knee High)	3	40
4-5 weeks after transplanting (Waist High)	4	60
6-7 weeks after transplanting (Chest High)	6	80
7 weeks after transplanting and beyond (Shoulder height up to topping)	7	100

Note: Above directions are for dilute sprays. If concentrate sprays are used, adjust rate and volumes proportionally, e.g. for mist blows, use 2X concentrate and 1/2 the spray volume.

Begin applications when the **Blue Mold Advisory states that conditions favor development of blue mold**, and before the onset of disease. Continue applications on a 5-7 day spray schedule until weather conditions favoring infection and sporulation decrease. Discontinue sprays when and if the threat of blue mold subsides. **Restrictions (Field Applications): DO NOT** exceed 8 oz/acre per application. **DO NOT** exceed 30 oz/acre of **FORUM™ fungicide** per season. **Tobacco may be harvested the day of the last application, after spray has dried.**

Chemical and Formulation	Rate Per Acre	Remarks
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Actigard 50 WG 0.5 oz

Apply Actigard any time after tobacco reaches 18 inches high. Make a second application 10 days later

Actigard is not a traditional fungicide. Actigard induces a disease resistance mechanism in some plants including tobacco. It takes 5-7 days after an Actigard application for the disease resistance process to become fully effective.

BLACK SHANK

Black Shank is caused by the fungus *Phytophthora parasitica* var. *nicotianae*. DO NOT GROW TRANSPLANTS IN ANY FIELD WHERE BLACK SHANK IS KNOWN TO HAVE OCCURRED. METHYL BROMIDE WILL NOT ERADICATE THIS FUNGUS OR GUARANTEE DISEASE FREE TRANSPLANTS. Black shank infection is favored by wet spring weather. Highest losses then occur during dry summer periods as rotted roots fail to keep up with water demands. Typically black shank results in extensive root rotting, pith disking and decomposition, and blackening on the outer surface of the stalk. Resistant varieties show less obvious symptoms in the pith.

USE ROTATION

One of the best control measures for black shank is rotation. Keep tobacco out of fields with a history of black shank as long as possible. Alternate year production provides little or no benefit. Three or more years rotation will provide a consistent moderate to high level of benefit.

Table 3. Chemical Control of Black Shank¹

Chemical and Formulation	Rate Per Acre	Pounds Active Ingredient	Remarks
(mefenoxam) ²		(1 + 0.5 - 1.0)	Broadcast-Incorporate prior to setting. ³
Ridomil Gold	(1 pt PPI + 0.5-1 pt layby)		Mefenoxam may be applied to the beds at first plowing if heavy rainfall (>1") occurred since the PPI treatment. Apply mefenoxam at layby using two drop nozzles per row. Direct spray to bed. Follow with layby plowing.
Ultra Flourish	(1 qt PPI + 1-2 pt layby)		

¹ Where root-knot nematodes and the black shank fungus occur in the same field, use a preplant fumigant for nematode control.

² Additional mefenoxam may be applied at any plowing if >1" of rainfall has occurred since transplanting or field history warrants.

³ Mefenoxam should be applied 48 hours prior to or within 24 hours after transplanting. Any delay between treatment and transplanting can result in chemical loss by leaching or breakdown.

FOLIAR APPLICATIONS OF RIDOMIL GOLD/ULTRA FLOURISH FOR BLACK SHANK CONTROL ARE ILLEGAL AND USELESS!

- 1) Very little mefenoxam is taken up by leaves.
- 2) Almost none of the mefenoxam taken up by a leaf moves out of that leaf.
- 3) All mefenoxam movement in plants is upward away from the roots where the black shank fungus enters.

USE RESISTANT VARIETIES

Seventy five percent of the tobacco now grown in Georgia is rated as having high black shank resistance. This is based on the presence of these varieties (NC 71, NC 72, NC 297, Speight 168, etc.) of a single gene giving near total resistance to pathogen race O. A statewide survey conducted in 1994 found a second race designated pathogen race 1 at very low levels but scattered all over the Georgia tobacco production area. THE NEW PATHOGEN RACE O RESISTANT VARIETIES HAVE LITTLE OR NO RESISTANCE TO PATHOGEN RACE 1. Black shank is becoming increasingly common in these varieties and in all cases has been found to be associated with pathogen race

1. CONTINUOUSLY GROWING THESE VARIETIES IS SELECTING AND BUILDING UP PATHOGEN RACE 1.

The only way to minimize losses is:

- I. ROTATE OUT AS LONG AS POSSIBLE
- II. USE A SOUND CHEMICAL CONTROL PROGRAM (TABLE 3.)
- III. ROTATE WITH K 346. Research at N.C. State University has found K 346 has some resistance or tolerance to pathogen race 1 as well as moderate to high resistance to pathogen race O. Using K 346 in a rotation program tends to favor pathogen race O and minimizes losses from race 1. ALWAYS USE MEFENOXAM (RIDOMIL OR ULTRA FLOURISH).

BACK-UP ANY RESISTANT VARIETY WITH A SOUND MEFENOXAM PROGRAM (Table 4.)

Table 4. Control of Black Shank with Resistance and Ridomil¹

Variety	Black Shank Rating	Final % Black Shank	
		Check	Ridomil Gold ²
K 326	L	51.1 a	26.5 a
GL 737	M	30.4 b	11.2 bc
NC 297	M	26.8 b	13.6 b
Spt H 20	H	19.4 bc	6.8 bc
NC 71	H	17.2 c	3.9 c

¹Ridomil was applied at 1 pt/A at transplanting + 0.5 pt/A at 1st plowing + 0.5 pt/A at layby.

²Reduction in black shank with Ridomil for each variety is significant (p=0.05).

BROWN SPOT

Brown spot, caused by *Alternaria alternata*, is a foliar disease that usually develops from mid season to harvest. It begins in the lower leaves and works up the plant. Brown spot is favored by wet weather, excess nitrogen and tight plant spacing. Fungicides are not effective for brown spot control.

FUSARIUM WILT

Fusarium wilt, caused by *Fusarium oxysporum f.sp. nicotianae*, is not a common problem. It is a serious problem where it occurs. Symptoms usually develop on one side of the plant with distinctive leaf yellowing and drying. Peeling the outer bark will reveal brown to black discoloration in the woody stem cylinder. Initially there is little root rot. The best control for Fusarium wilt is to abandon an infested site. Where this is not practical long rotations with forage grasses or small grains are recommended. Root-knot nematodes will make Fusarium wilt much worse. In Fusarium infested sites, treatment with multi-purpose fumigants and RKN resistant varieties are useful.

SORESHIN

Soreshin is caused by the fungus *Rhizoctonia solani* AG-4 and usually develops during the first 4-6 weeks after transplanting. This disease is favored by rough handling transplants and cool, wet weather. Sand blasting stems in wind storms often leads to soreshin. There is no chemical control for soreshin.

Table 5. Application of Quadris for Target Spot

Chemical and Formulation	Rate Per Acre	Pounds Active Ingredient	Remarks
(azoxystrobin)		(0.2 lb)	Make a single application at the first sign of target spot. Full plant coverage is necessary. Use drop nozzles as needed.
Quadris F	(12 oz.)		

TARGET SPOT

Target Spot is frequently seen in plantbeds. It caused damage in Georgia tobacco fields for the first time in 1991. It is caused by races of *R. solani* in group AG-3 which are different from those causing soreshin.

In plantbeds and greenhouses the symptoms are small brown greasy looking spots. In the field it occurs first on lower leaves and in very wet seasons can move to some extent up the plant. Symptoms begin as small spots similar to what is seen in plantbeds. On field tobacco the spots enlarge, become somewhat circular, light colored, and papery with a target like pattern of concentric bands. Target spot is very difficult to distinguish from brown spot by symptoms alone. Target spot is favored by long periods of leaf wetness and continuous moderate temperatures (68°F - 86°F). These are similar to the conditions that favor blue mold. The *R. solani* races that cause target spot have always been present in our soils. The growing season weather will regulate future occurrence of target spot.

ANGULAR LEAFSPOT

Angular leafspot, caused by *Pseudomonas syringae* pv. *tabacina*, is a bacterial disease favored by wet weather, excess nitrogen, excess lime (high pH), low topping and tight plant spacing. Any handling of plants in infected fields during wet periods will spread the disease. Streptomycin sprays have been recommended in various sources for angular leafspot control. The value of these sprays is questionable. It is not economical to apply them every year, yet bacterial diseases become very hard to control once they are present in the field. The disease increases during wet weather. A warm, dry period that would dry the field out and allow for spraying usually halts spread of the disease. The program usually recommended is a solution containing 200 ppm Streptomycin applied at 25-35 gallons per acre every 7 days.

GRANVILLE (BACTERIAL) WILT

Granville wilt, caused by *Ralstonia solanacaerum*, is not a common problem in Georgia. However, it is a very serious problem for the growers who have it. Tobacco variety resistance to Granville wilt is given in Table 4. of the Variety Section of this book. Corn, cotton and peanuts are poor choices for rotational crops in fields where Granville Wilt is a problem. Use soybeans, small grains or weeds in these fields. In fields with a known history of Granville wilt use a multi-purpose fumigant such as Chlor-o-pic at 3 gpa or Telone C-17 at 10.5 gpa.

Above ground symptoms of Granville Wilt are virtually identical to those of Fusarium Wilt. In early stages before secondary deterioration begins, internal symptoms are somewhat different. Granville wilt usually shows a general darkening. Fusarium wilt will show dark streaks in the vascular tissue while the pith remains white. A way to verify Granville wilt is to suspend one end of a stem section in warm (not hot) water for two to 10 minutes. Set the stem section so that one end is about one inch under water, two inches or so above the bottom of the water reservoir. If Granville wilt is the problem, a distinct cloudy fluid or material will usually flow out of the underwater stem end.

HOLLOW STALK (Soft Rot, Barn Rot)

These diseases are caused by the bacteria, *Erwinia carotovora* var. *carotovora*. Disease is favored by tight plant spacing and wet weather, particularly during topping season. When the disease is present, tops and suckers should

not be pulled while the plants are wet. High rates of contact sucker control chemicals can contribute to disease in wet seasons. When disease is present, harvest should be avoided while the leaves are wet. Packing wet infested leaves into boxes or racks can result in further losses from barn rot.

TOBACCO ETCH VIRUS (TEV) and POTATO VIRUS Y (PVY, VEIN BANDING)

TEV and PVY are aphid transmitted viruses. The virus is carried as a contaminant on the mouth parts. The virus is picked up in feeding on infected plants. Virus can be transmitted to a healthy plant if an aphid feeds as briefly as 10 seconds. Nearly all the virus particles the aphid carries are wiped off of its mouth during the first feeding after picking up virus. Insecticide sprays will not help control these or other aphid borne diseases.

TOMATO SPOTTED WILT VIRUS (TSWV)

TSWV first appeared in Georgia tobacco in 1986. Leaf symptoms are quite variable and include necrotic banding along and around the main veins, target-like ring spots, leaf twisting with symptoms on only one side of the midrib, and/or general necrosis of bud leaves. Stalk symptoms are also somewhat variable. Early in the season the lower stalk may show a dark, somewhat sunken, area resembling soreshin. Near topping time, parallel black necrotic bands (curved or straight) may be seen moving down the stalk from infected leaves. These bands are different from the usual russet streaks that come from contact sucker control products. Large plants may develop symptoms (stalk and leaf) on one side or the entire stalk may become necrotic causing a rapid wilt, leaf yellowing and death. Near harvest, stalks of infected plants seem to blacken and rapidly deteriorate.

TSWV is spread by thrips. In tobacco the major carrier of TSWV is the tobacco thrips *Franklinella fusca*. TSWV must be picked up by juvenile thrips feeding on infected plants. TSWV may be spread by both juvenile and adult thrips. In tobacco, adult thrips are believed responsible for most infection.

Weeds provide the source of TSWV. About 30 species of common broad leafed weeds have been found to host TSWV in Georgia. Ten to 12 weed hosts of TSWV are present any time of the year. Tobacco thrips acquire the virus in native weed communities and bring it to tobacco as they move about in search of feeding sites. Weeds near tobacco may be more important than weeds further away but thrips are active flyers and move whatever distance is necessary to find suitable habitat.

SPOTTED WILT MANAGEMENT

I. TRANSPLANT DATE

The response to transplant date varies from year to year and from farm to farm in any particular year. No single best time to plant or not plant can be identified. However, in combining the results of all transplant date trials the data shows **the risk of most spotted wilt is twice as great in tobacco planted before 7 April as compared to planting after 7 April.**

II. ADMIRE 2F / PLATINUM (T-Moxx 2SC)

Admire 2F was labeled for TSWV suppression in 1997. Numerous trials have been conducted comparing Admire treated to nontreated plants. TSWV suppression with Admire has ranged from 0-60%. It is reasonable to expect 25-35% TSWV suppression with Admire when it is correctly applied. It has been found that when correctly applied (TABLE 5.) higher rates of Admire give improved TSWV suppression.

TABLE 6. APPLICATION OF ADMIRE (Imidacloprid) IN PLANT HOUSE

Chemical and Formulation	Rate per 1000 transplants	Remarks
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Admire 2F and other generic imidacloprid formulations (Alias, Nuprid, Couraze)	1.4-2.8 oz	Apply 3-7 days prior to transplant.
Admire PRO	0.6-1.2 oz	

Apply Admire or Platinum as a “spray-on rinse-off” tray drench. The rinse off must be complete before product dries on the plants. If treated plants look chalky the product did not rinse off and must be re-applied. Avoid over rinsing. If a milky scum is seen on the float water under trays just after rinse-off the product has been washed through the root medium and should be reapplied. **NOTE: Where plants are grown in trays on benches great care must be taken with post treatment watering not to leach the Admire or Platinum out of the trays.**

TABLE 7. APPLICATION OF ADMIRE (Imidacloprid) IN TRANSPLANT WATER

Chemical and Formulation	Rate per 1000 transplants	Remarks
Admire 2F and other generic imidacloprid formulations (Alias, Nuprid, Couraze)	1.8-2.8 oz	Apply in transplant water with thorough mixing.
Admire PRO	0.6-1.2 oz	

Mix Admire 2F or Platinum directly with transplant water or in a separate front mounted tank where it can be metered into the transplant furrow.

“Spray-on rinse-off” treatments with Admire in plant beds have failed to reduce TSWV.

III. ACTIGARD 50WG

Approval for use of Actigard in plant houses and plant beds has been granted through a special local needs registration. Product labels for this use must be acquired after accepting a Waiver of Liability and Indemnification Agreement on the Syngenta Farm Assist web site.

Under this registration the user of the product assumes ALL liability.

**Acquiring a Label for Actigard™ 50WG Use in the
Plant House / Float House And/or Field Bed
to
Suppress Tomato Spotted Wilt Virus**

[http://www.farmassist.com./](http://www.farmassist.com/)

ACTIGARD™ 50WG is a Syngenta product.

Use in the plant house / float house and field beds for TSWV suppression is not covered on the Section 3, Federal label.

Although Syngenta does not recommend the use of Actigard for TSWV they allow growers to assume all risks associated with the use of Actigard on tobacco transplants in exchange for signing a **Waiver of Liability and Indemnification Agreement**.

The University of Georgia Cooperative Extension recommends the use of Actigard as a part of the **Tomato Spotted Wilt Virus Management Plan (See page 117)**.

To sign a **Waiver of Liability and Indemnification Agreement** and receive a copy of the **ACTIGARD™ 50WG** label with which to make the application each prospective user should follow the instructions on the FarmAssist website to the waiver and agreement.

Go to: **<http://www.farmassist.com./>**

At the upper, left hand, corner click **Sign In** or **Register** if you have not yet registered on this site.

Next screen, complete the **Demographic Information** requested and click **“I Agree”**.

Next screen is the Home Page. Go to the **Products** tab in the column on the left side of the page.

Click **Syngenta Crop Protection**, then **Special Labels**.

Next screen, just under the statement **“If searching for indemnified labels, click here”** Click **“here”**

Next screen, from the drop-down box choose your state, then from the next select **Actigard 50WG**.

Next screen, from the drop-down box select **Tobacco (Flue-cured)** and Click **Submit**.

Next screen, **READ** the **Waiver of Liability and Indemnification Agreement**, Click **“I Accept”**

After clicking **“I Accept”** you will then see a copy of the **Actigard 50WG Section 24(C) Special Local Need Label** needed to make the application to tobacco seedlings in the greenhouse for Tomato Spotted Wilt Virus suppression. This labeling must be in the possession of the user at the time of pesticide application.

You may print a copy of the label for your personal use, but it is not to be shared with others as you have agreed by name to the Waiver of Liability and Indemnification Agreement and you have assumed ALL liability for the use of this product.

TABLE 8. APPLICATION OF ACTIGARD TO TRANSPLANTS

Chemical and Formulation	Rate
Actigard 50WG	0.5oz treats 32,000 - 50,000 plants.

- Spray Actigard over plants in houses or beds 5-7 days before transplanting.
- Potential for plant injury depends largely on plant size at the time of treatment.
- DO NOT treat until plants are large enough to transplant

Use Actigard with imidacloprid in a joint program.

TABLE 9. CONTROL OF TSWV WITH AN ACTIGARD/ADMIRE (IMIDACLOPRID) PROGRAM

YEAR	% TSWV CONTROL	
	HOUSE PLANTS	BED PLANTS¹
2000	48	41
2001	55	33
2002	46	33
2003	60	67
2004	45	35
AVG	51	42

¹Lower response in bed plants is mostly due to a generally less consistent benefit from Admire as compared to float house plants.

USE ACTIGARD VERY CAREFULLY:

1. Treat field ready seedlings.
2. DO NOT exceed 0.5oz/50,000 plants.
3. DO NOT treat plants with Actigard a second time.
4. DO NOT hold Actigard treated bed plants more than a day after pulling. Treated plants which are held do not perform as well as fresh plants. Do Not allow treated plants in trays to dry out on the trailer.
5. Use transplant water.

Even when Actigard is used carefully some plant damage in the form of slow early season growth may occur. How well plants recover depends on field environment the first few weeks after transplanting.

1. Use transplant water.
2. DO NOT plant in dry soil; pre-wet beds if necessary
3. AVOID transplanting on dry windy days
4. Irrigate before plants become stressed.

TSWV Management Plan for Tobacco

- 1. Transplant after April 7.**
- 2. For best results with Admire 2F (Imidacloprid) USE Greenhouse Plants.**
- 3. GREENHOUSE PLANTS**
 - a. ADMIRE 2F @ 1.4 - 1.8 oz/1,000, tray cells
or ADMIRE PRO @ 0.6 - 0.8 oz/1000 tray cells as per Growers Guide**
 - i. Apply and rinse-off foliage 3 to 7 days before transplanting**
 - ii. T-rail plants: avoid excessive irrigation after application.**
 - 1. Water only to maintain plants. Trays should not drip.**
- 4. BARE ROOT PLANTS**
 - a. ADMIRE 2F @ 2.4-2.8 oz/1,000 plants in transplant water as per Growers Guide
or ADMIRE PRO @ 0.8 - 1.2 oz/1000 plants as per Growers Guide**
- 5. ALL PLANTS (Plant house / Float house and Bare Root Plants)**
 - a. ACTIGARD @ 0.5 oz/ 50,000 plants as per Growers Guide**
 - i. apply ACTIGARD only to plants large enough and old enough to be transplanted.**
 - ii. apply ACTIGARD 5-7 days before expected transplant date.**
 - 1. ACTIGARD treatment is effective and plants may be used for at least 10 to 14 days after treatment.**
 - 2. DO NOT RE-TREAT PLANTS WITH ACTIGARD**
 - 3. DO NOT HOLD ACTIGARD treated plants overnight after removal from beds or plant houses / float houses.**
- 6. Pre-water beds during periods of drought/wind before transplanting.
A day or two delay in planting is better than planting ACTIGARD treated plants in dry beds.
ACTIGARD treated plants do not tolerate stress.**
- 7. USE TRANSPLANT WATER**
- 8. AVOID Transplanting on dry, windy days.**

ROOT-KNOT NEMATODE

Root-knot nematode (RKN) is the major nematode problem facing Georgia tobacco growers. Control of RKN is becoming more complicated each year. A virtual complete shift to varieties resistant to race 1 & 3 of Southern RKN has resulted in selection of previously minor species and races of RKN and elevating these to major pests. As a result, Javanese, race 2 and/or 4 of Southern and, to a lesser extent, peanut RKN are now major tobacco pests. There are no varieties resistant to these species or races leaving root destruction, crop rotation and chemicals as the only control options. Control of Javanese and peanut RKN must be more thorough than with the traditional Southern RKN because as individuals these species are much more damaging to tobacco.

ROOT AND STALK DESTRUCTION SHOULD BE DONE THOROUGHLY.

CROP ROTATION

In selecting rotational crops the grower must know which RKN species and races are present. For example, cotton is a good rotational crop for Javanese and Peanut RKN, but a poor one for Southern RKN. Soybeans vary widely in their resistance to various RKN species. Choice of best variety depends upon the specific RKN present.

NEMATODE SAMPLING

The only way to know what is present is to sample the field. Samples taken in the fall or winter especially following crops other than tobacco are almost worthless. When taking nematode samples, follow the guidelines outlined below:

- 1) Sample during the tobacco growing season (15 June - 15 July).
- 2) Sample moist soil, Do not add water to dry samples.
- 3) Sample the entire field.
- 4) Sample problem areas separately from non problem areas.
- 5) Keep samples in a portable cooler between collection and delivery to the County Extension Office. This will keep the samples from overheating which kills and rots nematodes very quickly.
- 6) Sample early in the week so samples will arrive at the lab in Athens the same week as collected.
- 7) Fill out the nematode sample form completely including tobacco variety information.
- 8) Check tobacco roots for nematode galls. These can be used to determine RKN species present. Knowing which kinds are present is much more useful than knowing how many.
- 9) Sampling crops other than tobacco the year before growing tobacco is generally a waste of time.

ROOT EXAMINATION

Root examination is very useful in evaluating nematode problems. From mid June until mid July, dig up a few stalks at various points in the field and look at the roots for galls. If RKN is present some galls may be seen on any variety regardless of what chemical nematicide is used. However, if root systems are consistently 25% or more galled, some loss is occurring and the control program should be reviewed. Always look at root systems in areas of any field where the tobacco does not grow well. Once the RKN population has been defined, the best rotational crops and chemical nematicide can be chosen.

ROOT-KNOT NEMATODE SPECIES IDENTIFICATION

The Extension Nematology Lab has technology to enable accurate identification of RKN species. At present there is no charge for the procedure. The procedure is expensive so growers taking advantage of this service are asked to:

- A. Use it only where reasonable suspicion of a problem exists (numerous galls on RKN resistant varieties).
- B. Keep good records so as to not continually re-sample fields where problems have been identified. Nematode populations vary with crop history and season, but they do not go away.
- C. Handle samples for root-knot nematode species identification through the county agent as with conventional nematode samples. Sampling involves mid-June to mid-July collection of plant roots. Samples are to be collected in the following manner.
 - 1) Map out the field and dig rather than pull up sample plants.
 - 2) Gently shake off most soil.
 - 3) Select for testing plants with moderate to severely galled root systems that show NO sign of secondary rotting or gall breakdown. The test requires live female nematodes to be present in the galls.
 - 4) Collect specimen plants from several areas in a field. Take a separate sample for each 10 acre block in a field.
 - 5) Place galled roots (tops should be cut off) in plastic bags containing moist field soil and store in a cooler. It is not necessary to send the whole root system. Individual roots with galls on them are good enough. Clip roots rather than pulling roots apart to avoid stripping or damaging root galls. DO NOT ADD WATER.
 - 6) Do not allow samples to heat or dry out.
 - 7) Collect samples early in the week (Monday or Tuesday) so they can be shipped and received in the same week.
 - 8). Call ahead to the lab to notify them root samples are being sent. More immediate processing is needed as compared to ordinary soil samples.

ROOT-KNOT NEMATODE CHEMICAL CONTROL

Table 10. Fumigant Nematicides

Chemical and Formulation	Rate Per Acre	Rate Per 100 Ft. of Row		Remarks
		cc	fl ozs	
1-3D (Telone II)	42" Row Treatment 6 gals	184	6.2	Inject 8 inches deep on the flat or 4-8 inches below top of a high wide bed. Seal by bedding or dragging. Wait 3 weeks between application and setting. Break bed open 1-2 days prior to setting.

A fumigant nematicide is recommended when nematode damage potential is moderate to high, or when either Javanese (*Meloidogyne javanica*) or Peanut (*M. arenaria*) root-knot nematode is known to be present, or when either Fusarium wilt or black shank is known to occur in the field.

FALL FUMIGATION - Application of Telone II is when applied anytime between November 1 and March 1. Soil conditions at time of application are far more important than when or how deep the application is made.

APPLY WHEN:

1. November 1 - March 1
2. Soil is damp (not wet).
3. Air temperature is >60°F.
4. Weather forecast calls for 3-5 days of warm sunny weather.

Table 11. Non-Fumigant Nematicides

Chemical and Formulation	Rate Per Acre Broadcast (Gal)	Pounds Active Ingredient Per Acre (Lbs)	Remarks
Broadcast and thoroughly incorporate non-fumigant nematicides prior to forming beds.			
Phenamiphos (Nemacur 3) +	1 gal +	3	Use 2 gallons of Nemacur or 1 gallon of Nemacur + 1 gallon of Mocap when potential for damage is low to moderate.
Ethoprop (Mocap 6EC)	1 gal	6	
Nemacur 3	2 gals	6	

RESISTANT VARIETIES

Root-knot nematode resistance in tobacco is specific for races 1 and 3 of Southern root-knot nematode. No varieties are available with resistance to Javanese, Peanut or races 2 and 4 of Southern root-knot nematode. For a listing of varieties resistant to races 1 and 3 of Southern RKN refer to Table 4 in the Variety Section of this book.