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PEST MANAGEMENT GUIDE 6



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BLACKSBURG, VIRGINIA

Chemical Control of Insects, Disease, and Weeds for Tobacco

VIRGINIA COOPERATIVE EXTENSION SERVICE
EXTENSION DIVISION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

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KEYS TO PROPER USE OF PESTICIDES

1. Read the label on each pesticide container before each use. Follow instructions to the letter; heed all cautions and warnings, and note precautions about residues.
2. Keep pesticides in the containers in which you bought them. Put them where children or animals cannot get to them, preferably under lock and away from food, feed, seed, or other material that may become harmful if contaminated.
3. Dispose of empty containers in the manner specified on the label.

SEE YOUR DOCTOR IF SYMPTOMS OF ILLNESS OCCUR DURING OR AFTER USE OF PESTICIDES.

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Tobacco Insect Management

Insect control is an important part of tobacco production. If certain insect pests are not controlled at the right time on tobacco, devastating losses in crop value can result. However, in many instances, tobacco growers tend to use more insecticides than are necessary to protect their crop. Unnecessary insecticide applications have several disadvantages. They increase production costs, kill beneficial insects, and increase the chances of pest insects developing resistance to the insecticide. Destruction of beneficial insects and pest insect resistance to insecticides often result in the need for additional insecticide applications.

To improve the timing of insecticide applications for insect control on tobacco, producers should use an integrated pest management (IPM) approach. IPM utilizes all available practices to reduce pest populations. It makes use of cultural and natural controls in combination with applications of recommended insecticides when weekly field counts indicate that an insect pest will cause economic damage to the crop if it is not controlled.

The IPM approach to insect control recognizes that a certain amount of insect damage will not reduce tobacco yield or quality enough to pay for the cost of treatment including insecticide, fuel, labor, and equipment. This approach to insect control helps to maximize profits. An important term in IPM is the economic threshold. The economic threshold is that pest insect population that, if allowed to go uncontrolled, will reduce the value of the crop. It takes into account the amount of damage done by a pest and the cost of its control. Cultural control practices such as early topping in the button or prebutton stage, good chemical sucker control, and stalk cutting and root destruction soon after harvest will help reduce feeding and overwintering sites for several tobacco insects. Natural control can be promoted by delaying insecticide applications until a pest insect reaches an economic threshold level and by using the insecticides that are least harmful to beneficial insects. Insecticides that have low toxicity to insect predators and parasites of the budworm and hornworm include: Dipel /Biotrol /Thuricide, Dylox /Proxol, and Lannate /Nudrin. Chemicals that are highly toxic to beneficial insects include: Azodrin, Guthion, malathion, parathion, and Supracide.

Sampling to Determine when Treatment is Necessary

At least 50 plants should be examined each week to determine the abundance of insect pests. Examine the upper one-third of each plant for budworms, hornworms, and green peach aphids. Budworms will be feeding in the bud or on the upper leaves. If a plant is damaged but no budworm is found, do not count the plant as having a budworm. When checking for hornworms, look primarily for their feeding damage, then locate the worm. Check several upper stalk leaves for the tiny, green colored aphid or "plant lice." Note whether the leaves have very few aphids or a moderate number of aphids. The entire plant should be examined for flea beetles which are generally on the lower one-third of the plant on the underside of the leaves.

Make a note of other insects that are present and causing damage to the crop. If you do not know what the insect is, check with your extension agent for assistance. Certain beneficial insects are frequently mistaken for insect pests by untrained personell.

Tobacco Budworm

Tobacco budworm larvae feed in the buds of young tobacco plants causing many holes in the tiny developing leaves. As these leaves increase in size, the feeding holes increase proportionally. This gives the leaves a ragged, distorted appearance. Tobacco plants are sometimes topped by budworms resulting in early sucker growth which will require extra labor for proper crop management. Tobacco budworm control should be initiated when 5 or more budworms are found per 50 plants at anytime prior to buttoning. Apply foliar sprays for budworm control using 1 or 3 full-cone or hollow-cone nozzles over each row and 40 to 60 pounds pressure.

Tobacco Hornworm

The tobacco hornworm is a large caterpillar that consumes considerable amounts of tobacco leaf. Infestations may develop anytime from transplanting until harvest, but the most severe damage occurs during August. Control should be initiated when 5 or more hornworms an inch in length or greater are found on 50 plants examined at various locations throughout the field. A hornworm with white egg-like cocoons of the parasitic wasp, *Apanteles congregatus*, will eat one-fifth as much as a healthy hornworm. Therefore, 5 parasitized hornworms should be counted as 1 hornworm when determining the economic threshold level. For the best hornworm control, insecticide sprays should be directed to the upper one-third of the plant.

Green Peach Aphid

The green peach aphid has been a severe pest of tobacco in Virginia for the past few years. It may infest tobacco plant beds, but the most severe damage occurs on field tobacco during late June and July. Aphids can be introduced into the field on infested tobacco transplants, but immigration of winged aphids into tobacco fields is the most important means of infestation. Heavy green peach aphid infestations can reduce tobacco yield by 600 pounds per acre. Aphids deposit honeydew on tobacco leaves and a dark, sooty mold often develops. This interferes with the curing of tobacco and results in a reduction in quality.

High green peach aphid populations develop during June and July when daytime high temperatures are from 80 to 90 F. However, extended periods with high temperatures in excess of 90 F will usually reduce aphid populations below damaging levels. Aphids are often more severe in partially shaded areas along the edge of fields. Treatment of these areas is usually sufficient for reducing aphid injury to tobacco.

Disulfoton (Di-Syston), applied as a preplant soil incorporated treatment, gives good green peach aphid control for two to three months after transplanting. If a preplant soil incorporated insecticide is not used for aphid control, the producer should watch for a buildup in aphid populations. The undersides of the upper leaves of tobacco plants should be examined at regular intervals to determine the extent of aphid population buildup. Producers should also be on the lookout for a layer of honeydew that gives tobacco leaves a shiny appearance and indicates that there may be an aphid problem. The economic threshold level for the green peach aphid is 2 plants out of 10 heavily infested with aphids. Most insecticides applied to the foliage have to come in contact with the aphids to provide adequate control. Therefore, nozzles should be oriented so that thorough coverage of each plant is obtained.

Tobacco Flea Beetle

Adult tobacco flea beetles feed on the leaves and stalks of tobacco in the plant bed and in the field, while the grubs or larvae feed on tobacco roots. Heavy feeding by both stages of the beetle on newly set transplants may cause stunting of the scattered plants in the field resulting in uneven stands. Treatment for tobacco flea beetle control should be initiated on newly set tobacco when there are 8 beetles or more per plant. Larger plants can tolerate very high flea beetle populations so treatment of older plants for flea beetle control should be initiated when there are 60 or more beetles per plant.

Application Methods

Insecticides must be applied properly for maximum insect control. On small tobacco good control can be obtained using a single solid-cone or hollow-cone nozzle per row directed to the bud. Operate equipment at 40 to 60 pounds pressure and do not exceed 4 1/2 miles per hour. Use at least 6 to 8 gallons of mixed spray per acre. After tobacco is 2 ft. tall, use one or three cone nozzles per row. If three nozzles are used, the two side nozzles should be oriented at a 45 degree angle toward the upper 1/3 of the plant. Use 40 to 60 pounds pressure and 18 to 25 gallons of spray mixture per acre. Set the nozzles 12 to 18 inches above the tobacco. If aphids are a problem, drop nozzles should be used so the spray can be oriented to the undersides of the leaves.

Precautions

Many of the insecticides used on tobacco are extremely poisonous. Always read the label before mixing or applying pesticides. See the list of precautions for pesticide use following the tobacco insect control recommendations.

| PLANT BED | | | | |
|--|--|----------------------------------|-------------------------|---|
| Insect | Insecticide and Formulation | Rate Per 100 Sq. Yds. | Re-entry Time (Days) 1/ | Remarks and Precautions |
| Cutworm | Acephate (Orthene Tobacco Insect Spray) 75%SP | 2 tbsp. in 3 to 6 gal. of water. | - | Apply as a spray. Make applications in the late afternoon to the plant beds and adjacent alleys. |
| Green June beetle larva | Diazinon 50WP 1/4 lb. per 50 gal. water | 100 gal. | - | Treat only affected areas. Apply as a drench using a sprinkler can. |
| | Parathion 1%D | 1 to 1 1/2 lbs. small plants | 5 | Dust plants and soil when pests appear. Apply dust in the afternoon on a warm day. Do not apply with shaker can or cloth bag. Workers should avoid skin contact with juice of treated plants, and if they must handle treated tobacco within 5 days after application of parathion, they should be protected from skin contact by wearing clean, dry, cotton gloves and tightly woven clothing. |
| | Trichlorfon (Dylox/Proxol) 80% SP drench 10 oz. in 100 gal. water | 100 gal. | - | Methyl bromide, when applied prior to seeding for weed control, will kill grubs present. |
| Green peach aphid, tobacco flea beetle | Acephate (Orthene Tobacco Insect Spray) 75% SP 1/4 lb. in 50 gal. of water or 1 tsp. per gal. of water | 3 to 6 gal. | * | Spray plants as needed. Do not pull plants until spray deposit has dried. <u>Carbaryl (Sevin) should not be used for flea beetle control in the plant bed because it may harm young plants.</u> |
| | Disulfoton (Di-Syston) 15% G | 9 oz. | - | Broadcast granules evenly over the plant bed just before seeding or after the plants have emerged and are 1/2 to 1 inch in diameter. Water thoroughly and do not apply to the plant bed more than once per season. |
| | Parathion 1% D | 1 to 1 1/2 lbs. | 5 | See remarks and precautions above for parathion. |
| Green peach aphid | Malathion 4% or 5% D | 10 oz. | - | Plants should be free of aphids before transplanting. Turnips, mustard, and dock (winter hosts of aphids) should be eliminated from the vicinity of the plant bed. |
| | Malathion spray, 1 lb. 25% WP in 50 gal. of water or 1 tbsp. per gal. of water | 3 to 6 gal. | - | |

* Do not re-enter plant bed until spray deposit has dried.

1/ Minimum interval between application and worker re-entry into field.

PLANT BED (Cont'd)

| Insect | Insecticide and Formulation | Rate Per 100 Sq. Yds. | Re-entry Time (Days) 1/ | Remarks and Precautions |
|-------------------------------|------------------------------|-----------------------|-------------------------|---|
| Midge larva, vegetable weevil | Parathion 1% D | 1 to 1 1/2 lbs. | 5 | See remarks and precautions above for parathion. |
| Snails and slugs | Hydrated or air slacked lime | | - | Lime dust applied in a band 3 to 4 inches wide along each margin of the bed may act as a barrier. |

PRETRANSPLANT SOIL TREATMENTS

| Insect | Insecticide and Formulation | Rate Per Acre | Waiting Periods | | Remarks and Precautions |
|--|--|---|-------------------------|-------------------------------|--|
| | | | Re-Entry Time (Days) 1/ | Application to Harvest (Days) | |
| Green peach aphid, tobacco flea beetle | Disulfoton (Di-Syston) 15%G | 13.3 to 26.7 lbs. | - | ** | Broadcast and disk into the soil immediately to a depth of 4 in., 2 days to 2 weeks before the tobacco is transplanted, or apply in a 12 to 18 in. band on top of the row before transplanting and incorporate to a depth of 4 in. Do not make more than one field application per crop season regardless of formulation used. |
| Tobacco flea beetle (Preventative Control) Soil treatments before transplanting. | Disulfoton (Di-Syston) 8 lbs. per gal. LC. (Flue-cured tobacco only) | 2 qts. | - | ** | Disulfoton is also available in combination with ethoprop (Mocap Plus) and fensulfothion (Dasanit-Di-Syston). |
| Tobacco flea beetle (SOIL TREATMENT BEFORE TRANSPLANTING) | Carbofuran (Furadan) 10%G | 40 lbs. flue-cured and fire-cured. 30 to 40 lbs. burley | - | ** | Preplant soil application method is same as above for Di-Syston. When Carbofuran is broadcast or applied to a row and incorporated, it will control flea beetles for most of the growing season and give early season control of hornworms. Overlapping and excessive rates may cause flecking of lower leaves and yield reductions. To reduce the possibility of plant injury, allow 14 days between application and transplanting. |
| | Carbofuran (Furadan) 4 lbs. per gal. F | 1 gal. per acre flue-cured and fire-cured tobacco only | - | ** | |
| Hornworm (Early season control only-Flue-Cured and fire-cured tobacco) SOIL TREATMENT BEFORE TRANSPLANTING | Carbofuran (Furadan) 10% G | 40 to 60 lbs. | - | ** | |
| | Carbofuran (Furadan) 4 lbs. per gal. F | 1 to 1 1/2 gal. | - | ** | |

** Non applicable.

1/ Minimum time interval between application and worker re-entry into the field.

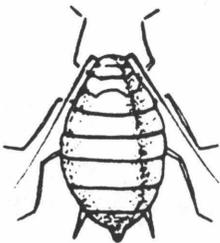
| Insect | Insecticide and Formulation | Rate Per Acre | Waiting Periods | | Remarks and Precautions |
|-----------------------------|---|---|-------------------------|-------------------------------|--|
| | | | Re-Entry Time (Days) 1/ | Application to Harvest (Days) | |
| Transplant Water Treatments | | | | | |
| Wireworm | Diazinon 50% WP (Hand transplanter) | 4 oz. per 200 gal. of water | - | - | At least 200 gal. of water per acre is recommended for hand transplanters and more for mechanical transplanters. |
| | (Mechanical transplanters) | 8 oz. per 200 gal. of water | | | |
| Broadcast Treatments | | | | | |
| Wireworm | Carbofuran (Furadan) 4 lbs. per gal. F | 1 to 1 1/2 gal. | - | ** | Apply 3 to 4 weeks before transplanting using a low-pressure, low-gallonage boom sprayer (weed control type), and disk 6 to 9 inches into soil for diazinon and 4 to 6 inches for carbofuran immediately after application. Apply with calibrated granular applicator, grain drill, or fertilizer spreader. Do not mix granules with fertilizer or other materials. Do not substitute dust formulations for granular formulations. Apply granules at least 2 weeks (3-4 weeks for Diazinon) before plants are set and disk them into the soil immediately after application to a depth of at least 4 in. for carbofuran, fonophos, fensulfothion, and ethoprop and 6 to 9 in. for diazinon and parathion. |
| | Diazinon (AG 500) 4 lbs. per gal. EC | 2 qts. | - | ** | |
| | Diazinon 14%G | 14 to 21 lbs. | - | ** | |
| | Ethoprop (Mocap) 10%G | 20 lbs. | - | ** | |
| | Fensulfothion (Dansanit) 15%G | 12 lbs. | - | ** | |
| | Fonophos (Dyfonate) 10%G | 10 to 20 lbs. | - | ** | |
| | Parathion 4G | 50 lbs. | - | ** | |
| | Carboturan 10%G (Furadan) | 40 to 60 lbs. | - | ** | |
| INSECTS ON LARGER TOBACCO | | | | | |
| Budworm | Acephate (Orthene Tobacco Insect Spray) 75%SP | 1 lb. in water or 2 tbsp. per gal. of water | * | 3 | Apply as a spray |
| |  Bacillus thuringiensis WP (Dipel/Thuricide) | 1/2 to 1 lb. | 0 | 0 | Apply as a spray or bait. There is no waiting period between application and harvest. Do not allow diluted sprays to stand in tank more than 12 hrs. Prepare bait by mixing 1 lb. of Bacillus thuringiensis with 49 lbs. of cornmeal. Apply bait overtop of each row using a duster or by gloved hand. |
| | Bacillus thuringiensis (Dipel/Thuricide) 2% Homemade Bait | 25 to 50 lbs. | 0 | 0 | |
| |  Carbaryl (Sevin) 80%WP | 1 to 2 lbs. in water | * | 3 | Apply as a spray. Do not apply until plants are established and growing. The green peach aphid often becomes a problem on tobacco following two or more applications of carbaryl. |
| | Endosulfan (Thiodan) 4%D | 15 to 24 1/2 lbs. | 1 | 5 | Apply dust to the bud and top leaves of each plant using a hand duster. AVOID HEAVY APPLICATIONS WITH CLOTH BAGS BECAUSE PLANT INJURY MAY RESULT. |

* Do not re-enter field until spray deposit has dried.

** Non applicable.

1/ Minimum time interval between application and worker re-entry into the field.

| Insect | Insecticide and Formulation | Rate Per Acre | Waiting Periods | | Remarks and Precautions |
|---------------------|--|--|-------------------------|---|---|
| | | | Re-Entry Time (Days) 1/ | Application To Harvest (Days) | |
| Budworm - continued | Endosulfan (Thiodan) 3 lbs. per gal. | 2/3 to 1 1/3 qts. in water | 1 | 5 | Apply as a spray. |
| | Methidathion (Supracide) 2 EC lbs. per gal. | 1/2 gal. per acre | 1 | 3 | Apply as a spray in at least 25 gal. water per acre. Do not apply with other pesticides. |
| | Methomyl (Lannate) 90%SP | 1/4 to 1/2 lb. in water | 1 | 7 flue-cured 14 fire and air-cured | Apply as a spray. Make applications as needed and direct the spray into the buds before buttoning. |
| | Methomyl (Lannate L or Nudrin) 1.8 lb. per gal. EC | 2 pts. | | | |
| | Methyl Parathion (Penncap-M) 2 lb. per gal. FM | 4 to 6 pts. in 18 to 40 gal. of water | 2 | 5 flue-cured 15 fire and air-cured | Apply as a spray. Avoid contact with plant juices when priming or cutting tobacco. |
| | Monocrotophos (Azodrin) 5 liquid lbs. per gal. | 1 to 1 5/8 pt. | 2 | 5 | Monocrotophos will kill birds and other wildlife. Keep out of any body of water. Do not apply when weather conditions favor drift from area treated. |
| Cabbage looper | Acephate (Orthene Tobacco Insect Spray) 75%SP | 1 lb. in 10 to 50 gal. of water or 2 tbsp. per gal. | * | 3 | Apply as a spray. |
| | Bacillus thuringiensis WP (Dipel/Thuricide) | 1/2 to 1 lb. | 0 | 0 | Apply as a spray. Do not allow dilute sprays to stand in tank more than 12 hrs. |
| | Methomyl (Lannate) 90%SP | 1/2 lb. in water | 1 | 7 flue-cured 14 fire and air-cured | Apply as a spray. |
| | Methomyl (Lannate L or Nudrin) | 1 qt. | | | |
| Cutworm | Acephate (Orthene Tobacco Insect Spray) 75%SP | 1 lb. | * | 3 | Apply as a spray ovetop of plants in affected areas when 5% of the plants are injured by cutworms. Make applications during the late afternoon using at least 25 gal. of spray/acre. |
| Grasshopper | Acephate (Tobacco Insect Spray) 75%SP | 1/3 to 2/3 lbs. | * | 3 | Apply as a spray. Treat the crop and a strip around the field to reduce grasshopper immigration. Avoid contact with plant juices when priming or cutting tobacco treated with methyl parathion. |
| | Methyl Parathion (Penncap M) 2 lbs. per gal. FM | 2 qts. in 18 to 40 gal. of water | 2 | 5 flue-cured 15 fire-cured and air-cured | |
| | Sevin 80%WP | 2/3 to 1 7/8 lbs. | * | 3 | |
| Green peach aphid | Acephate (Orthene Tobacco Insect Spray) 75%SP | 2/3 lb. in 10 to 50 gal. of water or 4 tsp. per gal. | * | 3 | Apply as a spray. Use drop nozzles to orient spray to the undersides of the leaves. Aphids fly to tobacco fields and may go unnoticed until plants become heavily infested. Spot treatment of localized infestations is beneficial and may prevent the need of treating the entire field. |
| | Diazinon (AG 500) 4 lbs. per gal. EC | 3/4 pt. in water or 3 tsp. per gal. of water | * | 3 | |
| | Dimethoate (DeFend) 2.67 lbs. or | 2/3 to 1 pt. in water or 3 to 4 tsp. per gal. of water | * | 21 | |
| | (Cygon 400) 4 lbs. per gal. EC | 1/2 to 2/3 pt. | * | 21 | |
| | Endosulfan (Thiodan) 4%D | 15 to 24 1/4 lbs. | 1 | 5 | Apply dust or spray evenly over the entire plant, especially the undersides of the leaves. repeat in 5 days if necessary. |
| | Endosulfan (Thiodan) 3 EC lbs. per gal. | 2/3 to 1 1/3 qts. in water | 1 | 5 | |

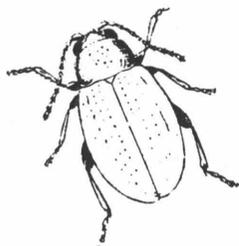


* Do not re-enter field until deposit has dried.
1/ Minimum time interval between application and worker re-entry into the field.

| Insect | Insecticide and Formulation | Rate Per Acre | Waiting Periods | | Remarks and Precautions |
|---|--|--|-------------------------|--|--|
| | | | Re-Entry Time (Days) 1/ | Application to Harvest (Days) | |
| Green peach aphid - cont. | Malathion 4 lbs. or 5 lbs. per gal. EC | 1 1/2 to 2 1/2 pts. in water or 2 to 3 tbsp. per gal. of water | * | 7 | Apply as a spray or dust. |
| | Malathion 4% or 5%D | 25 to 30 lbs. | * | 7 | |
| | Methomyl (Lannate) 90%SP | 1/4 - 1/2 lb. | 1 | 5 flue-cured 14 fire and air-cured | Apply as a spray. |
| | Methomyl (Lannate L or Nudrin) 1.8 lb. per gal. EC | 2 pts. | | 7 flue-cured 14 fire and air-cured | |
| | Methyl Parathion (Pennacap M) 2 lbs. per gal. FM | 4 to 6 pts. in 25 to 40 gal. of water | 2 | 5 flue-cured 15 fire and air-cured | Apply as a spray. |
| Monocrotophos (Azodrin) 5 lbs. per gal. liquid | 7/8 pt. or 14 oz. in water | 2 | 5 | Monocrotophos will kill birds and other wildlife. Keep out of any body of water. Do not apply when weather conditions favor drift from treated area. | |
|  Hornworm | Acephate (Orthene Tobacco Insect Spray) 75%SP | 2/3 lb. in water or 4 tsp. per gal. of water | * | 3 | Apply as a spray. Treat infested fields before worms exceed 1 1/2 in. in length. Insecticides should be directed toward the top six leaves of the plants. When treatments are necessary during harvesting, the application should be made immediately after, rather than before pruning. |
| | Azinphosmethyl (Guthion) 2 lbs. per gal. EC | 2 pts. in 25 gal. of water | 1 | 6 | |
| | Azinphosmethyl (Guthion) 50%WP | 1 to 1 1/4 lbs. | 1 | 6 | |
| | Bacillus thuringiensis WP (Dipel/Thuricide) | 1/4 to 1/2 lb. | 0 | 0 | Apply as a spray. Do not allow dilute sprays to stand in tank more than 12 hrs. Dipel can be tank-mixed with MH-30. |
| | Carbaryl (Sevin) 80%WP | 1 1/4 lb. in 25 gal. of water or 3 tbsp. per gal. of water | * | 3 | Apply as a spray. |
| | Endosulfan (Thiodan) 3 lbs. per gal. EC | 2/3 to 1 1/3 qts. | 1 | 5 | |
| | Endosulfan (Thiodan) 4%D | 15 to 24 1/4 lbs. | 1 | 5 | Apply as a dust. |
| | Methidathion (Supracide) 2 lbs. per gal. EC | 2 to 3 pts. | 1 | 3 | Apply as a spray in at least 25 gal. of water per acre. Do not mix with other pesticides. |
| | Methomyl (Lannate) 90% SP | 1/4 to 1/2 lb. in 25 gal. of water | 1 | 5 flue-cured 14 fire and air-cured | Apply as a spray. |
| | Methomyl (Lannate L or Nudrin) 1.8 lb. per gal. EC | 1 to 2 pts. | 2 | 7 flue-cured 14 fire and air-cured | |
| | Methyl Parathion (Pennacap M) 2 lbs. per gal. FM | 4 to 6 pts. in 25 to 40 gal. of water | 2 | 5 flue-cured 15 air and fire-cured | Apply as a spray. Avoid contact with plant juices when pruning or cutting tobacco. |
| Monocrotophos (Azodrin) 5 lbs. per gal. liquid | 7/8 pt. or 14 oz. in water | 2 | 5 | Monocrotophos will kill birds and other wildlife. Keep out of any body of water. Do not apply when weather conditions favor drift from area treated. | |

* Do not re-enter field until deposit has dried.
1/ Minimum time interval between application and worker re-entry into the field.

| Insect | Insecticide and Formulation | Rate Per Acre | Waiting Periods | | Remarks and Precautions |
|--|---|--|---------------------------------------|--|---|
| | | | Re-Entry Time (Days) 1/ | Application To Harvest (Days) | |
| Japanese beetle | Carbaryl (Sevin) 80%WP | 1 1/4 lb. in 25 gal. of water or 3 tbsp. per gal. of water | * | 3 | Apply as a spray. |
| Stink Bug | Endosulfan (Thiodan) 4%D | 15 to 24 1/4 lbs. | 1 | 5 | Apply as a dust. |
| | Endosulfan (Thiodan) 3 lbs. per gal. EC | 2/3 qt. in 100 gal. of water | 1 | 5 | Apply as a spray. |
| Tobacco flea beetle | Acephate (Orthene Tobacco Insect Spray) 75%SF | 2/3 lb. in water or 4 tsp. per gal. of water | * | 3 | Apply as a spray. Prime before treating. |
| | Azinphosmethyl (Guthion) 2 lbs. per gal. EC | 2 pts. in 25 gal. of water | 1 | 6 | |
| | Azinphosmethyl (Guthion) 2 lbs. per gal. EC | 1 to 1 1/2 lb. | 1 | 6 | |
| | Carbaryl (Sevin) 80%WP | 1 1/4 lb. in 25 gal. of water or 3 tbsp. per gal. of water | 0 | 3 | Apply as a spray. Do not apply until plants are established and growing. The green peach aphid often becomes a problem on tobacco following two or more applications of carbaryl. |
| | Endosulfan (Thiodan) 3 lbs. per gal. EC | 2/3 to 1 1/3 qts. | 1 | 5 | Apply as a spray. |
| | Endosulfan (Thiodan) 4%D | 15 to 24 1/4 lbs. | 1 | 5 | Apply as a dust. |
| | Methidathion (Supracide) 2 lbs. per gal. EC | 2 to 3 pts. | 1 | 3 | Apply as a spray in at least 25 gal. of water per acre. Do not apply with other pesticides. |
| | Methomyl (Lannate) 90%SP | 1/4 to 1/2 lb. | 1 | 7 flue-cured 14 fire and air-cured | Apply as a spray. |
| Methomyl (Lannate L or Nudrin) 1.8 lb. per gal. EC | 1 to 2 pts. | | | | |
| Monocrotophos (Azodrin) 5 lbs. per gal. liquid | 7/8 pt. or 14 oz. in water | 2 | 5 | Monocrotophos will kill birds and other wildlife. Keep out of any body of water. Do not apply when weather conditions favor drift from treated area. | |
| Methyl Farathion (PennCap M) 2 lbs. per gal. FM | 4 to 6 pts. in 25 to 40 gals. of water | 2 | 5 flue-cured 15 fire and air-cured | Apply as a spray. Avoid contact with plant juices when priming or cutting tobacco. | |



STORED TOBACCO

| Insect | Control | Remarks |
|-----------------------------------|--|--|
| Tobacco moth and cigarette beetle | Sanitation | Keep tobacco barns and packhouse free of tobacco debris and keep as dark as possible. Do not store tobacco near feed grain or seed. Do not store tobacco infested with tobacco moth or cigarette beetle. Sell all tobacco as soon as possible. |
| Tobacco moth | <u>Bacillus thuringiensis</u> (Dipel) 1/2 lb. per qt. of water per 100 lbs. of tobacco | Apply as a fine mist. Spray loose leaves as tobacco is being bundled from curing barn. Tobacco in storage: At first signs of infestation open bundles and spray loose leaves as the tobacco is rebundled. For tobacco on sticks, treat both sides of leaves as sticks are restacked. Avoid using too much water. |

* Do not re-enter field until deposit has dried.
1/ Minimum time interval between application and worker re-entry into the field.

Inquiries regarding pests on tobacco in commercial storage should be directed to Agricultural Marketing Service, U.S.D.A. Stored-Tobacco Insect Lab., P.O. Box 10125, Richmond, Virginia 23240.

Special Precautions

1. Parathion, azinphosmethyl, disulfoton, fenitrothion, etanoprop, fonophos, monocrotophos, methoxy are extremely poisonous and may be fatal if swallowed, inhaled, or absorbed through the skin. Reduce the possibilities of skin exposure by wearing recommended protective clothing and equipment. Wear goggles and a respirator that has been tested by the National Institute of Occupational Health and Safety (NIOSH) and found to be satisfactory for protection against the insecticides being used. If sickness occurs during or after using these insecticides, call your doctor immediately.
2. Parathion, azinphosmethyl, Fenitrop n, monocrotophos, malathion, and diazinon are highly toxic to bees exposed to direct treatment or residues on crops.
3. Carbaryl, methoxy, acephate, trichlorion, methidathion, endosulfan, and dimethoate are highly toxic to bees and should not be applied when bees are actively visiting the area.
4. Avoid excessive use of insecticides on tobacco. Do a thorough job of treating and repeat only when necessary.

DO NOT USE ENDRIK, ALDRIN, HEPTACHLOR, TOXAPHENE, CHLORDANE, LINDANE, BHC, DDT, DDE, DIELDRIN, OR LEAD ARSENATE ON THE FOLIAGE OF GROWING TOBACCO PLANTS.

DISEASES OF TOBACCO

D. A. Komm, Extension Specialist, Plant Pathology

Control of the diseases that attack tobacco involves the careful selection of one or more control practices for the disease situation for each field. Prevention of diseases before they occur saves money and stabilizes production. Remember, choose the correct practices which offer the maximum protection against disease losses.

Proper diagnoses and knowledge of disease problems is essential in selection of control practices. Disease counts and nematode assays should be done late in the season for each field. Knowledge of distribution of diseased plants this year prevent losses from the same disease next year.

Tobacco Disease Diagnosis and Control Services - Proper control of tobacco diseases by chemicals, resistant varieties, and/or cultural management depends on proper identification of the cause of the problem. Your local Cooperative Extension Service office will aid you in the identification of the tobacco problem and provide control recommendations.

Early Stalk and Root Destruction - This practice reduces carry-over populations of root knot and cyst nematodes, mosaic, and brown spot plus certain insects, weeds and grasses. This practice includes the following operations: 1) Cut stalks into small pieces with bushhog or similar equipment the day that harvest is complete. 2) The same day as step one, disc or plow out stubbles. 3) After 2 weeks, re-disc field to provide additional root kill and to bury crop refuse. If possible, fall plowing will complete root kill and bury plant residue. 4) Plant cover crop when root systems are killed and plant debris is buried. All tobacco growers should use the early root and stalk destruction practice.

Rotation - Rotation of tobacco with resistant crops provides reduction of many diseases such as black shank, granville wilt, root knot and cyst nematodes, mosaic, and black root rot. The use of the proper resistant crop for each disease is important in reducing the infestation level of the pest.

Disease Resistant Varieties - Disease resistant varieties offer good control of several of the major diseases of tobacco. However, growers should consider the major disease problem and infestation levels in choosing the best variety.

Control Systems - Application of chemical soil treatments will be beneficial in fields with disease problems. However, chemical soil treatments may not be needed where disease or nematode levels are very low due to past use of control practices (crop rotation, chemical control, resistant variety, early root and stalk destruction, etc). The decision regarding whether or not to use a chemical soil treatment or which of the different materials to select should be based on disease level, other control practices, and cropping plan. The selection of the proper control practices should be made to fit the disease situation and cropping sequence for each field. Contact your County Extension Service for assistance in selection of proper procedures.

Blue Mold - In the past two years, blue mold has been a major problem in both the plant bed and/or field. The main factors which determine if blue mold will be present in 1981 are the weather and the presence of blue mold spores. This disease is favored by cool, wet weather. However, hot weather will prevent the infection and spread of the disease. The major source of blue mold spores in the past two years has been countries and states south of Virginia. A type of blue mold spore can overwinter and may be a factor in local outbreaks.

An outbreak of blue mold in 1981 for Virginia tobacco will probably depend on the previous factors. A blue mold forecasting system has been established in Virginia and this system is connected with similar systems in other tobacco states. This forecasting system will alert the producer on the probability and occurrence of blue mold infection and symptoms in the plant bed and field. In the spring and early summer, the producer should contact the county extension agent for a current update on blue mold.

In 1980, blue mold caused serious losses to plant beds and fields planted with infested plants. Although the appearance of blue mold in the plant bed and field is not an annual event, the grower should take precautionary measures each year to prevent losses to blue mold. The following control measures are suggested for blue mold: 1) Plant bed: prevent blue mold in the plant bed by spraying with fungicides. Begin chemical application before disease appears and when plants are about the size of a dime (regardless of type of cover). Continue fungicide application twice a week until transplanting has been completed. Application must be made after each rain or irrigation. Warning: Preventive fungicides may fail to control blue mold if applied after infection and symptom production. 2) Field-preventive fungicides: Apply before infection and appearance of symptoms. Make field applications when disease is predicted or threatens and repeat at 7-day intervals. During active blue mold weather, spray at 3- to 4-day intervals. Cover both top and bottom of leaves. Drop nozzles increase plant coverage. Repeat application immediately after a rain. Warning: The preventive fungicides may fail to control blue mold if applied after infection and symptom formation. Results from 1980 indicate that satisfactory control was obtained when fungicides were applied before infection or symptom formation. 3) Field-Ridomil: Must be applied before transplanting. Apply broadcast and incorporate in the top 2-4 inches of soil. This chemical gives excellent control of blue mold and also reduces losses from black shank. 4) Practice early stalk and root destruction. Bury all tobacco residue from previous crop. 5) If possible, avoid fields where blue mold was a problem in previous years. Choose fields that are not shaded in the morning and have good wind circulation. 6) Destroy plant beds after transplanting has been completed. 7) After irrigation, the leaves should be allowed to dry before darkness.

In the near future, we expect additional control measures for blue mold. Contact your extension agent for an update.

Black Shank and Granville Wilt: The determination of the level of these diseases at the end of each season is essential in the prevention of losses for the following season. To determine the approximate disease level for black shank and/or Granville Wilt, count the number of plants with each disease and the total number of plants in every 10th row. Calculate the percentage of diseased plants by dividing the number of diseased plants by the total number of plants.

Severity Level

Low
Moderate
High

Black Shank or Granville Wilt

Less than 1%
1-5%
More than 5%

Maintain a record of the disease levels each year for each field. In fields with no observable black shank or Granville Wilt injury in recent years, varieties with moderate to high resistance to these diseases is preferred. No chemical treatment would be needed. The following control options can be used as a guide in the reduction of losses to black shank and Granville wilt.

Severity Level

Low
Moderate
High

Control Option*

2-year rotation and high disease resistance variety
2- to 3-year rotation, high disease resistant variety and chemical control
3- to 4-year rotation, high disease resistant variety and chemical control

*Continuous culture - (Tobacco following tobacco) is not recommended. However, if tobacco following tobacco cannot be avoided, use only varieties with high disease resistance and chemical control. In this situation, disease losses may occur regardless of control procedures.

Nematodes: The major nematodes causing losses to Virginia tobacco are root knot, tobacco cyst and lesion. Since the plant symptoms are often confused with other problems, nematodes may go undetected for years in a producer's field. Nematode control by chemicals, crop rotation, and resistant varieties depends upon a positive identification of the nematode species. A Nematode Assay Clinic at Virginia Tech provides a nematode assay service to aid in nematode identification and control recommendations. Contact your local Cooperative Extension Service Office for information on methods of collecting and handling plant soil samples for nematode assay.

Root Knot Nematode: In addition to a nematode soil assay, the producer can determine the level of root knot nematodes by the following procedure:

- 1) Examine roots after harvest just before early stalk and root destruction.
- 2) Rate the roots in the following manner:
 - a. slight - 0 to 10% of root area covered with galls
 - b. low - 11 to 25%
 - c. moderate - 26 to 50%
 - d. high - 51 to 100%

Caution: Do not substitute this method with a nematode soil assay. Other nematodes may also be present.

The following information contains suggested control options for root knot.

| <u>Root Knot Level</u> | <u>Control Option*</u> |
|------------------------|----------------------------------|
| Slight to low | Nematicide or resistant variety |
| Moderate to high | Nematicide and resistant variety |

*Rotation is recommended when nematodes are present. Use 2- to 4-year rotation for moderate to high levels. Continuous culture of tobacco is not recommended. Use only varieties with resistance combined with chemical control if continuous culture cannot be avoided.

Tobacco cyst nematode (TCN) (Globodera solanacearum) - TCN is widely distributed in Amelia, Brunswick, Dinwiddie, Halifax, Lunenburg, and Nottoway Counties. This nematode is more persistent and difficult to control than other tobacco nematodes. Visual diagnosis of this nematode is often missed because of the lack of typical diagnostic symptoms. Positive identification can only be made with a nematode plant and/or soil assay.

Since the nematode is difficult to control, the following measures should be taken to prevent the introduction of the cyst nematodes into a field.

1. Do not obtain transplants from farms with a cyst nematode infestation.
2. Do not obtain transplant water or irrigation water from ponds or streams which receive drainage water from infested fields.
3. Do not use equipment which has been previously used on infested land until it has been thoroughly cleaned. This also applies to equipment of custom applicators of fertilizers, herbicides and pesticides.

Fields already infested with the cyst nematode should be managed as follows:

1. Practice rotation. Do not follow tobacco with tobacco on infested land. Corn, sorghum, small grains and fescue have been shown to be effective rotation crops.
2. When tobacco is grown, use one of the nematicides listed below.
3. Early root and stalk destruction.
4. If tobacco is grown every year on infested soil, there is no guarantee that either fumigant or nonfumigant nematicides will prevent losses from the tobacco cyst nematode.

In conclusion, sanitation, crop rotation, and the use of nematicides will reduce losses to TCN.

Black Root Rot - This disease is prevalent in burley in Southwest Virginia and the Western and Northern part of the flue-cured and dark-fired area. This disease is expressed by stunted plants with black and reduced root systems. Plants may recover with an increase in summer temperature. The control practices are as follows: 1) Resistant varieties; 2) Keep soil pH at 5.6 or lower; 3) Use a 3-year rotation with small grains or corn. Do not precede tobacco with red clover, soybeans or other legumes since the same pathogen infects these crops; 4) Use chemical control.

Tobacco Viruses - Transmitted to plants by mechanical injury or on objects that have been in contact with tobacco products. Use resistant varieties (NC 628, S.C. 72, Coker 86, S.C. 71, and Virginia 770) to prevent losses from TMV, particularly if a field has a history of TMV and no rotation is used. Use the following control measures when TMV susceptible varieties are used:

1. Avoid use of manufactured tobacco products in plant bed during transplanting or in the field.
2. Use milk treatment in plant bed.
3. Wash hand in milk or phosphate detergent before handling plants and every 15 minutes thereafter.
4. Avoid materials used in contact with harvested tobacco (tobacco sheets, etc.). Phosphate detergent can be used to decontaminate the materials.
5. Remove plants showing mosaic symptoms before first cultivation to prevent spread of TMV by the equipment.
6. Use early root and stalk destruction program to reduce soil borne residue of TMV. Turn crop residue under early and plant a cover crop.
7. Rotation with a non-susceptible crop should be used where infection from soil-borne residue is a problem.
8. Control weed hosts (horsenettle and ground cherry).

Potato virus Y (PMV), Tobacco etch virus (TEV), Tobacco vein mottling virus (TMV), Cucumber mosaic virus (CMV), Peanut stunt virus (PSV) - These viruses are aphid transmitted from weed hosts or cultivated crops. PMV is found primarily in burley tobacco and some varieties are more tolerant than others. However, there are no resistant varieties for any of the aphid transmitted viruses. Control of weed hosts and aphid vectors in or near tobacco fields may reduce the rate of infection. Refer to Weed Control Guide and Insect Control Guide. However, there are no methods to prevent infection or chemicals to cure a virus-infected plant. Overwintering hosts include horsenettle, ground cherry, curly dock (for TMV), clovers for CMV and PSV.

Fumigation-Field Procedures - The tobacco producer should choose the correct fumigant and dose rate to control diseases and/or nematodes present in each field. Refer to tables for information on correct dosage rates on each disease and/or nematode. Use higher rates for heavier soils or higher disease infestations. At the time of fumigant application, the soil should be in good seed bed condition, free of clods and undecomposed plant material and with soil moisture at about 1/2 of field capacity. If undecomposed plant material is present, plow down and allow to decompose before applying fumigant. Soil temperature should be 50° to 80°F at the depth of injection. Fumigants can be applied by the following procedure: 1) **Row treatment** - Inject the fumigant 6 to 8 inches deep with one chisel-type applicator in center of the row. On the same operation as fumigant application, seal the soil by bedding the fumigated row area with enough soil to bring the soil surface 14 to 16 inches above the point of injection. 2) **Broadcast treatment** - Space chisels 12 inches apart and inject fumigant 10 to 12 inches below the soil surface. Immediately seal in the fumigant with a roller, drag or similar equipment.

After fumigation, leave soil undisturbed for 7 to 14 days for exposure period. Cold, wet soil retards diffusion of fumigants and requires a longer exposure period. At the end of the exposure period, aeration of the soil before planting is needed. Planting is generally considered safe when the odor is no longer detectable in the soil root zone. The following procedures can be used to hasten aeration, especially if rains or cold temperatures occur during the exposure period: 1) **Row** - Use a chisel in the bed without turning the soil. 2) **Broadcast** - Plow or deep cultivate to the depth of the treatment zone. **Caution:** In both types of treatment avoid contamination of treated soil with untreated soil. Do not rehill row if there is a danger of contamination with untreated soil. Use only transplants known to be disease free. Do not use tools, equipment and/or residues that are infected with soil-borne diseases. Remember, plant injury will occur if fumigant is still present in the soil at transplanting.

PLANT BED DISEASES

| Disease | Material | Application Rate/ 100 Square Yards | Remarks |
|---|---|---|---|
| Nematodes Blackshank Damping-off Weeds | Methyl Bromide: Brom-O-Gas DowFume MC-2 | 9.0 lbs or 18.0 lbs (1.0 lb/100 sq ft) | Prepare seedbed as you would for seeding. You must use an air-tight cover. Treat at soil temperature above 50°F. Expose to fumigation for 24-48 hours. Aerate for 1 week before seeding. Fall fumigation is preferred. Use high rate (18.0 lb) for areas infested with the tobacco cyst nematode and/or black shank. |
| | DowFume MC-33 | 7.23 lbs | Prepare seedbed as you would for seeding. Crop residues should be worked into soil and allowed time to decompose before treating. Soil temperature should be between 50°F and 80°F at the 5-inch level. Treated soil must be sealed immediately after application by rolling or cultipacking, and covered immediately with gas-tight plastic. Aerate 7-14 days prior to planting in treated area. Fall fumigation is preferred. |
| | SMDC: Vapam | 1.5 gals | Inject chemical to a depth of 5 inches at rate of 1.5 gal in 40.0 gal of water per 100 sq yds. Cover area immediately with plastic no less than 1 day, but no more than 2 days. After removing plastic--cultivate soil lightly and wait 7-14 days prior to planting in treated area. Fall fumigation is preferred. |
| | MIT: Vorlex | 4.0 qts | Inject or incorporate chemical to a depth of 5 inches and cover with plastic immediately. Treatment should be at least 4 weeks before seeding. Remove cover at least one week prior to seeding and work soil lightly. Aerate by cultivating and delay planting 7 days for each 23 pounds active used per acre. Fall fumigation is preferred. |

PLANT BED DISEASES (Cont'd)

| Disease | Chemical & Formulations; Active Ingredient | Rate | Remarks |
|---|---|---|---|
| Tobacco mosaic virus (TMV) | Milk (whole or skim) Milk (dry skim) | 5.0 gals/100 sq yds of bed 5.0 lbs in 5.0 gals water/100 sq yds | Spray plants in plant bed from 1 to 24 hours before pulling. See discussion on control of TMV. |
| | Phosphate detergent | 1/4 cup/gal of water | Wash hands before pulling and every 15 minutes thereafter. |
| Blue mold (<u>Peronospora tabacina</u>) Anthracnose (<u>Colletotrichum destructivum</u>) | Dithane Z-78 (75% WP) Zineb 75 WP (Blue mold only); (zineb) | For spray: 3.0 lbs/100.0 gals water (2 level tbsps/gal). Apply 2 1/2-5.0 gals per 100 sq yds, depending on size of plants. For dust treatment: Mixture containing 6.5% zineb with talc of prophyllite. | Begin chemical application when plants are about the size of a dime. Follow application twice per week until plants are transplanted to the field. Rate per 100 square yards depends upon plant size. Repeat twice weekly or more often if sprays are washed off with rain or irrigation. Continue treatment until transplanting is complete. Application must be made before infection occurs. Warning: Preventive fungicides may not control plant bed disease when applied after infection and symptom expression. Preventive fungicides (excluding streptomycin sulfate) can aid in the reduction of damping-off. FOLLOW MANUFACTURER'S INSTRUCTIONS. |
| | Carbamate Fungicide (76% WP) (Blue mold only); (ferbam) | For spray: 3.0 lbs/100.0 gals water (4 level tbsps/gal). Apply 2 1/2-5.0 gals per 100 sq yds, depending on size of plants. For dust treatment: Mixture containing 11.4% ferbam with talc or pyrophyllite. | Same as above. |
| | Dithane M-22 (80% WP); (maneb) | For spray: 1/2 lb/100.0 gals water (1 heaping tsp to 4.0 gals of water). Apply 2 1/2-5.0 gals per 100 sq yds, depending on size of plants. | Same as above. |
| | Dithane M-22 Special (maneb + zinc); | For spray: 1/2 lb/100.0 gals water (1 heaping tsp to 4.0 gal of water). Apply 2 1/2-5.0 gals per 100 sq yds, depending on size of plants. | Same as above. |
| | Polyram (80% WP)*; -ethylenebis (dithiocarbamate) - zinc and -(dithio)bis (thio carbonyl) iminoethylene) bis (dithiocarbamate) zinc | For spray: 1 1/2-2.0 lbs/100.0 gals water. Apply 3.0-6.0 gals per 100 sq yds, depending on size of plants. | Same as above. |

PLANT BED DISEASES (Cont'd)

| Disease | Chemical & Formulations; Active Ingredient | Rate | Remarks |
|---|--|--|---|
| Blue mold (<u>Peronospora</u> <u>tabacina</u>) (Cont'd) | Agri-Strep; Agri- mycin 17; streptomycin sulfate (Blue mold only) | Spray plant bed at a rate of 5.0 gals of solution/100 sq yds. Where disease exists, use 1.0 lb Agri-Strep/100.0 gals of water. Where disease is not established, use 0.5 lb Agri-Strep/100.0 gals of water. | Begin chemical application when plants are about the size of a dime. Follow application twice per week until plants are transplanted to the field. Rate per 100 square yards depends upon plant size. Repeat twice weekly or more often if sprays are washed off with rain or irrigation. Continue treatment until transplanting is complete. Application must be made before infection occurs. <u>Warning:</u> Preventive fungicides may not control plant bed disease when applied after infection and symptom expression. FOLLOW MANUFACTURER'S INSTRUCTIONS. |
| Anthracnose (<u>Colletotrichum</u> <u>destructivum</u>) (Cont'd) | | | |
| Wilting (<u>Pseudomonas</u> <u>tabaci</u>) | Agri-Strep; streptomycin sulfate | Spray plant bed at a rate of 5.0 gals of solution/100 sq yds. Where disease exists, use 1.0 lb Agri-Strep/100.0 gals of water. Where disease is not established, use 0.5 lb Agri-Strep/100.0 gals of water. | Same as above. |

* Polyram has not been evaluated for anthracnose control under Virginia conditions.

FIELD DISEASES OF TOBACCO

| Disase | Material Rate/A | Method of Application | Remarks |
|---|--|--|---|
| Blackshank (<i>Phytophthora parasitica</i> var. <i>nicotianae</i>) | Terro-O-Cide 15; 10.0-12.0 gals OR Terro-O-Cide 30; 6.0-8.0 gals OR Terro-O-Cide 54-45; 2.7-3.6 gals OR Telone C-17; 8.5-10.5 gals OR Vorlex; 5.0 gals | Inject 8 inch deep with one shank in center of row when soil temperatures are above 50°F. Wait 2-3 weeks after fumigation before planting. Rates based on 42 inch rows. | In fields with low levels of blackshank, use a 2-year rotation and a high resistant variety. Moderate levels: Use 2- to 3-year rotation, high resistant variety, and control. High levels: Use 3- to 4-year rotation, high resistant variety, and chemical control. See Bull. 393 "Crop Rotation for Flue-cured Tobacco." Continuous culture (tobacco following tobacco) should not be considered if the number of plants with black shank exceeds 5%. Use higher rates for heavier soils or higher pest infestations. Refer to previous comments on black shank control and fumigation practices. |
| | Ridomil 2E; 2.0-4.0 qts | Apply broadcast and incorporate in the top 2-4 inches of soil. | Flue-cured tobacco only. In fields with expected levels of blackshank at low to moderate (less than 6%), either rotate 2 to 4 years, or use the low rate of Ridomil (2 qts) and a resistant variety. When the expected level of blackshank is high (greater than 6%) either rotate 2 to 4 years or use the high rate of Ridomil (4 qts) and a resistant variety. Continuous culture of tobacco (tobacco following tobacco) should not be considered if the expected level of blackshank exceeds 6%. Failure to control nematodes in fields treated with Ridomil may result in poor control of blackshank. Do not use on varieties of flue-cured tobacco which are extremely susceptible to blackshank. Tobacco, corn, or root crops may be planted the year following treatment. Small grain cover crops may be planted during the fall following treatment provided they are plowed down and not used for food or feed. Other crops may be planted 18 months following application. Consult label for chemicals compatible with Ridomil. |
| Granville Wilt (<i>Pseudomonas solanacearum</i>) | Telone C17; 10.5 gals OR Terro-O-Cide 30; 6.0 gals OR Terro-O-Cide 15; 10.0-12.0 gals OR Terro-O-Cide 15D; 12.0 gals OR Terro-O-Cide 54-45; 2.7-3.6 gals | Same as for Blackshank. | Refer to remarks under Blackshank. |
| Black Root Rot (<i>Thielaviopsis basicola</i>) | Telone C17; 8.0-10.5 gals OR Vorlex; 5.0 gals OR Terro-O-Cide 15D; 12.0 gals | Same as for Blackshank. | Keep soil pH at 5.6 or lower. Use a 3-year rotation with small grains or corn. Do not rotate with red clover, soybeans or other legumes since the same pathogen that attacks tobacco infects these crops. Multipurpose chemicals applied before transplanting will aid in the reduction of symptoms caused by black root rot. |
| Fusarium Wilt (<i>Fusarium oxysporum</i> f. sp. <i>nicotianae</i>) | Vorlex; 5.0 gals | Same as for Blackshank. | Most varieties carry some resistance. In severe cases use a multipurpose chemical, and a 2-year rotation. Do not rotate with sweet potatoes since the same fungus attacks both crops. |

FIELD DISEASES OF TOBACCO (Cont'd)

| Disase | Material Rate/A | Method of Application | Remarks |
|--|--|--|--|
| Verticillium Wilt (Verticillium albo-atrum) | Terr-O-Cide 30; 6.0 gals OR Vorlex; 5.0 gals OR Terr-O-Cide 54-45; 2.7-3.6 gals | Same as for Blackshank. | Rarely a problem. Some resistant varieties are available. Use multipurpose chemicals in severe areas. |
| Nematodes (except Tobacco cyst nematode) | DD or Vidden D; 10.0 gals OR Telone II; 6.0 gals OR Soilbrom 90; 1.75 gals OR Soilbrom 85; 2-1/2 gals OR Soilbrom 40; 7.0 gal OR Telone C-17* 8.5-10.5 gals OR Terr-O-Cide 15D*; 12.0 gals OR Terr-O-Cide 30*; 6.0-8.0 gals OR Terr-O-Cide 54-45*; 2.7-3.6 gals | Inject 8 inches deep in row with single shank in center of row when soil temperatures are above 50°F. Wait 2-3 weeks after fumigation before planting. Rates based on 42 inch rows. | Use higher rates for heavier soils or higher pest infestations. Planting is generally considered safe when odor is no longer detectable in the soil root zone. Refer to note on fumigation practices. *These materials control fungi and nematodes. |
| <u>Fumigants</u> | | | |
| <u>Granular or Liquid Non-Fumigants</u> | | | |
| | Mocap EC6; 1.0 gal OR Mocap 10G; 60.0 lbs OR Mocap Plus 10-5G; 60.0 lbs OR Nemacur 15G; 40.0 lbs OR Nemacur 3; 2.0 gals OR Dasanit SC; 1.0 gal OR Dasanit 15G; 40.0-60.0 lbs OR Dasanit-Disyston 4-2SC; 1 1/2 gals OR Dasanit-Disyston 10-5G; 60.0 lbs OR Dasanit SC; 2 2/3 qts + Nemacur 3; 2 2/3 qts OR Furadan 10G; 60.0 lbs OR Furadan 4F; 6.0 qts OR Vydate L; 1-1/2 pts | Apply broadcast and incorporate 3-4 inches deep before bedding. | Granular and liquid nonfumigant nematicides must be applied uniformly and incorporated by crossdisking before shaping beds. Mocap: No waiting period is required but at least a 5-day waiting period enhances wireworm control. Dasanit - Do not apply this product with a knapsack or similar equipment that is placed on user's body. Furadan - Labeled for flue-cured only. Excessive rates will produce plant injury. Measure accurately -- over applications may cause stunting of tobacco. |
| | | Apply as transplant water treatment and use a minimum of 100 gals of water per arce. | Vydate: Measure accurately to avoid injury to tobacco. Other labeled uses of Vydate are as follows: 1) broadcast and soil incorporated 4 to 6 inches; 2) row treatment; 3) foliar treatment; 4) transplant water treatment or foliar treatment following the use of Vydate, other nematicides, or multipurpose fumigants. The performance of these Vydate treatments have not been tested on the control of nematodes in Virginia tobacco. |

FIELD DISEASES OF TOBACCO

| Disase | Material Rate/A | Method of Application | Remarks |
|---|---|--|---|
| Tobacco cyst nematode (<i>Globodera solanacearum</i>) | Telone II; 18.0 gals OR Vidden D or DD; 30.0 gal/A | Broadcast with chisels spread 12 inches apart and inject chemicals 8 to 12 inches deep. Apply when soil temperatures are above 50°F. Wait 2 to 3 weeks after fumigation before planting. | See previous remarks on use of fumigants. |
| <u>Fumigants</u> | | | |
| <u>Granular or Liquid Non-Fumigants</u> | | | |
| | Nemacur 15G; 40.0 lbs/A OR Nemacur 3; 2.0 gals/A OR Furadan 10G; 60.0 lbs/A OR Furadan 4F; 1 1/2 gals OR Mocap Plus; 10 + 5G; 80.0 lbs/A OR Mocap 10G; 80.0 lbs/A OR Mocap EC; 6.0 qts/A | Broadcast uniformly and incorporate 3 to 4 inches deep before bedding. | See remarks under Nematodes (Except Tobacco Cyst Nematode). |
| Blue mold (<i>Peronospora tabacina</i>) | Agri-Mycin 17; Agri-Strep; etc. (Streptomycin sulfate); 100 ppm (1/4 lb/50.0 gals); 200 ppm (1/2 lb/50.0 gals) (For serious infections) OR Dithane M-45; Manzate 200; mancozeb (mancozeb); 1 1/2-2.0 lbs OR Dithane M-22 Special; Manzate D; maneb special (maneb plus zinc); 1 1/2-2 lbs OR Carbamate (terbam); 2.0-3.0 lbs OR Zineb 75; Dithane Z-78 (zineb); 3.0 lbs | Foliar Spray: Apply at 50 psi in 20 to 50 gals of water. The amount of chemical and water depends on size of plant. Use higher rates for mature plants. Cover both top and bottom of leaves. Drop nozzles increase plant coverage. | Apply before infection and appearance of symptoms. Make field applications when disease is predicted or threatens and repeat at 7-day intervals. During active Blue mold weather, spray at 3- to 4-day intervals. Repeat application immediately after a rain. Discontinue spray application when disease is no longer a threat. Warning: The preventive fungicides may fail to control Blue mold if applied after infection and symptom formation. |
| | Ridomil 2E; 1.0-2.0 qts | Apply broadcast and incorporate in top 2-4 inches of soil. | <u>Flue-Cured</u> - Apply 1 to 2 qts. Under low disease pressure, use 1 qt per acre. Under high disease pressure or for full season control, use 2 qts per acre. <u>Burley and Other Types</u> - Apply 2 qts per acre. Tobacco, corn, or root crops may be planted the year following treatment. Small grain cover crops may be planted during the fall following treatment provided they are plowed down and not used for food or feed. Other crops may be planted 18 months following application. Consult label for chemicals compatible with Ridomil. |

| Disease | Comments |
|---|---|
| Sore Shin (<u>Rhizoctonia solani</u>) | This disease often occurs first in the plant bed, so disinfection of the bed is important. Choose disease-free transplants. There is no field control and no resistant varieties are available. |
| Southern Stem (<u>Sclerotium rolfsii</u>) and Root Rot | This fungus grows on slowly decomposing organic matter, so soils high in organic matter should be avoided. No resistant varieties are available. |
| Brown Spot (<u>Alternaria alternata</u>) | Can be severe on mature tobacco. In addition, this disease can be serious during periods of high humidity. To help reduce losses, use a tolerant variety. Avoid practices that would leave mature leaves in the field or delay the maturity of the tobacco. Sucker control with MH-30 reduces the incidence of brown spot. Early harvest is recommended. |
| Frog Eye (<u>Cercospora nicotianae</u>) | Avoid over-fertilization with nitrogen. Use a 2-year rotation and be sure to plow-under refuse early. The green spot stage can be avoided by starting the curing process at 38°C (100°F) with 100% relative humidity. |
| Wildfire and Angular Leaf Spot (<u>Pseudomonas tabaci</u> and <u>Pseudomonas agulata</u> , respectively) | Resistant varieties and early harvesting are necessary to prevent complete loss. Rotation is recommended. Streptomycin sulfate is used in the plant bed to obtain bacteria-free transplants. In addition, streptomycin sulfate can be used in the field. See recommendations for control of blue mold with streptomycin sulfate. |
| Virus (mosaic, vein-banding, etc.) | Once a plant is infected, it remains infected for life. See special note on viruses. |
| Damping-off (<u>Pythium</u> spp.) | Since this disease can first occur in the plant bed, proper control measures in the plant bed are essential. Choose disease-free transplants. Cool, wet weather following transplanting favors field infection. Do not replant in same spot as dead plant. |
| Frenching (non pathogenic causal agent) | This disorder has been associated with toxins produced by a nonpathogenic bacterium (<u>Bacillus cereus</u>) and other nonpathogenic microorganisms. Frenching is more prevalent on wet, poorly-aerated soils. This problem can be more severe on neutral or alkaline soils and is sometimes associated with lack of available nitrogen or other minerals. Proper soil drainage and fertilization can be beneficial. Do not plant in alkaline soils and avoid heavy applications of lime. |

Disease Reactions of Varieties of Flue-Cured
Tobacco Tested in Virginia

| Variety | Rootknot ¹ | Black shank | Granville wilt | Fusarium wilt | Brown spot | TMV |
|-----------------|-----------------------|-------------|----------------|---------------|------------|-----|
| Coker 48 | S | H | H | H | MT | S |
| Coker 86 | R | H | H | M | MT | R |
| Coker 187-Hicks | S | H | M | M | SE | S |
| Coker 254 | R | M | M | H | SE | S |
| Coker 319 | S | L | L | L | SE | S |
| Coker 347 | R | M | M | H | MT | S |
| Coker 411 | S | H | L | S | SE | S |
| McNair 133 | S | M | L | S | SE | S |
| McNair 373 | R | M | H | L | -- | S |
| McNair 944 | S | H | L | S | SE | S |
| McNair 1040 | S | M | L | L | T | S |
| NC 13 | S | M | L | L | SE | S |
| NC 79 | R | M | L | M | MT | S |
| NC 82 | S | H | H | M | T | S |
| NC 88 | R | M | M | H | T | S |
| NC 89 | R | M | L | L | T | S |
| NC 98 | R | M | M | M | MT | S |
| NC 628 | k | M | M | M | T | R |
| NC 2326 | S | M | S | L | MT | S |
| SC 72 | R | M | H | H | SE | R |
| Speight G-23 | R | M | H | H | T | S |
| Speight G-28 | R | H | H | H | T | S |
| Speight G-52 | S | H | M | S | MT | S |
| Speight G-58 | R | M | H | L | MT | S |
| Speight G-70 | R | H | M | L | MT | S |
| Speight G-140 | S | H | M | L | SE | S |
| VA 080 | R | M | L | H | T | R |
| VA 115 | S | M | L | S | MT | S |

S = Susceptible; L = Low Resistance; M = Moderate Resistance; H = High Resistance; T = Tolerant; R = Resistance; MT = Moderately Tolerant; and SE = Sensitive.

¹The varieties listed above have been tested against the southern root-knot nematode which is the most common nematode in Virginia.

WEED CONTROL IN TOBACCO

D. A. Kamm, L. A. Link and C. L. Foy *

Plant Beds

| Weed Problem | Chemical Rate/100 sq yd (Product/A) | Remarks |
|-------------------|--|---|
| Most annual weeds | methyl bromide (Dowfume MC 2, other) 9.0 lb | Prepare seedbed as you would for seeding. You must use an airtight cover. Soil temperatures should be above 55 F. Expose soil to chemical for at least 24 hours and then aerate 24 to 48 hours before seeding. The hot-gas method will permit shorter exposure time. <u>METHYL BROMIDE IS EXTREMELY POISONOUS.</u> |
| | metham (Vapan) 8.0-10.0 qt of 32% formulation (Rate must not exceed 383.0 lb) | Prepare seedbed as you would for seeding. Apply to freshly prepared moist soil when temperature is above 55 F. Soil moisture should be ample to form a crumbly ball. Drench metham into the soil with 100 gal of water per 100 sq yd. Use 1/2 rate if airtight cover can be installed immediately after treating. Keep cover on for 48 to 72 hours. Do not disturb area for at least 14 days, or 30 days if temperature is below 60 F. Work soil to depth of 1-1/2 to 2 inches at least 7 days before seeding. Do not get metham in your eyes or on your skin, clothing or shoes. If application requires walking over the area, wear rubber boots. |
| | methyl isothiocyanate (Vorlex) 2-1/4 to 4-1/2 qt of 80% formulation | Prepare seedbed as you would for seeding. Apply anytime during fall or winter when soil is workable. Inject or incorporate into the soil and cover with plastic immediately. Expose to fumigation for 4 to 7 days. Aerate by cultivation and delay planting 4 weeks. |
| White clover | diphenamid (Enide 50W or 90W) Light to Medium Soils: 50W 3.0 oz (100 sq yd); 90W 1.7 oz (1000 sq ft) Heavy Soils: 50W 4.0 oz (100 sq yd); 90W 1.7 oz (1000 sq ft) | Apply at seeding to control most grasses and weeds that may escape fumigation. Apply in ample water (approximately 3 gal) to spray evenly over bed. If no rainfall occurs within a few days after application of Enide 50W or 90W, irrigate plant bed with no more than 1/2 inch of water. Plants may be 2 to 4 days delayed in reaching transplant size. |

Field Grown Tobacco

| Weed Problem | Chemical Rate/lb/A (Product/A) | Remarks |
|--|--|--|
| Annual bluegrass, carpetweed, crabgrass, chickweed, foxtails, goosegrass, knotweed, lambsquarters, pigweed, purslane, ryegrass, sandbur, Texas panicum | benefin 1.12-1.5 lb ai (Balan EC 3.0-4.0 qt or 2.5 G 45.0-60.0 lb) | Use only on burley or dark tobacco. Apply to clean soil prior to but no earlier than 10 weeks before transplanting and incorporate thoroughly within 8 hours to a depth of 2-3 inches. Use low rate on coarse and medium soils and high rate on fine soils. Do not shape bed after chemical is applied. Set plants in an upright position so that their roots extend below the layer of chemically treated soil. Do not apply after transplanting. Some cases of stunting have occurred. |

*Extension Specialist, Plant Pathology; Extension Specialist, Tobacco; and Extension Specialist, Plant Physiology; respectively.

Field Grown Tobacco (Cont'd)

| Weed Problem | Chemical Rate/lb/A (Product/A) | Remarks |
|---|---|---|
| Barnyardgrass, carpetweed, corn spurry, crabgrass, evening primrose, fall panicum, foxtails, Florida pusley, goosegrass, lambsquarters, johnsongrass from seed, pigweed, purslane, red sorrel, sandbur, smartweed, witchgrass, annual bluegrass, annual sedge, cheat, fall panicum, ryegrass, stinkgrass, wild oat, common chickweed, field pepperweed, groundsel, knotweed, mouseear chickweed, shepherdspurse, spiny amaranth, thymeleaf sandwort | diphenamid 4.0-6.0 lb (Enide 50W 8.0-12.0 lb or Enide 90W 4.4-6.6 lb) | Apply evenly to soil surface 0-7 days before transplanting and thoroughly incorporate into the top 2 inches of soil; or apply to freshly prepared soil 0-7 days after transplanting. Spray may be applied directly over the top of the plants or as a directed spray. Use higher rate on heavy soil and for pre-bedding application; lower rate on light soils. Diphenamid kills weed seedlings as they start to germinate. Will not control weed that have started to grow. Shallow cultivation will not destroy effectiveness. May also be used after last clean cultivation. If diphenamid was previously used, reduce rate to 2-4 lb ai. Do not use more than 8 lb ai per acre in both applications. Do not graze treated areas. Do not plant treated areas to crops not on label within 6 months after treatment. Small grain cover crop sown within 6 months after treatment may be injured. Small grain cover crop may be sown after tobacco harvest, provided Enide 90W or 50W was applied as a band treatment reducing the possibility of cover crop injury. Do not use cover crop for feed or food within 6 months after application. Will aid in suppression of ragweed. |
| Barnyardgrass, carpetweed, crabgrass, foxtails, fall panicum, Florida pusley, goosegrass, johnsongrass from seed, lambsquarters, pigweed, poorjoe, purslane, ryegrass | isopropalin 1.5 lb (Paarlan 6E 1.0 qt) | Use on flue-cured, burley or dark tobacco. Apply broadcast to clean soil prior to but no earlier than 5 weeks before transplanting. Incorporate into soil immediately (prior to bed formation if applicable) either by PTO-driven equipment (tillers, cultivators and hoes) set to cut 3-4 inches deep or by tandem discing 4-6 inches deep at right angles (cross-discing). Shallower incorporation may result in erratic control. Does not control cocklebur, jimsonweed, nutsedge, ragweed, velvetleaf and venice mallow. |
| Barnyardgrass, crabgrass, fall panicum, goosegrass, johnsongrass from seed, carpetweed, common purslane, lambsquarters and pigweed | napropamide 1.0-2.0 lb (Devrinol 50W 2.0-4.0 lb) | Adjust rate to soil texture. Use the lower rate on light, coarse-textured sandy soils and higher rate on heavy soils (fine-textured clay). Apply prior to transplanting flat-planted or bedded tobacco to well worked soil that is dry enough to permit thorough incorporation to a depth of 1 to 2 inches. Incorporate the same day as applied, using equipment which will result in uniform incorporation of the herbicide to the desired depth. After harvest or prior to planting succeeding crops, a deep moldboard or disk plowing operation must be carried out. Do not seed to alfalfa, small grains, sorghum, corn, lettuce or sugar beets for 12 months after application. |
| Barnyardgrass, annual bluegrass, signalgrass, crabgrass, crowfootgrass, fall panicum, foxtails, goosegrass, johnsongrass from seed, Florida pusley, lambsquarters, pigweed and common purslane | oryzalin 0.5-1.0 lb (Surflan 75W 0.66-1.33 lb or Surflan 4AS 1.0-2.0 pt) | For use on flue-cured tobacco only. Apply as a directed spray following the last normal cultivation, usually 4 to 6 weeks after transplanting. Apply in 20 to 40 gal of water per acre using a properly calibrated low-pressure herbicide sprayer equipped with drop nozzles that will allow treatment to be made in a 16-24 inch band in the row middles. A one-half inch rain is necessary for activation. Do not plant any root crop for 12 months following application as crop injury may occur. |

Field Grown Tobacco (Cont'd)

| Weed Problem | Chemical Rate/lb/A (Product/A) | Remarks |
|---|---|---|
| Nutsedges and barnyardgrass, bermudagrass, crabgrass, Florida pusley, foxtails, goosegrass, ground cherry, lambsquarters, pigweed, purslane | pebulate 4.0 lb (Tillam 6E 2.6 qt or Tillam 10G 40.0 lb) | Use on flue-cured or burley tobacco. Apply prior to transplanting and incorporate immediately 2-3 inches deep with power driven rotary tiller or a tandem disc set to cut 6 inches. For thorough mixing, disc in 2 different directions (cross disc). |
| Above weeds, annual bluegrass, johnsongrass from seed, signalgrass, ripgut brome, wild barley, wild oats, millet, chickweed, common fiddleneck, common knotweed, henbit, nettleleaf, goosefoot, hairy nightshade, common sowthistle, filaree, pineappleweed, prickly lettuce, blackeyed susan, and shepherdspurse | pebulate 4.0 lb (Tillam 6E 2.6 qts) + napropamide 1.0 lb (Devrinol 50WP 2.0 lb) | Use on transplanted tobacco. Apply in 25 to 50 gallons of water per acre prior to transplanting and incorporate immediately 2-3 inches deep with a power driven rotary tiller or a tandem disk set to cut 6 inches. For thorough mixing, cross disk. Crop should be planted immediately after incorporation. Shallow cultivation may be necessary to control susceptible weeds that escape control as well as those not susceptible to either herbicide. Do not seed to alfalfa, small grains, sorghum, corn, lettuce or sugar beets for 12 months after application. |
| Barnyardgrass, crabgrass, goosegrass, signalgrass, johnsongrass from seed, panicums, foxtails, crowfootgrass, pigweed, lambsquarters, purslane, carpetweed, annual spurge and Florida pusley | pendimethalin 0.75-1.25 lb (Prowl 4EC 1.5-2.5 pt) | Use on transplanted tobacco. Use lower rate (1.5 pt) on light and medium textured soils and higher rate (2.5 pt) on heavy soil types. Adjust rate to soil texture. Apply in 20 or more gallons of water per acre to clean soil immediately prior to or up to 60 days prior to transplanting and incorporate into the soil within 7 days after application. For bedded tobacco, incorporate to a sufficient depth so that bedding does not bring up untreated soil. Use a disk harrow set to cut 4-6 inches and cross disk or use a power driven rotary tiller set to cut 3-4 inches. For flat transplanted tobacco, incorporate 1-2 inches by use of a disk set to cut 3-4 inches or use a power driven rotary tiller set to cut 2 inches deep. Does not control morningglory, cocklebur, hemp sesbania, prickly sida, nutsedge, ragweed or wild mustard. Will aid in the control of and reduce competition from velvetleaf and smartweed. Applied according to directions and under normal growing conditions, Prowl will not harm transplanted tobacco. Under stress conditions for plant growth such as cold/wet or hot/dry weather, Prowl can produce a temporary retardation of tobacco development. |

DO NOT USE A SPRAYER
THAT HAS CONTAINED 2,4-D OR RELATED COMPOUNDS
TO APPLY INSECTICIDES OR FUNGICIDES
TO TOBACCO PLANTS

