VARIETIES

Danny R. Peek, Extension Specialist, Burley Tobacco

Carol A. Wilkinson, Associate Professor, Agronomy

Selecting the right burley tobacco variety for your farm is one of the most important decisions you make in producing a profitable crop. Individual farmers have different requirements for the variety or varieties grown on their farm. Consider your requirements for disease resistance, yield potential, ease of growing, maturity, curing, and market acceptance when selecting a burley tobacco variety. Another important consideration for growers in the piedmont area of Virginia is holding ability. Many of the burley varieties commonly grown in the traditional burley area of Virginia begin to decline in yield four weeks after topping in the piedmont area. So a variety that can stand longer from topping to harvest and continue to increase, and not decrease, in yield is desirable.

The most important factor to consider when selecting a burley tobacco variety is the disease history of the farm where tobacco will be grown. Diseases such as black shank, blue mold, black root rot, and virus complexes are the diseases that result in the most significant yield losses for burley tobacco. For all these disease problems there is some level of varietal resistance. However, no one variety currently has total resistance to the combination of all these diseases. Simply selecting a variety based on its yield potential over another variety could result in disaster.

Black shank is the number one disease to consider when choosing a variety. If black shank exists in the field tobacco is to be planted in, select a variety with at least medium resistance. Varietal resistance along with labeled fungicides and crop rotation will help minimize yield losses to black shank. In the past when selecting for higher black shank resistance to both race 0 and race 1, varieties sacrificed yield potential. Much of the yield loss due to the lower yield potential of resistant varieties compared to nonresistant varieties has been eliminated with the recent release of burley varieties KT 204 LC and KT 206 LC.

KT 206 LC (tested as KTH 2404) was released jointly by the University of Kentucky and the University of Tennessee and offers some improvements. KT 206 LC has a good disease package and the best black shank resistance currently available. It has a 10 level to race 0, indicating no black shank symptoms would be expected in fields with only race 0 black shank, and a 7 level to race 1. With many burley-growing areas now reporting the presence of race 1 black shank in combination with race 0, KT 206 LC is expected to provide good black shank tolerance. In areas with heavy race 1

black shank pressure, products containing mefenoxam (Ridomil Gold or Ultra Flourish) are still recommended for KT 206 LC.

KT 206 LC has also shown some tolerance to blue mold. Tolerance to blue mold is not as good as NC 2002, so KT 206 LC will not be symptom free. It should be comparable to TN 90 LC in terms blue-mold tolerance.

N 7371 LC was released by Newton Seeds Inc. in 2007. Early indications are that its resistance to black shank early in the season may be fair, but preliminary tests indicate that the resistance does not hold up later in the season. However, results may vary depending on the predominant black shank race and the weather during the growing season. N 7371 LC is a late maturing variety with a high number of long but narrow leaves and is a high-yielding, good-quality variety. Topping may be slower than comparable varieties due to the smaller upright leaves in the top of the plant at topping time.

Hybrid 404 LC is expected to be released by Clays Seed Inc. for the 2008 season. This variety must meet final approval before it can be officially released. It is described as high yielding, semi-upright, and medium green in color. In limited testing during the 2007 growing season, it appeared to hold up very well under drought conditions. It is reported to have black root rot resistance, which would make it a better choice than Hybrid 403 LC for second-year tobacco. It does not have black shank resistance and should not be used in fields with a history of black shank. Yield potential is expected to be similar to Hybrid 403 LC.

HB 3307P LC is expected to be released by F.W. Rickard Seed Company for the 2008 growing season. This variety must meet final approval before it can be officially released. HB 3307 PLC is described as a medium maturity variety with good yield potential and quality. It is expected to have high resistance to race 0 black shank and moderate resistance to race 1. It should have moderately high yield.

KT 204 (tested as KTH 2006) was released jointly by the University of Kentucky and the University of Tennessee. It is a moderately late maturing hybrid with high yield potential. KT 204 has moderately high resistance to black shank, in comparison to other burley varieties, and is recommended for growers with serious black shank problems. It has a high level of resistance to black root rot. KT 204 is resistant to tobacco mosaic virus, wildfire, and the virus complex (potato virus Y, tobacco etch virus, and tobacco vein mottling virus). KT 204 has a higher cured-leaf quality than does KT 200, thus, it would be a better choice for controlling black shank. KT 204 is not as tolerant to blue mold as is TN 90.

NC 7 (tested as NC 2001) was developed by North Carolina State University. It is a moderately high yielding hybrid with resistance to tobacco mosaic virus, the virus complex, and wildfire. NC 7 has a high level of resistance to fusarium wilt and black root rot. NC 7 has a high level of resistance to race 0 black shank and a low level of resistance to race 1 black shank. NC 7 seems to hold up well in the piedmont area of Virginia compared to many other varieties. Seed is available from Gold Leaf and Workman Seed Companies.

NC 2002 (tested as DH 6008) was developed by North Carolina State University. It has moderate yield potential of a high-quality cured leaf. NC 2002 has good blue mold resistance, very similar to NC 2000. NC 2002 is late maturing but about five to seven days earlier than NC 2000. It is susceptible to black shank, the virus complex, and has a low level resistance to black root rot. It is resistant to tobacco mosaic virus. Seed will be available from F.W. Rickard Seed Company.

The agronomic characteristics of the burley tobacco varieties tested at the Southwest Virginia Agricultural Research and Extension Center in 2007 are shown in Table 1. Disease resistance of the burley varieties is discussed in the disease section of the production guide on page 43. For more detailed information on varieties, contact you local Extension agent.

Table 1. Yield and agronomic data for released varieties tested at the Southwest Virginia Agricultural Research and Extension Center, Glade Spring, 2007.

		Plant			Top Leaf	
	Yield	height	Leaf	Days	L	W
Cultivar or Line	lbs/A	inches	no.	to flower	--inches--	
KY 14 x L8 LC	3413	48.5	18.6	62	23.0	10.9
HB 3307 LC	3180	48.3	20.4	71	20.2	9.1
TN 90 LC	2981	50.1	19.6	68	20.6	9.4
TN 97 LC	3249	49.9	21.7	69	22.3	9.7
KT 204 LC	3189	50.1	20.8	69	20.1	9.5
KT 206 LC	3275	49.6	23.3	75	21.5	8.9
NC 3	3253	48.4	19.4	70	21.0	9.5
NC 5	3253	47.0	20.1	69	21.2	9.3
NC 6	3205	47.9	17.5	72	20.1	9.4
NC 7	3240	48.2	20.6	77	20.1	9.8
NC 2000	3129	49.9	22.0	77	18.4	8.4
NC 2002	3051	49.1	21.4	69	20.9	9.5
NC BH 129	2925	44.8	18.8	65	22.8	9.6
R 630 LC	2968	50.5	19.9	66	22.5	11.1
R 712 LC	3123	51.3	20.1	67	21.3	10.1
HB04P LC	3162	45.0	18.7	65	24.7	11.7
N 7371 LC	3110	53.9	23.2	77	19.9	8.5
Clay's 403 LC	3331	45.8	18.7	66	23.3	10.1

TRANSPLANTING AND SPACING

The time of transplanting depends largely upon when the plants reach transplant size. It is good to plan to have the plants ready for transplanting about May 15. Early transplanting, before June 1, is better than a later planting because the moisture conditions for quick, early growth are usually better. Good stocky plants with a healthy root system are essential to obtaining a full stand without replanting. Plants 6 to 8 inches in length with stems about the diameter of a pencil live better and grow more rapidly than smaller or larger plants.

Using a properly adjusted mechanical setter is highly desirable and results in a stand with better early growth than a hand-set stand. Replanting missing plants is usually not an economical practice if the original stand is 90 percent or more. With a limit on the pounds of burley that can be marketed, growers should strive for efficiency and lower cost of production to increase their income. Under the poundage control program, growers are now permitted certain practices either were not feasible or not permitted under the program of acreage control.

Some suggestions which may be helpful are:

1. At transplanting, plan for a 95 percent or better stand without replanting by setting only strong, stocky plants about 6 inches long (from ground to bud) and using sufficient water at time of planting.
2. Use a wider spacing. Space plants 18 to 24 inches apart. This will result in more weight per plant so that fewer plants will need to be handled at setting, harvesting, and stripping. The acreage used will need to be slightly larger than that used previously.
3. Plant eight to ten rows and skip one so that a tractor sprayer may be used to apply any needed insecticides and the sucker control chemical. This will also facilitate harvesting operations by permitting easier dispersal of sticks before cutting and more convenient pick-up of tobacco when housing.

SPACING CHART - PLANTS PER ACRE

Row Width (Inches)	Spacing in Rows (Inches)				
	16	18	20	22	24
42	9334	8297	7467	6788	6222
44	8912	7920	7128	6480	5940
46	8523	7576	6818	6198	5682
48	8167	7260	6534	5940	5445

EFFECT OF SPACING

Yields and values of burley tobacco (from three fertility treatments with two plant spacings) at the Southwest Virginia Research and Extension Center.

Treatments[1]	Plant Spacing	Yield lb/acre	Value $/Cwt	Value $/acre
150-200-300	18”	2662	117.39	3125
	24”	2598	117.51	3053
200-200-300	18”	2634	117.08	3084
	24”	2553	117.66	3004
150-200-475	18”	2749	117.35	3226
	24”	2573	117.41	3021
Average of	18”	2682	117.26	3145
Average of	24”	2575	117.51	3026

[1] Pounds per acre of nitrogen, phosphorus, and potassium.

Percent of tobacco by quality, group, and color (as affected by three fertility treatments with two plant spacings) at the Southwest Virginia Research Station.

Treatments[1]	Plant spacing	Percent by weight		
		Quality 1,2,3	X & C group	Poor color
150-200-300	18”	85	61	3
	24”	83	43	2
200-200-300	18”	83	45	2
	24”	81	43	0
150-200-475	18”	83	60	7
	24”	85	57	2

[1] Pounds per acre of nitrogen, phosphorus, and potassium.

The 18-inch spacing produced a higher acre yield than the 24-inch spacing at each fertility level, with an average 4.15 percent increase for the closer spacing. The 18-inch spacing requires 2075 more plants to be produced, transplanted, harvested, housed, and stripped. As an average of the three fertility levels, plants at the 18-inch spacing returned $37.90 per 100 plants, while plants at the 24-inch spacing returned $48.63 per 100 plants or 28.31 percent more per plant.

There was a slight trend for tobacco from the 24-inch spacing to be a little better in value. There was little or no difference in the percentage of quality tobacco produced from the two spacings, but there was a slight trend for the tobacco from the wider spacing to be heavier in body. Tobacco produced from the 24-inch spacing was slightly better in color.

FERTILIZATION

A tobacco fertilization program should supply the nutrients needed to produce a good yield of high-quality tobacco and also maintain and/or build up the nutrient level of the soil. Of the many factors that influence burley tobacco production, fertilization practices are among the more important. Fertilizer requirements for burley tobacco are higher than for most other agronomic crops and you must give special attention to this phase of production to realize the highest net profit.

Nutrient Rates

The first step in determining fertilizer needs is a soil test. It will indicate the level of phosphorus and potassium in the soil and aid in determining if lime is needed to keep the pH in the desirable range (6.0 - 6.5) and to supply needed calcium and magnesium. The Soil Testing Laboratory at Virginia Tech will run a soil test, for in-state commercial farmers, at no charge, $3.00 for organic matter, and $3.00 for soluble salts. Soil testing is also available through commercial laboratories and farm supply dealers. In addition to results of the soil test, consider the following factors when determining fertilizer rates:

1. Amount and quality of manure to be applied
2. Stand and growth of legume to be turned under
3. Cropping and fertilizer history of the field
4. Yield and quality of tobacco generally produced on the field

Although the fertilizer program begins with a soil test, it ends with *your experience.* Your past results should be a major consideration when arriving at fertilizer rates.

Because many factors must be considered when making fertilizer recommendations for a particular field, data in the following table can be used only as general recommendations for nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O).

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P_2O_5	K_2O
L	175-200	150-250	250-350
M	175-200	60-100	200-250
H	175-200	40	100-200
VH	175-200	40	50-100

Nitrogen usually affects the yield and cured-leaf quality of burley tobacco more than any other nutrient. Failure to apply enough nitrogen will result in small plants, early firing, and low yield and quality. Excess nitrogen can cause plants to grow too large and become difficult to harvest and cure. Present research indicates that a total of 175 to 200 pounds of nitrogen per acre is necessary to produce high yields of good quality burley tobacco.

The total amount of nitrogen supplied may come from commercial fertilizer, manure, legumes, and other crop residues. Dairy manure will normally supply about 5 pounds of available nitrogen per ton. However, dairy manure should not be applied in excess of 10 tons per acre because of chlorine and soluble salts.

Yield of Burley Tobacco by Nitrogen Rate – Average of 12 Experiments
2004-2006 Tennessee, Virginia, and Kentucky

Sidedress Nitrogen (lbs N/acre)	Preplant Nitrogen (lbs N/acre)		
	80	160	240
	---------- Yield (lbs/acre)----------		
0	2358	2520	2643
50	2527	2660	2659
100	**2648***	**2647**	**2652**

*Yields in **bold type** are not different from each other by statistical tests.

These results, across a wide variety of soils and growing conditions, show that burley yields top out at no more than 180 pounds per acre of nitrogen when split into a preplant and sidedress application, and at no more than 240 pounds per acre without sidedressing. Applying 160 pounds per acre without sidedressing actually maximized yield in nine out of 12 trials, but in three cases in wet seasons, the tobacco did respond to an extra 50 pounds sidedressed. Across all 12 experiments, including some wet years, there was never a yield response to sidedressing when 240 pounds of nitrogen were applied preplant. These results are consistent with university recommendations, especially when the N is partly applied as a sidedress. In this case, farmers can consistently reach top yields with less than 200 pounds nitrogen per acre.

Phosphorus is probably the most excessively used nutrient in tobacco fertilization in Virginia. Repeated applications of larger quantities of phosphorus than plants can absorb with essentially no loss from leaching have resulted in a general buildup of this element. Fertilizer sales indicate that generally about twice as much phosphorus is used on tobacco as is needed. Based on a summary of soil analyses of tobacco fields by the Virginia Tech Soil Testing Laboratory, approximately 88 percent of the soils had a medium or higher phosphorus level. Present research indicates that 40 to 60 pounds per acre of P_2O_5 is adequate for tobacco if the soil test shows phosphorus to be medium or higher.

Potassium probably affects the quality or usefulness of the cured leaf more than any other element. Potassium is necessary not only for growth, but it also enhances the burning quality of tobacco. Potassium promotes the spread, or width, of the leaves and makes them light bodied. A deficiency of this element will be noticeable in the growing plant at the leaf tips and margins, which will have a bronze yellow appearance and tend to turn down or curl under. The tips of the leaves may deteriorate and fall off in the field, giving the tobacco a ragged appearance. Tobacco deficient in potassium is more subject to leaf diseases such as wildfire and brown spot.

The amount of potassium to apply for the burley crop may vary from about 100 pounds per acre of K_2O for soils testing in the upper high range of availability to 300 or more for soils testing in the low range.

Since high levels of chlorine in tobacco can result in poor curing and poor leaf characteristics (“wet dog”), you should use nonchlorine sources of potash, i.e. potassium sulfate (0-0-50) or potassium nitrate (13-0-44). Do not use muriate of potash (0-0-60). Do not apply than 30 pounds of chlorine per acre to burley tobacco.

Selecting the Fertilizer Grade

Once the N, P_2O_5, and K_2O requirements have been determined, you should consider the options available to supply the required nutrients at the most economical prices. The following table gives some of the available fertilizers blended for burley.

Nutrients Contained In:

	Amount	lbs/A		
Analysis	lbs	N	P_2O_5	K_2O
5-10-15	1000	50	100	150
8-16-24	1000	80	160	240
10-6-18	1000	100	60	180
11-6-20	1000	110	60	200
34-0-0	100	34	0	0
16-0-0	100	16	0	0
15-0-14	100	15	0	14
13-0-44	100	13	0	44

The analysis of a fertilizer gives the percentage of nitrogen, phosphorus (P_2O_5), and potassium (K_2O) contained in the material. The analysis determines the amount of nutrients supplied. For example, a 5-10-15 supplies 5 pounds of nitrogen, 10 pounds of phosphorus (P_2O_5), and 15 pounds of potassium (K_2O) for each 100 pounds of fertilizer. Custom blended fertilizer materials are available in most areas and can be used to meet fertility needs more precisely. By shopping for the best price, you can obtain a less costly fertilizer program.

Transplant Starter Solutions

Using soluble fertilizer materials in the transplant water has historically resulted in reductions in plant stand and stunted growth. The probability of such an effect is great enough to discourage the use of starter solutions. If any benefit is to be expected from their use, it would be the ready availability of phosphorus to the transplant when soil availability may be lacking. This would be most important in years with a cool, wet spring. In recent years, new materials with relatively high phosphorus levels have become available. In 1993, a study evaluated five of the many products available. The study evaluated starter fertilizers using both plant bed- and greenhouse-grown transplants. Treatments tested included the following.

Trt No.	Product	Analysis	Application rate
1	Untreated	-----	----
2	Exceed	10-10-10	2 qts/a
3	Jump-Start	8-31-4	2 qts/a
4	Charge	8-32-5	2 qts/a
5	Pro-Sol	10-52-8	10 lbs/a
6	Miller	12-48-8	10 lbs/a

The products tested differ in analysis (N:P:K) and no attempt was made to apply similar nutrient levels with each product. Products were applied at labeled rates; and therefore, nutrient levels are not equal among the treatments.

Measurement of plants in the field indicated that Treatments 3 through 6 (high P) resulted in more rapid early-season growth than observed with the low P fertilizer (Treatment 2) or untreated plants (Treatment 1). As plants neared topping stage, differences between the treatments tended to diminish. However, plants in Treatments 3 through 6 did come into top earlier than those in Treatments 1 and 2. There was no apparent difference in the response of plant bed- and greenhouse-grown transplants to the fertilizers. Research conducted previously has shown the benefit of available P on early-season growth; however, no benefit has been observed in the final yield of the crop. Such was the case with this study. There was no significant difference in the yield of any of the treatments for both plant bed and greenhouse transplants, regardless of the observed early-season growth effects (see Table 7).

Table 7. Topping and yield data for six transplant water treatments applied to plant bed- and greenhouse-float transplants, Southern Piedmont AREC, 1993.

Starter	Percent of plants topped by July 19		Yield (lbs/a)	
Fertilizer	GH	PB	GH	PB
Untreated	33	30	3456	3471
Exceed	23	30	3365	3400
Jump-Start	69	88	3094	3424
Charge	59	64	3440	3525
Pro-Sol	81	88	3122	3399
Miller	86	59	3169	3356

GH = greenhouse and PB = plant bed grown transplants

Liming

A liming program, based on a soil test, should be a part of the overall management program for burley tobacco production. According to a summary of soil analyses from the Virginia Tech Soil Testing Laboratory, approximately 31 percent of the tobacco fields in Virginia need liming. With the shift to higher analysis fertilizer grades containing less lime filler, there is a greater need to supply calcium and magnesium through a liming program. Calcium and magnesium can be obtained at a lower cost from lime than from fertilizers.

The desirable pH range for burley tobacco in Southwest Virginia is 5.8 to 6.2. Applying dolomitic lime when needed will lower soil acidity (raise pH) and reduce the exchangeable aluminum, which can be toxic to plants. Increasing the soil pH will also reduce the available manganese contained in the soils. The efficiency of plant uptake and use of phosphorus and other nutrients is increased when soils are properly limed. Since limestone contains magnesium and/or calcium, these nutrients are increased as lime is applied. The approximate amounts of limestone to attain a pH of 6.2 (on unlimed sandy, loamy, and clayey soils) are shown in the following table:

Approximate Amounts of Limestone to Attain a Desired pH of 6.2

pH of	Soil Type		
Unlimed Soils	Sandy	Loamy	Clayey
	--------Lime, Tons/Acre--------		
5.0	2.50	3.25	3.75
5.4	1.50	2.0	2.5
5.8	0.75	1.00	1.25

Lime should be applied as indicated by a soil sample. Tobacco fields should not be overlimed because of the possibility of increasing certain disease problems (black root rot and black shank) and causing an imbalance of certain micronutrients such as boron.

Manganese Toxicity

Acid soils increase the availability of manganese. This element, though essential for plant growth, may be taken up in sufficient amounts to be toxic to the plants. There usually is no trouble with manganese toxicity when the acidity level is pH 5.5 or higher, but it can be expected to occur if the soil reaction drops to pH 5.2 or lower.

Under conditions of manganese toxicity, the leaves of the plants take on a light greenish yellow to a pale white, mottled appearance

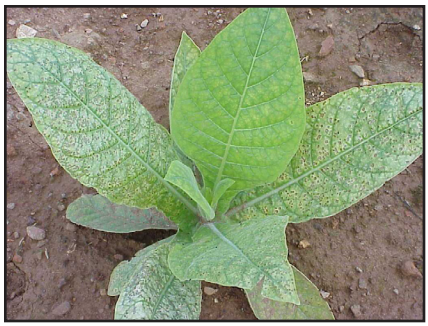

Figure 1. Manganese toxicity in burley tobacco

with dark green areas along the veins. The leaves also may appear to have a hard, semi-glossy surface. If the condition is not severe, the plants may seem to fully recover and return to normal appearance. Applying lime as a sidedressing cannot be expected to correct the trouble for the immediate crop.

Secondary Elements and Micronutrients

In addition to nitrogen, phosphorus, and potassium, burley tobacco requires sulfur, calcium, and magnesium to produce normal growth.

Sulfur is amply supplied to tobacco as a naturally occurring element in the soil, as a constituent of rain water, and as a chemical compound used in the preparation of fertilizers.

Land that has recently been limed to reduce soil acidity and has a pH between 5.5 and 6.0 should contain sufficient calcium for burley tobacco. It is not necessary to supply additional calcium in the form of fertilizer.

Since most tobacco fertilizers contain magnesium and nearly all ground limestone contains some magnesium, this element is usually supplied in adequate amounts through the normal fertilizing and liming practices.

Other elements needed in very minute amounts are boron, zinc, manganese, copper, iron, molybdenum, and chlorine. The soil types on which burley is produced contain these elements to some degree, and the recommended pH level favors their availability to the plant. Also, fertilizers contain varying quantities of these elements. There is no evidence at this time to indicate that the application of micronutrients should become a general practice in the fertilization of burley tobacco.

Method of Application

On a fertile soil, it makes little difference whether subsequent fertilizer applications are plowed under or broadcast and disked-in after plowing. Row applications in excess of 500 pounds per acre of high-analysis mixed fertilizer should not be used because of the danger of root injury.

Sidedressing burley tobacco is not generally recommended. However, sidedressing will be beneficial when nitrogen or potassium deficiency symptoms appear early in the season because of excessive rainfall or lack of fertilization before planting. Use about 50 pounds of nitrogen and/or 100 pounds of potash per acre, incorporated into the soil by cultivation.

Foliar Fertilization

Using water-soluble fertilizers as a foliar application has not been proven to increase yields. Research from the University of Kentucky showed no advantage other than greening up the crop.

TOPPING AND SUCKER CONTROL

Topping

Research has shown that burley tobacco benefits from early topping before the development of the full flower stage. Generally, you should try to top tobacco at the elongated-bud to early-flower stage. Allowing a crop to reach full flower throughout an entire field before topping results in reduced yield of a lower quality tobacco, more difficult sucker control, increased likelihood of plants blowing over in the wind, and decreased drought tolerance. Suckers greater than one inch long should be removed at topping.

Chemical Sucker Control

Three types of chemicals are currently available for sucker control. Growers must have a basic understanding of how the various chemicals work in order to use them successfully.

1. *Contacts* (fatty alcohols) quickly kill suckers by burning and must come in direct contact with the sucker buds to be effective. Suckers should turn brown within an hour after contact application. It requires a sufficiently concentrated solution of contact material to obtain adequate sucker control. Use a 4-percent solution or 2 gallons in 48 gallons of water.
2. *Systemic* chemicals or maleic hydrazide (MH) restrict sucker growth physiologically by stopping cell division. The only growth made after MH is applied is in the expansion of cells already present in the plant. Maleic hydrazide should be applied as a course spray to the upper 1/3 of the plant. MH should be applied in a total spray volume of 50 gallons per acre.

3. The *local systemic* (Prime+ and Butralin) stops cell division in a localized area and must wet the sucker buds in each leaf axil to be effective. Prime+ has no true contact activity and does not turn the sucker black. Treated suckers will have a yellow, deformed appearance.

SUGGESTED TOPPING AND SUCKER CONTROL PROGRAMS

The following topping and sucker control programs may be followed:

Program I. Early Topping with Contact and Systemic Chemicals

1. Apply a contact sucker control at a 4-percent concentration (2 gallons in 48 gallons of water or 5 ounces in 1 gallon of water) when plants reach the button stage.
2. A labeled rate of MH should be applied one week later. Alternatives to MH alone include:
   - A tank mix of Prime+ or Butralin at 2 quarts per acre with 1 to 2 gallons per acre of MH or 4 fluid ounces of Prime+ or Butralin and 16 fluid ounces of MH in 3 gallons of water.
   - FST-7 alone at 3 gallons per acre or tank mixed with Prime+ or Butralin (FST-7 is a commercial product combining MH with contact fatty alcohol).

Program II. Late Topping with MH Alone

Apply a labeled rate of MH when plants are in the elongated button to full flower stage. Remove all suckers greater than one inch long. Alternatives to MH alone include:

- A tank mix of Prime+ at 2 quarts per acre with 1 to 2 gallons per acre of MH.
- FST-7 alone at 3 gallons per acre or tank mixed with Prime+ (FST-7 is a commercial product combining MH with contact fatty alcohol).

Program III. Prime+/Butralin Individual Plant Method

Apply Prime+ with a dropline, backpack, or jug when plants reach the elongated-bud stage. Usually two or three trips are required to remove tops and treat all plants in the field. Individual plants should not be treated more than once. **You must comply with all label directions regarding worker protection standards (WPS).**

Precautions with contacts:

1. Apply when suckers are small (not over one inch long).
2. Never spray foam from tank; this will burn plants.
3. Do not spray extremely succulent tobacco (tobacco with a light green to creamy white bud area). This indicates a fast rate of growth.
4. Rain within an hour after application of contacts may reduce their effectiveness.
5. Avoid weak solutions of product (see Table 5). Contact solutions should be at least a 4-percent concentration in order to kill both primary and secondary suckers. It may be necessary to increase the concentration to 5 percent when applications are made under cool, overcast weather conditions.

Precautions with local systemics:

1. Rain occurring within 2 hours after spraying may reduce effectiveness.
2. Applications to leaning plants, wet plants, or wilted plants may reduce effectiveness.
3. Applications made before the elongated-button stage of growth may result in chemical topping or distortion of leaves that were too immature at time of application.
4. If suckers are not contacted by the material, they will grow vigorously and become very large.
5. Prime+ carryover residues may injure small grain and corn and have been reported to stunt early season growth of tobacco when used with dinitroaniline herbicides such as Prowl. A number of precautions have been added to the Prime+ label to apprise growers and applicators of the potential carryover and subsequent stunting of rotational crops that can occur if Prime+ is applied excessively. Fall disking and deep tillage are suggested to minimize this potential.

Precautions with systemics:

1. Do not apply during the hot part of the day when stomata are closed and leaves are wilted.
2. Rain within six hours after application of MH may reduce its effectiveness. Recent research by Seltmann in North Carolina showed that if a significant rain occurs more than three hours after application, only a half rate of MH should be reapplied to maintain good sucker control.

Butralin

Butralin is a local systemic material, similar to Prime+ in chemistry and use. The current label allows butralin to be applied with a boom type sprayer, knapsack, or jug application. Butralin should be mixed at 1.7 fluid ounces per gallon of water. One gallon of the mixture should treat approximately 200 plants. Larger quantities may be mixed with 2 quarts of butralin in 35 gallons of water. Butalin may be used alone or in combination with MH-30 or other maleic hydrazide containing products. According to label, if tank mixed with MH-30 the mixture should contain 1.5 to 2.0 gallons of MH-30 and 2 quarts of butralin in 50 gallons of water per acre. Applied alone, butralin should be applied at a rate of 2 to 3 quarts in 50 gallons of water per acre. If tank mixing butralin and MH-30 for knapsack sprayer, use 4 fluid ounces of butralin and 12 fluid ounces of MH-30 in 3 gallons of water. No matter which application method is used, apply as a course spray that provides adequate contact with each leaf axil.

EPA WORKER PROTECTION STANDARDS

Read and follow all label directions regarding EPA Worker Protection Standards (WPS). Proposed WPS rules will have a dramatic impact on how Virginia growers apply sucker control chemicals. Required personal protective equipment (PPE) and restricted-entry intervals (REI) following application will make hand application of Prime+ and contacts impractical. Hand topping following contact application provides the best level of sucker control, since the top serves to funnel the material down the stalk to contact each leaf axil. However, topping within the restricted-entry interval means workers must wear all required personal protective equipment to comply with WPS. Growers are also responsible for the instruction of early-entry workers on how to prevent, recognize, and give correct first aid for heat illness (too much heat stress).

ATTENTION!

Precautions

1. **RINSE OUT ALL SPRAY EQUIPMENT BEFORE USING IT WITH ANY SUCKER CONTROL MATERIAL.**
2. **Observe all restrictions and precautions on pesticide labels.**
3. **Store all pesticides behind locked doors, in original containers with labels intact.**
4. **Use pesticides at correct dosages and intervals to avoid excessive residues and injury to plants and animals.**
5. **Apply pesticides carefully to avoid drift.**

Suggestions for Application of Sucker Control Materials

Type of Product	When to Apply	Time of Day	Application Rate	Application Procedure
Contacts (fatty alcohols)	1. 1st appl. at 50% button 2. Later applications should be made 1 wk apart (if needed)	When plants are turgid and leaves dry (mid-morning to mid-afternoon)	3-4% solution or 2 gal in 48 gal of water and apply at 50 gal of spray material per acre.	Hand Application 20 psi max. and 1/2 to 2/3 fl oz per plant Power Spray 20 psi using 3 solid-cone nozzles per row (i.e. TG-5 and 2 TG-3's)
Prime+ or Butralin	1. Individual plants at elongated-button stage (droplines or jug application) 2. 7-10 days after 1st contact application	When leaves are dry	2% solution or 1 gal in 49 gal of water (2.5 fl oz of Prime+ per gal of water)	coarse spray (20 psi and TG-3 or 5 nozzle) or drench using jugs and apply 1/2 fl oz per plant.
Systemics (MH)	When used as part of sequential control program - apply 7 to 10 days after last contact application.	In morning, after leaf surfaces are dry. Do not apply during the middle of hot days (plants wilted).	1 1/8 to 2 1/4 lb of MH (3/4 to 1 1/2 gal of 1.5 lb/gal product) (1/2 to 1 gal of 2.25 lb/gal product) Apply 40 to 50 gal of spray material per acre.	40 to 60 psi using 3 hollow-cone nozzles per row (i.e. TX-18) Direct spray toward upper third of the plant.