

FERTILIZATION

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Proper fertilizer is important in managing a tobacco crop for good yields and highest possible quality at least cost. A soil test is an excellent way to determine the amount of nutrients needed for each field. It also helps to keep the pH near the optimum of 5.6-6.0. Field surveys have shown a significant number of fields with pH less than 5.6. Greater than ninety percent of the samples had P reading high or greater, while 90% or more of the samples had K readings medium or better. This indicates producers should pay close attention to soil testing and adding lime to get the pH into a desirable range. This should significantly help performance of rotational crops. Approximately one-third of the tobacco producers soil test on an annual basis. Fertilizing by soil test has proven to be extremely cost effective.

Most tobacco soils in South Carolina need 60-80 lb of nitrogen (depending on depth to clay), 40 lb or less of phosphorus (P_2O_5), and 120-140 lb of potassium (K_2O) per acre. Phosphorus and potassium should be applied according to soil test recommendations. Using more nutrients than needed is wasteful, increases production costs, decreases profit and adds to environmental concerns.

County agent surveys indicate 89 lb of N, 85 lb of P_2O_5 and 184 lb K_2O per acre were used on S. C. tobacco in 2005. The nitrogen rate has decreased from a high of 128 lb/A in 1977, but has increased in recent years.

TRANSPLANT WATER FERTILIZATION

The use of fertilizer in tobacco transplant water has traditionally been discouraged because of lack of crop response and potential crop injury. There has been recent interest in using transplant water fertilizer with greenhouse plants to help offset a reported slow start from these transplants. In 18 on-farm studies conducted in South Carolina using greenhouse grown transplants from 1994-1999, 50% showed an early season response to high phosphorus starter fertilizer applied in transplant water. In a couple of cases this resulted in earlier flowering. However, there was no positive yield or quality response to starter fertilizers. There is a potential for fertilizer salt injury with these materials especially when low volumes of water are used, extra fertilizer rates are used, or soil moisture is low. When other fertilizer materials like 16-0-0 or liquid N (30%) are used in transplant water severe injury may occur. Approximately 30% of South Carolina tobacco producers used starter fertilizer in 2006.

EFFECT OF EXCESSIVE NITROGEN

Nitrogen affects yield and quality more than any other nutrient. Too much nitrogen will increase sucker growth, delay optimum harvest time, increase the severity of some foliar diseases, lower quality, and even lower yields. Research in other states indicates that modern varieties are much more efficient at utilizing nitrogen than older varieties, and consequently, this factor should be considered when selecting a fertilizer program.

On-farm tests were conducted during 1985 through 2002 with various nitrogen rates. The recommended rate of nitrogen used at each location varied from 60 to 80 lb/A depending on topsoil depth. All treatments received a base rate of 667 lb/A of 6-6-18 with enough nitrate of soda added to give the various nitrogen levels. Yield and quality index are shown in the following table:

**ON-FARM NITROGEN TEST
1985-2002 (49 locations)**

NITROGEN	YIELD Lb/A	Q.I.	% UNRIPE & IMMATURE GRADE*
Recommended	2,739	62	66
Rec + 20 lb	2,819	60	75
Rec + 40 lb	2,755	58	79

* 2002 - 3 locations

Yield did not significantly increase beyond the recommended level of nitrogen. Highest rates decreased the quality index and raised the percentage of unripe and immature grades, thus causing the grade to become a third or fourth quality versus a first or second.

Sucker problems increase with excessive nitrogen. The following table shows an additional 20 lb/A of nitrogen increased sucker count by 15 percent, while 40 lb/A of additional nitrogen increased sucker number over 50%.

EFFECT OF EXCESSIVE NITROGEN ON SUCKER GROWTH-1993

NITROGEN RATE/A	SUCKERS NUMBER/A
Recommended	2,167
Recommended + 20 lb	2,500
Recommended + 40 lb	3,300

3 locations

EFFICIENT USE OF FERTILIZER NUTRIENTS

Tobacco growers should strive to get the most efficient use of fertilizer. This may be accomplished by (1) using high analysis fertilizer, (2) using only enough complete fertilizer to supply the needed nutrients, (3) matching applied nutrients with soil test results (4) applying all fertilizer at or after transplanting, and (5) applying all nutrients early.

Approximately 70 percent of South Carolina growers used 6-6-18 or another high analysis fertilizer in 2006. These growers recognize the economic advantage and the lower labor and transportation costs associated with high analysis fertilizer. Complete fertilizer supplies a basis on which to build. Most growers should be using enough complete fertilizer to supply approximately 40 lb of nitrogen/A plus adequate phosphorus and potassium. The remaining nitrogen should be supplied by one of the nitrogen sidedressing materials like nitrate of soda, calcium nitrate or their equivalent. In 2006, 81% of the growers used 15.5-0-0 as their sidedress material. Research has shown this system equal in yield and quality to using complete fertilizer to supply all nutrients. This system also saves money (2-3 cents/lb of tobacco).

Nitrate nitrogen used as a sidedress material has been popular in the past. Recent studies illustrate that numerous nitrogen sources produce quality cured leaf. The actual cost of each nitrogen source should be considered. The following tables compare various nitrogen sources as sidedress materials.

**EFFECT OF NITROGEN SIDEDRESSING MATERIAL
ON FLUE-CURED TOBACCO*
1988-90 (8 Locations)**

MATERIAL	YIELD (lb/A)	Q.I.
16-0-0	2623	61
15-0-14	2615	59
15.5-0-0	2560	62
34-0-0	2529	58
46-0-0	2556	59

*All treatments received 667 lb/A of 6-6-18. Remainder of nitrogen up to recommended level came from sidedress materials.

**VARIOUS SIDEDRESS MATERIALS USED
ON FLUE-CURED TOBACCO
1999-2002 (12 Locations)**

SIDEDRESS MATERIAL	YIELD (lb/A)	Q.I.	PRICE (\$/cwt)
16-0-0	2679	64	173
15-0-14	2670	64	173
30% N	2569	64	173
S-24	2641	64	173
6-6-18	2643	63	172

- a. All plots received 667 lb of 6-6-18; remainder of nitrogen up to recommended level came from sidedress materials.
- b. All materials were equally effective in producing quality cured leaf.

As indicated earlier, greater than 90% of the tobacco soils test high or above in phosphorus. Twenty to 40 lb per acre of phosphorus fertilizer is recommended on these tobacco soils. The table below shows data from tobacco tests grown on high phosphorus soils. This data shows no response to adding greater than 40 lb/A phosphorus. These results indicate that producers can save money, fertilizer nutrients and be environmentally sound by fertilizing tobacco according to soil tests.

**EFFECT OF PHOSPHORUS FERTILIZER ON YIELD AND QUALITY
OF FLUE-CURED TOBACCO**

9 Locations On-Farm Test 1989-91, 2003-2004

FERTILIZER GRADE	LB P₂O₅/A	YIELD (lb/A)	Q.I.
1-0-3	0	2323	64
1-1-3	40	2384	66
1-2-3	80	2295	64
1-3-3	120	2473	67

**BLEND VS. AMMONIATED FERTILIZER
1994-96 (6 locations)**

FERTILIZER	YIELD (lb/A)	Q.I.	PRICE (\$/lb)	VALUE (\$/A)
6-6-18 Ammoniated	2917	71	176	5142
6-6-18 Blend	2830	72	176	4971
3-9-9 Blend	2997	69	175	5262
6-18-18 Blend	2970	74	177	5265
	NS	NS	NS	NS

There is little difference in yield and quality of tobacco when using blends versus ammoniated fertilizer.

Most South Carolina growers delay application of fertilizer until a week after transplanting. This decreases fertilizer injury, lessens the chance of leaching before transplanting, improves fertilizer efficiency, and provides flexibility for the grower if replanting is necessary.

All nutrients should be applied by the third to fourth week after transplanting. Avoid late applications of nitrogen at layby. The results of on-farm tests indicate a decrease in yield and value when nitrogen is applied later in the season.

ADJUST FOR LEACHING

Recommended rates of nitrogen range from 60 to 80 pounds per acre under most conditions. When excessive amounts of rainfall occur from transplanting until about the 7th week, additional nitrogen may be necessary. A good practice is to have a rain gauge near each field and record rainfall daily. Sandy soils leach more readily than heavier soils. **DO NOT OVER-ADJUST!** Foliar fertilizers supply small amounts of nutrients, are therefore expensive, and may lower quality if used in an attempt to compensate for leaching losses.

PERCENT OF NITROGEN (N) TO BE REPLACED¹

DEPTH TO CLAY	INCHES OF ² EXCESS WATER	WEEKS AFTER TRANSPLANTING		
		1-3	4-5	6-7
Less than 12" (Total N needed = 60 lb)	1	0	0	0
	2	20	10	0
	3	30	20	0
12-16" (Total N needed = 70 lb)	1	30	20	0
	2	45	30	10
	3	60	40	15
Over 16" (Total N needed = 80 lb)	1	50	25	15
	2	75	35	20
	3	100	45	25

¹ Apply 1 pound of potassium per pound of nitrogen when adjustments are made.

² Excess water is that amount moving through the soil after the soil has reached its water-holding capacity. Subtract the estimated amount of water that runs off the field from the total rainfall to determine excess water.

SOIL MOISTURE MANAGEMENT

The quality and chemical composition of flue-cured tobacco is determined by the interaction of nitrogen, sugar, and soil moisture. Ideally, nitrogen should be depleted about the time flowering occurs. As nitrogen is depleted, sugar accumulation begins. Dry spells 30-60 days after transplanting have pronounced effects on yield and quality of flue-cured tobacco, as nitrogen uptake and metabolism is limited. Normal nitrogen-sugar metabolism is delayed, thus preventing normal ripening of the tobacco. When cured, this tobacco has less than desirable physical and chemical characteristics.

Factors that may improve soil moisture availability include in-row subsoiling and supplemental irrigation. Irrigation of tobacco would improve quality and yield and promote a normal maturing crop. Tobacco grown on Coastal Plain soils usually responds less to irrigation than that of the Sandhills, but surveys in neighboring states indicate, in an average year, yield and value/lb could improve 10-15%. In a severe drought, like 2002, yield and price/lb might improve 25% or more with irrigation. Irrigation allows timely maturity and thus helps keep sucker control, harvesting, curing and marketing on schedule. North Carolina data indicates it costs \$11.45/A to irrigate tobacco one time. In addition, the fixed cost based on a 72 acre traveling gun system would be \$67/A.

For irrigation of tobacco, a dependable supply of clean water is a must. The water can come from ponds, streams, or wells and should be free of plant disease organisms and high levels of chemicals, such as sulfur and chloride. Water should be tested prior to use.

A practical irrigation system for South Carolina producers is some type of traveling gun. At transplanting and the layby to flower stage are the most critical periods of drought stress for tobacco. A light irrigation (about .5 inch) usually proves beneficial at transplanting. In the knee high to bloom stage, a drought can drastically affect yield and quality of the crop, and tobacco will need about 1 inch of water per week. Begin irrigation when 50% of the available soil moisture is depleted during this stage. Irrigate at the after transplant to knee high and after flowering stage only when severe drought and wilting occur. Irrigation of tobacco would have been of tremendous benefit in 1980, 1986, 1990, 1993, 1998, 1999, and 2002 in South Carolina. Approximately 5.0% of South Carolina's tobacco crop was irrigated in 2006.