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FIELD TESTS OF SOME LIMING TREATMENTS FOR GROWING BURLEY TOBACCO ON ACID SOILS

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A major problem in the production of tobacco on acid soils in Kentucky is manganese toxicity, despite the fact that it can be easily prevented. Since manganese toxicity is caused by high levels of soil acidity, prevention of soil acidity by liming is the best method of control. And soil testing is the only way to determine how acid a field has become.

Ideally, a good plan is to follow a crop rotation of 2 years grass-legume sod followed by 2 years tobacco and to apply lime immediately after the last tobacco crop in the rotation in sufficient amounts to maintain soil pH adequately (pH around 6.5) for legumes during the sod part of the rotation. For land which is kept in continuous tobacco, the best practice is to take a soil sample during late summer so that if results show need for lime, it can be applied and worked into the field when seeding the winter cover crop.

In reality, however, many growers either lime indiscriminately or not at all, and become aware of their problem only after planting the crop and severe manganese toxicity damage has occurred. Others wait until spring to have their soil tested, and then apply lime too late for obtaining the most benefit from its use.

A few field tests have been conducted during the past few years to test the effectiveness of fall and spring application of lime for production of burley tobacco. Table 1 shows yield results obtained on an extremely acid soil (initial pH was 4.7) in one experiment conducted in Ohio County.

As shown, plants did not survive without use of lime before transplanting. With lime, good yields were obtained, the fall application giving somewhat higher yields than the spring applications. Even though yields were good, soil pH in all plots at the end of the growing season was still very acid. Either there had not been enough neutralization by the ag lime to raise pH appreciably within 6-12 months time, or the rate (4 or 6 T/A of ag lime) was insufficient. The notable point is that even though there was only slight increase in soil pH from the ag lime treatments, good yields were obtained where it was used as contrasted to no yields when lime was not used.

Table 1. Effect of Time, Source, and Rate of Lime Application on Burley Tobacco - Ohio County, Kentucky, 1974.

Treatment	Soil pH (Fall, 1974)[1]	Yield (lbs cured leaf /A)
No Lime	4.0	0[4]
Ag Lime in Fall, 1973 (4 T/A)[2]	4.9	2943
Ag Lime in Spring, 1974 (4 T/A)[2]	5.0	2752
Ag Lime in Spring, 1974 (6 T/A)	5.0	2798
Hydrated Lime in Spring, 1974 (2.68 T/A)[3]	-	2729
Hydrated Lime Sidedressed in Summer, 1974 (0.5 T/A)	-	0[5]

data Av. 3 reps/tmt

[1]Initial soil pH 4.7 in fall of 1973.

[2]Rate recommended on basis of soil test

[3]Rate is 2/3 that of Ag lime

[4]Plants died soon after transplanting due to extreme acidity

[5]Even though some plants were alive when sidedressed, all died.

Another test was conducted during 1976 on a soil in Franklin County which was not as acid initially as the soil in Ohio County. Results from this study are summarized in Table 2. As shown, a significant yield increase was obtained from use of lime in the spring on an initially moderately acid (pH 5.5) soil. Even the 1,000 lb/A top-dressing of fine lime on July 1 when plants were 12-18 inches tall was effective. Since the plots which were summer topdressed had received no lime prior to July 1, their pH and leaf content of manganese should have been similar to that of the no-lime treatment just prior to the July 1 topdressing. And as indicated by the leaf content of manganese on July 1, there was considerably more manganese in plants growing on unlimed plots than on limed plots. Visual manganese toxicity symptoms of plants appeared before July 1, but it was not judged to be severe. This is reflected in the leaf content of manganese which, although much greater in unlimed (186 ppm manganese) than in limed plots (50-65 ppm manganese), is not as great as that (above 500 ppm manganese) commonly found in leaves of plants showing severe manganese toxicity.

In addition to its effect on leaf yield and manganese concentration, liming also increased leaf calcium and magnesium and slightly decreased leaf phosphorus and potassium. The most marked effect was on molybdenum concentrentation, with molybdenum concentration from the fine lime treatment being nearly double that of no lime. Other U.K. research has shown that leaf level of molybdenum should be around 0.40 ppm.

Results from this study point out that although spring liming of acid soils for burley tobacco production is not considered the best liming practice, it is better than not liming at all--even on a soil just moderately acid (pH 5.5). And even a light (1000 lbs/A) application of finely ground lime broadcast over the field and worked-in between the rows after visual manganese toxicity occurred was measureably better than not liming at all.

There are basic principles which should be followed in liming, particularly when fast reaction is desired (such as spring liming for tobacco). That is, the lime should be mixed with the soil as thoroughly as possible rather than broadcast and turned under. Application after plowing but before discing is a practical way to get good mixing in situations where ground is plowed. If large amounts are to be applied, lime can be mixed deeper into the rooting zone by plowing under half the lime, then broadcasting the remaining half and discing it in. The later a person waits to lime before he plants a crop, the more important it is to do as thorough a job as possible in mixing lime into the soil so that acidity around roots of young plants or seedlings will have been somewhat neutralized before seeding or planting.

From the studies reported here, it was concluded that ag lime is just as effective as fine lime or hydrated lime when these are applied in the spring. Sidedressing with 1000 pounds per acre of finely ground lime gave an equal response to spring application of ag lime on a moderately acid soil (pH 5.5) when it was applied after manganese toxicity was observed in the field. Sidedressing, however, was not effective when the soil pH was initially extremely acid and when manganese toxicity symptoms were very severe. Sidedressing with lime to correct soil acidity and manganese toxicity in tobacco should be done only as a last resort.

Manganese toxicity in tobacco is by no means the only problem caused by acid soils, although it is often the first sign of trouble that the grower observes. The soil pH influences the availability of many nutrients to the growing plant. When soils become too acid, the improper balance of plant nutrients may effect yields long before the warning sign of manganese toxicity is observed. Therefore, control of soil acidity has a very favorable influence on the production of high yields and quality tobacco.

K. L. Wells
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Table 2. Effect of Lime on Yield of Burley Tobacco Grown in Acid Soil - Franklin Co., Ky. - 1976[1/]

Treatment [2/]	Soil pH(0-6")		Soil Manganese during season (ppm)	Leaf Content during season[5/] (July 1)						Yield Lbs Cured Leaf/A
	Before liming and fertilizing (April 2)	During growing season (July 1)	(July 1)	%				ppm		
				P	K	Ca	Mg	Mn	Mo	
No Lime	5.5	5.0	23	0.32	5.10	3.50	0.27	186	0.35	2291
Spring Applied Ag Lime (3.5 T/A[3/]	5.5	5.2	14	0.27	4.13	4.37	0.26	65	0.40	2497*
Spring Applied Fine Lime (3.5 T/A)[3/]	5.6	5.6	11	0.28	3.83	3.80	0.47	49	0.60	2191
Fine Lime Topdressed July 1(0.5 T/A)[4/]	5.7	---	--	----	----	----	----	---	----	2483*

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[1] Av 3 reps/tmt

*Significantly different from check

[2] All tmts received 260 lbs N/A

[3] Broadcast (recommended rate) over plowed land (April 2) and disced into soil

[4] Broadcast over tobacco (July 1) and roto-tilled into soil

[5] P=phosphorus; K=potassium; Ca=calcium; Mg-magnesium; Mn-manganese; Mo-molybdenum