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The Effect of Rate and Source of Potassium Fertilizer on Cured Leaf Yield of Burley Tobacco and Leaf Content and Soil Test Levels of Potassium and Magnesium

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In response to questions being asked by tobacco growers about the effectiveness of sulfate of potash magnesia (SPM; 21% K_2O and 11% Mg) as compared to sulfate of potash (SP; 50% K_2O), field studies were conducted during 1993-1994 to compare the two potassium (K) sources for use on burley tobacco. Any effect of SPM on yield of tobacco should be due to Mg since the only difference between the two sources in kind of nutrient contained is the presence of magnesium (Mg) in SPM. To compare the two K sources, we selected field sites low enough in soil test K levels that normally would result in increased tobacco yields due to application of fertilizer K.

Field Studies Conducted

Studies were conducted on two contrasting soils (Maury silt loam and Lowell silt loam) in Scott County, Kentucky in 1993. The Maury soil is representative of the deep, well-drained limestone-derived upland soils of the Inner Bluegrass Area, and the Lowell soils are representative of the deep, well-drained limestone/shale derived upland soils of the Outer Bluegrass and Hills of the Bluegrass Regions.

In these two trials, there was no significant yield response to either K or Mg application on the Maury soil, despite the initially low level of soil test K. While there was a significant (p = .10) yield response to applied K on the Lowell soil, the higher average yields for the SPM treatments were not significantly different (statistically) from the SP treatments at 200 and 400 lbs K_2O/acre.

Two sites were selected for more detailed studies in 1994. A Lowell silt loam soil was selected in Scott County, KY, located very near the same field in which the 1993 study had been conducted. Although the field was normally in a rotation of 2 years tobacco and 2 years of sod and had been in tobacco during 1992 and 1993, it was kept in tobacco in 1994 to enable the study to be conducted. An Allegheny loam soil was located in Pendleton County, KY, for a similar study. The Allegheny soils are deep, well-drained, terrace position soils developed in old alluvial deposits.

Treatments of K-source and rates of K and Mg were established in a randomized block experimental design with 4 replications. Individual plots were 4 rows wide and 40 ft long. The K fertilizers were broadcast by hand and then disked into the soil just ahead of transplanting the tobacco. The tobacco producer at each site applied all other nutrients needed except for K, onto the experimental area. Yield was measured by weighing the cured leaf from 5 sticks (30 stalks) from the 2 center rows of each plot and extrapolatingthe average leaf weight per stalk to an acre basis. Cured leaf composition of K and Mg and soil test levels of K and Mg after harvest were also determined. Leaf composition was determined from a composite sample of 10 leaves randomly selected while stripping from stalk positions above the flyings. Soil samples were taken from each individual plot immediately following harvest.

Data collected in 1994 for the Lowell and Allegheny soils are summarized in Tables 1 and 2. Correlation coefficients for various comparisons of yield, leaf content, and soil test levels of K and Mg are shown in Table 3. The results show that there was no leaf yield response to fertilizer K or Mg on the Lowell soil. The somewhat lower than usual yields from this field were attributed to a possible low-level build up of black root rot disease organisms in the soil from not rotating out of tobacco after 2 years. Results from previous field studies in the Hills of the Bluegrass Area would have indicated a likely possibility for a K response, even at a soil test K level of 322 lbs/A, on similar soils. Application of Mg did increase soil test and leaf content of Mg as shown by the highly significant relationship between soil test Mg and leaf Mg in Table 5. Soil test K levels were also increased by increased rates of K fertilization, and this also resulted in a highly significant effect on content of leaf K. Despite these effects, neither soil test levels nor leaf content of K and Mg significantly affected yield of cured leaf at this site.

On the Allegheny soil, there was a significant effect of K rates on leaf yields, as shown in Table 3. However, leaf yields were not increased by the addition of Mg, even though Mg fertilizer did increase soil test levels and leaf content of Mg as compared to no Mg at the 400 and 600 lb K_2O/A rates. As shown in Table 5, soil test K levels significantly affected leaf K levels and leaf yields, and leaf K content was significantly correlated with leaf yields. Although soil test Mg was not well correlated with leaf yield, it was significantly correlated with leaf content of Mg. Leaf content of Mg was not significantly correlated with yield. At this site, there was a significant effect of increased soil test K levels depressing leaf content of Mg, even though this did not affect leaf yields.

Table 1. Effects of K rate and source on cured leaf yield, cured leaf content, and soil test levels of K and Mg - Lowell soil, 1994.

	lbs/A Applied		*lbs/A*	*Leaf Content (% DM)*		*Soil Test Levels (lbs/A)**	
K-Source	*K_2O*	*Mg*	*Leaf Yield*	*K*	*Mg*	*K*	*Mg*
--	0	0	2120	3.47e	0.57c	382c	210b
SPM	100	52	2349	3.86de	0.56c	393c	244b
SP	200	0	2317	4.14cd	0.45d	402c	193b
SPM	200	104	2293	4.35bcd	0.67b	532b	372a
SPM	300	156	2192	4.61bc	0.75a	528b	406a
SP	400	0	2094	4.77ab	0.47d	588b	202b
SP	600	0	2361	5.27a	0.43d	727a	195b
	LSD (p = 0.05)		NS	0.59	0.07	94	58
	cv (%)		14	9	8	13	15

Averages followed by the same letter are not different
* Av. from samples taken immediately after harvest; initial soil test levels from a field composite sample taken in March: pH 6.6, P 127, K 322, Mg 194.

Summary

Results from 4 field trials conducted to test the effect of Mg fertilization on tobacco production showed no significant yield increase due to the Mg. The use of fertilizer Mg did increase both soil test level and leaf content of Mg. We concluded from these studies that there is no difference in the effect of SPM on tobacco yields from that obtained with use of SP.

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Table 2. Effects of K rate and source on cured leaf yield, cured leaf content, and soil test levels of K and Mg - Allegheny soil, 1994.

	lbs/A Applied		*lbs/A*	*Leaf Content (% DM)*		*Soil Test Levels (lbs/A)**	
K-Source	*K O*	*Mg*	*Leaf Yield*	*K*	*Mg*	*K*	*Mg*
0	0	0	2477c	1.98e	1.27a	147c	397bc
SP	200	0	2959ab	3.35c	0.99b	195c	400bc
SP	400	0	3193a	4.31b	0.88bc	359b	399bc
SPM	400	210	2994ab	4.33b	1.01b	337b	473ab
SP	600	0	2908b	5.13a	0.76c	477a	351c
SPM	600	315	3060ab	4.79ab	1.01b	404ab	541a
	LSD (p = 0.05)		241	0.53	0.17	94	97
	cv (%)		5	9	11	20	15

* Av. from samples taken immediately after harvest; initial soil test levels from a field composite sample taken in March: pH 6.2, P 118, K 278
Averages followed by the same letter are not statistically different.

Table 3. Relationship between soil test levels , leaf content , and yield

	Correlation Coefficient	
Comparison	*Allegheny Soil*	*Lowell Soil*
Soil Test K vs Yield	0.47 *	0.07 NS
Soil Test K vs Leaf K	0.86 **	0.77 **
Leaf K vs Yield	0.59 **	0.23 NS
Soil Test Mg vs Yield	0.33 NS	-0.07 NS
Soil Test Mg vs Leaf Mg	0.50 **	0.82 **
Leaf Mg vs Yield	-0.27 NS	-0.15 NS
Soil Test K vs Leaf Mg	-0.53 **	-0.18 NS

Soil test levels of K and Mg immediately following harvest
Content (% DM) of cured leaf
Yield of cured leaf, lbs/A
* = significant at p = 0.05; ** = significant at p = 0.01; NS = non-significant

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