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AGRONOMY NOTES

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Effect of Fertilizer Rates and Placement Practices on Yield of Burley Tobacco

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Management of fertilizer practices in production of burley tobacco is very important in control of manganese (Mn) toxicity of the crop. In addition to the use of agricultural limestone, the use of fertilizers in the appropriate amounts, the appropriate kinds, and in the appropriate manner can strongly influence acidity in the rooting zone during the growth of burley. Studies of these effects have made up a major thrust of the University of Kentucky's research programs on fertility of burley, and have largely been conducted by J.L. Sims and his students during the past 15 years.

Generally, results from this work have shown that early growth of burley (0-45 days) is better when nitrogen (N) and potassium (K) fertilizers are largely kept away from the setter row at transplanting as compared to the common practice of pre-plant plowdown or disked-in broadcasted fertilizer. This improved early growth response has been shown to be related to the higher soil pH and lower fertilizer salt concentration of the root zone in band treatments, thereby lowering soil Mn solubility as compared to broadcasting the large amount of acid-forming fertilizers commonly used. Experiments in this regard have shown that soil pH can drop 0.5 to 1.0 unit after broadcasting incorporation of such large amounts of fertilizer, and that this fertilizer-induced acidity persists throughout most of the growing season. Tests conducted on banding fertilizers to the side of the setter row a few days after transplanting have resulted in lower plant Mn concentrations, in faster early season growth, and shorter time to maturity.

Cured leaf yields were increased by banding 10 to 12 inches to the side of the row in many, but not all of these experiments. Results from these early experiment station studies were promising enough that we field tested some fertilizer management practices in grower's fields under the same field management used by the grower. Our objective was to test the effectiveness of fertilizer rate and placement on yield of burley under actual on-farm conditions. The results described below were obtained from two experiments tested on grower's fields in Anderson County, Kentucky.

EXPERIMENT I

Experimental Procedures

This experiment was conducted for 3 years (1984-86) on an Elk silt loam soil of 3-6% slope. The grower was Mr. Billy Shelton, of Lawrenceburg, Ky. Initial soil test of the experimental site was pH 5.7; Bray's #1 P 200+; and neutral ammonium acetate replaceable K 229. The objective was to determine the effect on yield of banding some or all of the fertilizer to the side of the setter row as compared to broadcasting all the fertilizer. Three main placement treatments were tested: (1) all fertilizer (280-0-250 N-P₂O₅-K₂O) broadcast and disked in just ahead of setting, (2) 1/3 of the fertilizer broadcast and disked in just ahead of setting with the remaining 2/3 banded 12 inches to the side of each row 10 days after transplanting, (3) all fertilizer banded 12 inches to the side of each row 10 days after transplanting. These main treatments were split, with half of each treatment receiving a setter water fertilizer (3 gal/A of 7-14-7) treatment and half receiving no setter water fertilizer. Each treatment was replicated 4 times in a randomized block design. Subplots were 4 rows wide (13.33 ft) and 50 ft. long. The center of each 4-row plot was a stick row, and after cutting all plots, 5 sticks (30 stalks) were taken from the stick row in each plot, tagged, cured, stripped, and weighed. Cured leaf weights per subplot were then calculated, based on average cured leaf weight per plant and number of plants per acre. All management, except for the fertilizer treatments was applied by the grower just as he would routinely produce tobacco. This included liming the field (3 T/A) in March, 1984. Yield data from this 3-year study are shown in Table 1.

Table 1. Effect of Fertilizer Placement and Use of Starter Fertilizer on Yield of Burley Tobacco.

Placement ¹	-----Pounds Cured Leaf/A-----							
	Without Starter				With Starter ²			
	1984	1985	1986	3-Yr. Av.	1984	1985	1986	3-Yr. Av.
All Broadcast	3519	3756	4056	3777	3280	3920	4292	3831
1/3 Bdcst, 2/3 Banded	2768	3103	3605	3159	3588	3512	4077	3726
All Banded	3041	3103	3648	3264	3280	3675	3970	3642
Av.	3109	3321	3770	3400	3383	3702	4133	3733

¹ 280-0-250 lbs N-P₂O₅-K₂O per acre per year, using ammonium nitrate and potassium sulfate.

² 3 gals 7-14-7 per acre per year (2.3-4.6-2.3 lbs N-P₂O₅-K₂O/A).

Results

As the data show, excellent yields were obtained during all 3 years of this experiment. Broadcast fertilizer yielded more than the all banded or split application treatments during all 3 years when no setter water fertilizer was used. When setter water fertilizer was used, yields were always higher, regardless of main fertilizer placement, except for the split treatment in 1984. Broadcast fertilizer placement yields were also higher than banded placement yields when setter water fertilizer was used except in 1984.

Average of the 3-year results from this study on a deep, well-drained Elk silt loam soil showed a yield response to use of setter water fertilization regardless of fertilizer placement. Also, 3-year average yields from the broadcast placement were higher than for banded placement, especially without use of setter water fertilizer. Yield results indicate that Mn toxicity from broadcast application of all fertilizer was not a problem at this site, probably due to the 3T lime per acre applied in March 1984, just prior to initiation of the study.

EXPERIMENT II

Experimental Procedures

This experiment was conducted for 2 years by James Stevens of Lawrenceburg, Kentucky, (1985-86) on a Mercer silt loam soil with initial soil test values of pH 6.4, Bray's #1 P 114 lbs/A, and neutral ammonium acetate replaceable K of 265 lbs/A. The fertilizer recommendation for burley tobacco at this soil test level was 300-0-300 lbs N-P₂O₅-K₂O per acre. The objective of this test was to determine (1) if banding fertilizer influenced yields, and (2) if rate of recommended fertilizer could be lowered from a band placement as compared to broadcast application. Main fertilizer treatments were banded 12 inches from the setter row or broadcast and were split with 3 rates of fertilizer. Each treatment was replicated 4 times in a randomized block design. All treatments received setter water fertilizer (3 gal/A of 7-14-7) at transplanting.

Plot size and harvesting procedure was the same as these for experiment I. Except for fertilizer placement and rates, the plots were managed by the grower in the same manner as normally used in tobacco production. Yield data from this 2-year study are shown in Table 2.

Table 2. Effect of Fertilizer Placement and Rate on Yields of Burley Tobacco.

Fertilizer Rate ¹	Fertilizer Placement					
	Broadcast at Transplanting			Banded After Transplanting ²		
	1985	1986	2-Yr. Av.	1985	1986	2-Yr. Av.
-----1bs Cured Leaf/A-----						
150-0-150	3633	2695	3164	3815	2532	3174
225-0-225	3633	2777	3205	3815	2654	3234
300-0-300	3125	2777	2951	3597	2858	3228
Av.	3464	2750	3107	3742	2681	3212

¹ Lbs N-P₂O₅-K₂O/A/yr. All treatments received 3 gal/A of 7-14-7 in the setter water² at transplanting.

² Banded fertilizer was applied 10 days after transplanting.

Results

The recommended rate of fertilizer (300-0-300) reduced yields in 1985 when broadcast rather than band placement was used, indicating that Mn toxicity (not visually observed during the season) may have been the reason. There was no difference in yields between the two lower rates of fertilizer in 1985, and both were higher than from the 300-0-300 rate in both band and broadcast treatments. Yields were lower in 1986 due to dry weather following transplanting and throughout the growing season. There was little yield difference among fertilizer rates when all fertilizer was broadcast. However, there was a rate response to banded fertilizer, the high rate yielding better probably because of dry growing conditions limiting root growth and K movement. Average of the 2-year results from this experiment indicated the 225-0-225 rate, either broadcast or banded, to have yielded better than the 300-0-300 recommended rate.

SUMMARY

Cured leaf yields were higher when N and K fertilizer was broadcast than when banded in Experiment 1 on Elk soil. In contrast, band treatments were equal to or slightly higher than broadcast treatments in Experiment 2 on Mercer soil. Reasons for these differences aren't known with certainty, but may be related both to a lessening of Mn toxicity by band applications in Experiment 2 and to differences in initial soil test levels for K. Initial soil test K was medium on Elk soil but high on Mercer soil. On soils testing low or medium in P or K, the soil may not be capable of supplying sufficient early nutrition while plant roots are growing out to the fertilizer placed 12 inches to the side of the row.

These data suggest, together with that from other experiments, that most N should be banded 10 to 12 inches to the side of the row after transplanting while most K (and probably P) should either be broadcast preplant or placed sufficiently near the row for best early nutrition.


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