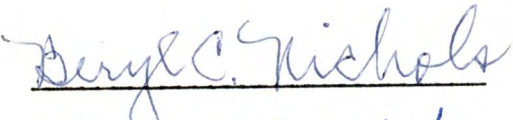
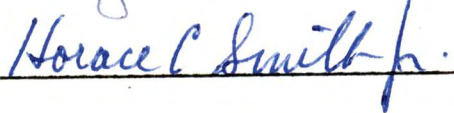


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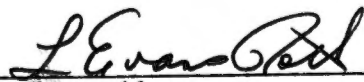
I am submitting herewith a thesis written by Joseph Edward Moore, Jr., entitled "Burley Tobacco Yield, Quality and Chloride Content as Affected by Muriate of Potash Applications at Different Times before Transplanting." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Plant and Soil Science.


Larry Parks, Major Professor

We have read this thesis and
recommend its acceptance:

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BURLEY TOBACCO YIELD, QUALITY AND CHLORIDE CONTENT AS
AFFECTED BY MURIATE OF POTASH APPLICATIONS AT
DIFFERENT TIMES BEFORE TRANSPLANTING

A Thesis

Presented for the

Master of Science

Degree

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Joseph Edward Moore, Jr.

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ABSTRACT

This investigation was conducted to study the effects of varying rates of muriate of potash applications at three times prior to transplanting on burley tobacco yield, quality and leaf and stalk chloride content. The experimental design was a randomized complete block with four replications of each treatment.

Tobacco leaf chloride levels indicated that the general trend was for chloride to decrease from the bottom to the top of the stalk. Regardless of time of application, the muriate of potash treatments increased chloride levels in all instances. Lower leaf chloride levels were noted in the 100 pounds K_2O/A as KCl applied in October.

Tobacco stalk chloride levels were significantly higher in the top of the stalks at harvest and at stripping. Generally soil chloride levels were highest in the muriate of potash treatments applied in February and prior to transplant. Substantial leaching losses occurred in the October applications of 100 and 300 pounds K_2O/A as KCl .

The cured tobacco leaf yield indicated that the sulfate and muriate forms of potash resulted in comparable yields. The 1977 growing season produced low yielding, inferior quality leaf, regardless of source or time of potash application.

The dollar per acre and dollar per hundred weight values, which were used as quality indicators in this study, showed no significant differences as related to source or time of potash application.

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CHAPTER I

INTRODUCTION

Previous studies have shown that the chloride ion in muriate of potash fertilizer is detrimental to the curing and leaf burn of tobacco. Recent shortages of potassium sulfate have resulted in a desire to find alternatives to this source of potassium. The muriate form of potash being the most economical and abundant source was a logical alternative. This investigation was conducted to study the uptake of the chloride ion in the leaves and stalks as affected by muriate of potash applications prior to transplanting. Soil chloride levels were also monitored to determine the amount of leaching taking place within the soil profile while varying dates of potash application.

Another objective was to determine yield and quality responses to the various fertilizer treatments and dates of application.

CHAPTER II

REVIEW OF LITERATURE

As early as 1688 Clayton recognized that the combustibility of tobacco was impaired when grown near the sea. In 1860, Schloesing reported that potassium enhanced the leaf burn of tobacco. From the standpoint of degree of importance, potassium influences leaf-burn the most, and it was the only nutrient that influenced it positively (Attoe 1945, Peterson 1964). It was shown in 1883 by Nesslerer that the addition of chloride as a soil amendment was deleterious to tobacco leaf burn. Tobacco growers in Holland were cautioned to avoid use of potassium salts or farm manures likely to be high in chlorides in 1879 (Mayer 1890). The influence of the chemical constituents in the tobacco leaf that had a negative effect on leaf-burn were in the order of: chloride, sulfate, magnesium, nitrate nitrogen, total nitrogen (Peterson 1964), calcium and phosphorus (Johnson 1944).

The magnitude of the influence of fertilizer applied chloride, in the form of muriate of potash, varies with soil type, amount of rainfall, and the moisture-holding capacity of the soil (Garner et al. 1930). The tobacco plant (Nicotiana tabacum L.), has the capacity to absorb chlorides in direct proportion to its concentration in the soil (Myhre et al. 1956, Neas 1959, Reisenauer 1950, Vickery et al. 1940). It was not until 1954 that chloride was recognized as an essential micronutrient (Broyer et al. 1954). This essentiality

can be evidenced in the role of chloride and manganese ions in the electron transport system during photosynthesis (Negbi et al. 1975). Uptake of the chloride ion was more rapid than that of sulfate, even though most plants need more sulfate than chloride, since sulfur is incorporated into amino acids (Swanback and Anderson 1947).

The ability of tobacco to burn with a glow has been an important quality in all forms of smoking tobacco because of its bearing on the fire-holding capacity, aroma, flavor, and character of the resulting ash (Johnson et al. 1944). About 80% of the variation in leaf-burn of tobacco has been accounted for on the basis of its content of potassium, chloride, sulfate-sulfur, magnesium, nitrate-nitrogen, phosphorus, and calcium (Peterson 1964). The combustion product of potassium salts of organic acids was potassium carbonate (Peterson 1964). Because of the porous nature of the ash, the spread of fire was facilitated with complete combustion of the carbon, which produces a light-colored ash (Peterson 1964). Salts of chlorides and sulfates were nonporous and fused easily during combustion, thus encasing carbon particles which resulted in a darkened ash (Peterson 1964). The degree of combustion, therefore, was more or less proportional to the potassium existing as salts of malic or citric acids (Garner et al. 1930). When muriate of potash was applied the chloride:potassium ratio was also high, but potassium salts of organic acids were low (Garner et al. 1930). Application of sulfate of potash on the other hand would result in a low sulfate:potassium ratio, therefore a larger part of the potassium was free to combine with organic acids (Garner et al. 1930).

Studies in Germany concluded that the higher the potassium content of the leaf, the higher the chloride content that could be tolerated in relation to burn (Nessler 1889). It was assumed that no tobacco could burn well that contained more than 0.4% chloride and less than 2.5% potassium in the leaf (Nessler 1889). Later studies stressed the importance of restricting chloride levels to 0.5% or less in smoking tobacco types (Swanback and Anderson 1947, Nichols 1958). A typical chemical analysis for 60% muriate of potash is 51% potassium and 48% chloride (Turrentine 1948). Fertilizers, therefore, high in chlorides such as muriate of potash and ammonium chloride have not been recommended for smoking tobacco types for many years (McMurtrey et al. 1934). In order to remain within the 0.5% chloride tolerance level for leaf tobacco, state laws were passed limiting the total amount of chlorides in tobacco fertilizers to a maximum of 2% (Peterson 1964). Chloride also found its way into manure through hay and forage crops fertilized with commercial fertilizers containing chlorides and from salt fed to cattle (Nichols 1962). Although tobacco has been benefitted in many ways by manure, it should be used in moderation so that chloride levels are held in check (Johnson 1941, Nichols 1956).

It was presumed that if potassium chloride remained in its present state within the plant, it would not be harmful to leaf-burn of tobacco since it was not harmful to the glow of filter paper (Johnson 1944). The chloride radical was therefore believed to combine with the calcium and magnesium salts in the growing leaf tissues or during combustion to inhibit leaf-burn (Johnson 1944). Leaf-burn values were highest

at the tip of the individual leaf, intermediate in the middle, and lowest in the basal area (Peterson 1964). The lower leaves had the highest leaf burn, grading to the lowest values in the top leaves (Peterson 1964). In comparison to this, potassium occurs in higher concentrations in the tip of the leaves than in the base (Peterson 1964). Potassium however, tended to migrate out of the overmature bottom leaves into the actively growing upper leaves (Bowman et al. 1958). In contrast, the distribution of chloride, the strongest burn-depressant factor, was uniformly distributed over the leaf, as evidenced by studies with radioactive chlorides (Peterson 1964). Leaf-burn studies sampled from the same position on plants at different dates during the growing season showed that the lower leaf burn of the top leaves was definitely related to their position on the stalk rather than to maturity factors (Peterson 1964). The normal tendency was for the chloride level to increase from the base to the top of the plant (Nichols et al. 1958). The increase in chlorides in the upper leaves was highest at the later harvests, which indicated that chloride uptake by the leaves was somewhat more rapid than the increase in dry matter (Nichols et al. 1958).

U The proper amount of chloride imparted a smoothness in the green leaf and improved the hygroscopic properties and color of the cured leaf (Elliot and Vickery 1956). As the chloride level increased within the tobacco plant, necrosis due to drought decreased because of improved water relations within the plant (Garner 1930, Swanback and Anderson 1947). Chloride supplied in tobacco fertilizer has been shown to contribute to an improvement in yield, quality, and drought

resistance (Moss et al. 1927, Clark 1953). Approximately normal crops were produced with twenty pounds of chloride per acre, however this rate reduced grade quality slightly and produced a darkened ash (Garner et al. 1930). In some tobacco producing areas the beneficial effect of muriate of potash on the yield and to some extent on the general quality during dry seasons led to the recommendations of as much as 2% chloride in fertilizer formulations (Johnson and Ogden 1941). Applying 40-100 pounds of chloride per acre resulted not only in poor leaf burn, but also produced sleek, glabrous, crinkled leaves in the field (Garner et al. 1930). In extreme cases, the leaf margins curl up and exhibit brittleness and thickness in the leaf lamina (Clark 1953). During the latter stages of growth the leaf surface becomes splotched with green and yellow (Clark 1953). When the chloride levels reached 4-7% within the leaf, the cells become gorged with starch which cause some of the curling and crinkling within the leaf (Garner et al. 1930). Suppression of the amylitic enzyme was thought to be responsible for this abnormal accumulation of starch within the leaf cells (Garner et al. 1930). Muriate of potash fertilized leaves were light green in color, shiny, and thinner than those fertilized with potassium sulfate (Bowling and Brown 1947).

Cured leaf produced from muriate of potash exhibited muddy, uneven, lustreless, color with reduced toughness and elasticity (Garner 1930, Bowling and Brown 1947, Johnson 1941). The cured leaves produced with muriate of potash were lighter per unit area, more hygroscopic, favored excessive "casing" and retention of moisture which would increase the

danger of damage in tobacco both in the bundles and in fermentation (Johnson and Ogden 1941). Tobacco high in chloride tended to be overconditioned during grading and sour in odor (Neas 1959). The use of muriate of potash clearly decreased leaf-burn even after the third year after application, which showed that leaching from a single heavy application can be slow from a soil heavy in texture (Johnson and Ogden 1941). Burley tobacco chloride levels tended to decrease as applied fertilizer nitrogen was increased (Nichols et al. 1962). Anion competition between the nitrate and chloride ions for uptake would account for part of the decrease while larger yields obtained by increasing nitrogen rates would dilute the chloride effect (Nichols et al. 1962). It was also concluded that increasing the soil pH showed a decrease in chloride uptake because of an improved medium for nitrification which would provide an anion competitor for uptake (Reisenauer and Colwell 1950).

In Tennessee burley tobacco data, muriate and sulfate of potash gave similar yields where muriate and sulfate were applied at the rate of sixty pounds K_2O per acre (Nichols et al. 1956). Muriate of potash significantly lowered value per hundred pounds, grade index, crop index, and dollar per acre value as compared with the sulfate form (Nichols et al. 1956). At present the sulfate form of potash finds its greatest use in tobacco and potato production (Tisdale and Nelson 1975). Muriate of potash, however, has been the most widely used potash fertilizer and also the cheapest (Tisdale and Nelson 1975). Burley producers have been faced with shortages of

sulfate of potash in previous years, therefore the muriate form has been considered as an alternative if production methods can reduce the chloride leaf content.

CHAPTER III

METHODS AND MATERIALS

General Information

A field experiment was conducted at the Tobacco Experiment Station in Greeneville, Tennessee. It started in the fall of 1976 and ran through the growing season of 1977 on a Waynesboro loam (Typic Paleudult; clayey, kaolinitic, thermic) that had been in wheat the previous year. A randomized complete block design was used and treatments were replicated four times. Treatments 1, 2, 3, 4 were applied on May 12, 1977, 22 days prior to transplant and consisted of 100 and 300 lbs. K_2O/A as K_2SO_4 and, KCl , respectively. Treatments 5, 6 were applied on February 25, 1977, and consisted of 100 and 300 lbs K_2O/A as KCl , respectively. Treatments 7, 8, and 9 consisted of muriate of potash applied on October 13, 1976, at the rates of 100, 300, and 500 lbs, K_2O/A as KCl , respectively. Prior to transplant 150 lbs. of nitrogen as ammonium nitrate and 90 lbs. P_2O_5 as triple superphosphate were broadcast and disked in. Potash applications were made by hand to each individual plot.

Each plot consisted of four 42-inch rows, 30 feet long, with plants spaced 16 to 18 inches in each row, providing a population of 9,334 plants per acre. The variety Burley 37, a blackshank and wildfire resistant variety, was transplanted on June 1. Plants were topped on August 9 and treated with maleic hydrazide for suckers on August 11.

Green leaf and stalk samples were taken on September 13 and the tobacco plots were harvested on September 14.

Collection of Field Data

Composite plant samples for chloride analyses were taken at harvest and at stripping. The sampling procedure consisted of segmenting whole leaves into six groups of three leaves each from the top of the stalk to the bottom. The bottom leaf samples may contain more than three leaves in a few cases. Stalk portions adjacent to each three leaf sampling were also segmented into six groups from the top to the bottom. The composite plant samples were dried at 70° C, ground in a Wiley mill, labeled and stored in plastic bags for analysis.

Duplicate 0.1 gram leaf and stalk samples were extracted by 25 milliliters of deionized water. Aliquots of the extracted solution were used for the determination of chlorides by the Technicon Autoanalyzer.

Composite soil samples were taken at depths of 0 to 6 inches and 6 to 12 inches on October 13, 1976, prior to the first fertilizer application, on May 12, 1977, prior to the last fertilizer application and after harvest on September 14 and 15, 1977, for chloride determinations. Duplicate 5 gram soil samples from the depths of 0 to 6 inches and 6 to 12 inches were extracted with 25 milliliters of 1 N potassium nitrate. Aliquots of the extracted solution were used for the determination of chlorides by the Technicon Autoanalyzer. Portions of all composite soil samples taken were sent to the Soil Testing Lab in Nashville for determinations of pH, available phosphorus and available potassium.

Laboratory Analyses

All leaf and stalk samples were analyzed for chloride concentration by a modification of the procedure by Piper (1944). This procedure is outlined in Appendix A. In essence, the leaf and stalk samples were mixed with deionized water and activated carbon and subsequently filtered. A portion of the filtrate was placed in the Technicon Autoanalyzer where it was diluted and mixed with 6% $\text{FeNH}_4(\text{SO}_4)_2$ in 6 N HNO_3 and a saturated solution of $\text{Hg}(\text{CNS})_2$ for colorimeter analysis. The Technicon procedure is outlined in Appendix B.

All soil samples were analyzed for chloride content by a modification of the procedure by Piper (1944). This procedure is outlined in Appendix A. In short, the soil samples were mixed with 1N KNO_3 and then filtered. A portion of the filtrate was placed in the Technicon Autoanalyzer where it was mixed with 6% $\text{Fe NH}_4(\text{SO}_4)_2$ in 6 N HNO_3 and a saturated solution of $\text{Hg}(\text{CNS})_2$ for colorimeter analysis. The Technicon procedure is outlined in Appendix B.

All laboratory analyses were converted to parts per million (ppm) chloride. The ppm chloride in the leaves, stalks and soils were determined by multiplying the ppm chloride in the solution by the dilution factor used. For use in the text, the ppm chloride was then converted to a percentage basis.

Statistical Analyses

The treatment means for the leaf and stalk samples at harvest and at stripping were subjected to an analysis of variance. The treatment

means for the soil samples at transplant and at harvest were also subjected to an analysis of variance. The statistical analysis of the randomized complete block design was carried out by procedures outlined by Le Clerg et al. (1962). Hartley's test for homogeneity of experimental error variances was carried out as outlined by Steel and Torrie (1960). When the individual treatment variances were not homogeneous it was possible to partition the sum of squares in the analysis of variance as outlined by Snedecor and Cochran (1976). Duncan's Multiple Range Test at the 0.05 level of probability was carried out for mean separation as outlined by Le Clerg et al. (1962). SAS, an integrated system for statistical analyses, was used for data manipulation as described by Barr et al. (1976). Calculations were done using the IBM 360/65 computer at the University of Tennessee Computing Center.

CHAPTER IV

RESULTS AND DISCUSSION

Soil Test Values

Initial soil pH values for treatments 7, 8 and 9 prior to any potash fertilization (Table 1) ranged from 6.4 at the 0 to 6 inch depth to 6.2 at the 6 to 12 inch depth. The phosphorus soil test values were medium to high in the surface soil and medium to low in the 6 to 12 inch layer. Potassium soil test values were high in both the surface and 6 to 12 inch layer. Soil test values for treatments 5, 6, 7, 8 and 9 after potash application and before potash application in treatments 1, 2, 3 and 4 (Table 2) indicated that soil pH ranged from 6.3 at the 0 to 6 inch depth to 5.6 in the 6 to 12 inch layer. The phosphorus soil test values were medium to high in the 0 to 6 inch layer and medium to low in the 6 to 12 inch depth. The potassium soil test values were high in both the surface and 6 to 12 inch layer. Soil test values for soil samples obtained immediately after harvest (Table 3) indicated a rather sharp decline in soil pH, from a low of 4.8 at the 0 to 6 inch depth to a high of 6.1 at the 6 to 12 inch depth. Soil pH values at the 0 to 6 inch depth exhibited a .5 to 1.1 unit drop when compared to the soil pH values prior to transplanting (Table 2). This drop in pH can be attributed to salt depression of soil pH by the fertilizers which were broadcast prior to transplanting. Although no manganese toxicity problems were apparent in this study, those soils having a pH below 5.5 and an adequate manganese supply were susceptible to this problem. The phosphorus soil test values were high in the 0 to 6 inch layer and medium to high in the 6 to 12 inch depth. The potassium soil test values were high in both the surface and the 6 to 12 inch layer.

Table 1. Soil Test Values* for Treatments 7, 8 and 9 Prior to Any Potash Fertilization

Tmt. No.	Treatment	pH	P (lb./A)	K (lbs./A)
0"-6" depth				
7	100 lbs. K_2O/A as KCl	6.4	35	318
8	300 lbs. K_2O/A as KCl	6.3	27	300
9	500 lbs. K_2O/A as KCl	6.2	21	283
6"-12" depth				
7	100 lbs. K_2O/A as KCl	6.3	20	303
8	300 lbs. K_2O/A as KCl	6.3	14	263
9	500 lbs. K_2O/A as KCl	6.2	10	270

*Soil Test Values Represent an Average of Four Replications of Each Treatment.

Table 2. Soil Test Values* for Treatments 5, 6, 7, 8 and 9 after Potash Application and before Potash Application in Treatments 1, 2, 3, and 4 (Prior to Transplanting)

Tmt. No.	Treatment	pH		P (lbs./A)		K (lbs./A)	
		0"-6"	6"-12"	0"-6"	6"-12"	0"-6"	6"-12"
1	100 lbs. K ₂ O/A as K ₂ SO ₄	6.2	6.2	27	18	298	350
2	300 lbs. K ₂ O/A as K ₂ SO ₄	6.1	6.2	28	18	320	318
3	100 lbs. K ₂ O/A as KCl	6.0	6.0	29	17	333	313
4	300 lbs. K ₂ O/A as KCl	6.0	6.1	29	21	263	290
5	100 lbs. K ₂ O/A as KCl	5.9	5.9	26	15	563	265
6	300 lbs. K ₂ O/A as KCl	5.9	6.0	27	11	375	273
7	100 lbs. K ₂ O/A as KCl	6.3	5.6	32	14	425	360
8	300 lbs. K ₂ O/A as KCl	6.2	6.2	26	14	405	263
9	500 lbs. K ₂ O/A as KCl	6.0	5.9	25	13	625	350

*Soil Test Values Represent an Average of Four Replications of Each Treatment.

Table 3. Soil Test Values* for Soil Samples Obtained Immediately after Harvest of Tobacco

Tmt. No.	Treatment	pH		P (lbs./A)		K (lbs./A)	
		0"-6"	6"-12"	0"-6"	6"-12"	0"-6"	6"-12"
1	100 lbs. K ₂ O/A as K ₂ SO ₄	5.7	5.9	43	24	273	253
2	300 lbs. K ₂ O/A as K ₂ SO ₄	5.5	5.9	61	32	323	268
3	100 lbs. K ₂ O/A as KCl	5.4	5.8	40	29	273	245
4	300 lbs. K ₂ O/A as KCl	5.3	5.8	40	24	400	270
5	100 lbs. K ₂ O/A as KCl	4.8	5.8	40	24	363	263
6	300 lbs. K ₂ O/A as KCl	5.3	5.8	43	25	265	255
7	100 lbs. K ₂ O/A as KCl	5.5	6.0	44	28	260	273
8	300 lbs. K ₂ O/A as KCl	5.7	6.1	43	27	333	300
9	500 lbs. K ₂ O/A as KCl	5.4	5.9	40	25	388	373

*Soil Test Values Represent an Average of Four Replications of Each Treatment.

Cured Leaf Yield

Exceptionally heavy rainfall in June (Table 4) manifested by a hot, dry July and August produced a poor, low yielding tobacco crop with inferior rooting systems (Table 5). No trend in yield levels as related to time or source of potash application was observed. The high levels of potash (300 lbs. K_2O/A) in both the sulfate and muriate form were comparable in yield. As expected, the lower levels of potash (100 lbs. K_2O/A) generally yielded lower than the other treatments.

Dollar Value

Although no method devised gives completely satisfactory quality comparisons, an indicator of quality is the dollar value (Table 6). The dollar value was determined from the season's average selling price of the respective Federal grades. No significant differences as related to source or time of application were noted in the dollar values at the 0.05 level of probability. Poor growing conditions favored reduced leaf quality regardless of source or time of potash application.

Soil Chloride Determinations

Average soil chloride determinations from samples obtained prior to any potash fertilization in October for treatments 7, 8 and 9 (Table 7) ranged from 2.8 to 10.6 parts per million (ppm) chloride in the 0-6 inch layer. At the 6 to 12 inch depth average chloride concentrations ranged from 6.9 to 13.4 ppm initially.

Soil chloride content in samples obtained after potash application in treatments 5, 6, 7, 8 and 9 and before potash application in

Table 4. Rainfall in Inches at Tobacco Experiment Station in Greeneville, Tn., for 10 or 11-Day Intervals and Monthly Totals from September 1976 through September 1977

Month and 10-11 Day Intervals	1-10	11-20	21-31	Total
1976				
September	0.72	0.95	1.41	3.08
October	2.36	0.23	1.53	4.12
November	0.03	0.44	1.42	1.89
December	0.62	1.62	1.75	3.99
1977				
January	1.43	0.36	0.32	2.11
February	0.00	0.42	0.58	1.00
March	0.82	1.36	2.34	4.52
April	3.77	0.00	1.87	5.64
May	1.23	0.00	1.92	3.15
June	0.68	2.95	5.04	8.67
July	0.52	1.28	2.02	3.82
August	0.26	1.40	0.42	2.08
September	2.98	1.55	0.79	5.32
Total for Period				50.18

Table 5. Cured Tobacco Leaf Yields as Affected by K_2SO_4 and KCl Applied at Different Rates and at Different Times

Tmt. No.	Treatment	Time of Application	Replication				Average
			1	2	3	4	
			Lbs./Acre				
1	100 lbs. K_2O/A as K_2SO_4	Prior to Transplant	902	1203	1181	1381	1167 b*
2	300 lbs. K_2O/A as K_2SO_4	Prior to Transplant	1379	1245	1150	1407	1295 ab
3	100 lbs. K_2O/A as KCl	Prior to Transplant	1329	1102	770	1495	1174 b
4	300 lbs. K_2O/A as KCl	Prior to Transplant	1391	1391	1337	1633	1438 ab
5	100 lbs. K_2O/A as KCl	In February	1242	1298	1022	1207	1192 b
6	300 lbs. K_2O/A as KCl	In February	1193	1325	1245	1302	1266 ab
7	100 lbs. K_2O/A as KCl	In October	1092	1129	1339	1391	1238 ab
8	300 lbs. K_2O/A as KCl	In October	1472	1806	1286	1375	1485 a
9	500 lbs. K_2O/A as KCl	In October	999	1379	1441	1383	1301 ab

*Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 6. Dollar Value as Affected by K_2SO_4 and KCl Applied at Different Rates and at Different Times

Tmt. No.	Treatment	Time of Application	Replication				Average	Average
			1	2	3	4		
			Dollar/A					\$/cwt
1	100 lbs. K_2O/A as K_2SO_4	Prior to Transplant	\$1000	1112	1048	1062	1056*	90.49*
2	300 lbs. K_2O/A as K_2SO_4	Prior to Transplant	1052	1082	991	1076	1050	81.08
3	100 lbs. K_2O/A as KCl	Prior to Transplant	1077	1106	1053	1125	1090	92.84
4	300 lbs. K_2O/A as KCl	Prior to Transplant	1109	1097	1125	1180	1128	78.44
5	100 lbs. K_2O/A as KCl	In February	1043	1106	1143	1018	1078	90.44
6	300 lbs. K_2O/A as KCl	In February	1136	1089	1106	1107	1110	87.68
7	100 lbs. K_2O/A as KCl	In October	1128	1050	1126	1138	1111	89.74
8	300 lbs. K_2O/A as KCl	In October	1084	1106	1101	1118	1102	74.21
9	500 lbs. K_2O/A as KCl	In October	1053	1085	1133	1128	1100	84.55

*No Significant Differences at the .05 Level of Probability.

Table 7. Chloride Content in Soil Samples* for Treatments 7, 8 and 9 before Any Potash Fertilization

Tmt. No.	Treatment	lbs./A Cl	Replication					Replication				
			1 2 3 4				Average	1 2 3 4				Average
ppm 0"-6"												
7	100 lbs. K ₂ O/A as KCl	40.0	17.5	10.0	5.0	10.0	10.6	11.3	10.0	10.0	22.5	13.4
8	300 lbs. K ₂ O/A as KCl	119.0	1.3	2.5	2.5	2.5	2.8	11.3	5.0	2.5	8.8	6.9
9	500 lbs. K ₂ O/A as KCl	198.0	2.5	3.8	3.8	11.3	5.3	10.0	5.0	10.0	12.5	9.1
ppm 6"-12"												

*Soil Chloride Content Represents an Average of Four Replications of Each Treatment.

treatments 1, 2, 3 and 4 and those obtained immediately after harvest are given in Tables 8, 9, 10 and 11, respectively.

Soil chloride levels in the October treatments of 100 and 300 pounds of K_2O/A as KCl did not differ significantly at the 0 to 6 inch depth from the untreated plots prior to transplant (Table 8). This would indicate a movement of the chloride ions out of the rooting zone when potash fertilization occurred in October. Chloride content in soils fertilized in February were significantly higher than the 100 and 300 pounds K_2O/A as KCl applied in October.

Chloride levels for the treated plots were generally higher at the 6 to 12 inch depth (Table 9). Leaching of the chloride ions throughout the soil profile would account for the higher concentration at this depth. Soil chloride levels in the October treatment of 100 and 300 pounds of K_2O/A as KCl were not significantly higher than the untreated plots prior to transplant. The October treatment of 500 pounds K_2O/A as KCl was significantly higher in chloride content than all untreated plots prior to transplant and the 100 and 300 pounds of K_2O/A as KCl applied in October.

Chloride content in soils obtained at the 0 to 6 inch depth immediately after harvest (Table 10) indicated that all treatments were significantly lower in chloride content than the 300 pounds of K_2O/A as KCl applied prior to transplant. Chloride levels in all other treatments were comparable to the plots fertilized with K_2SO_4 except for the 100 and 300 pound rates of K_2O/A as KCl applied prior to transplant. Leaching losses from the 0 to 6 inch depth during the growing season would account for the lack

Table 8. Chloride Content in Soil Samples Obtained at the 0 to 6 Inch Depth after Potash Application in Treatments 5, 6, 7, 8 and 9 and before Potash Application in Treatments 1, 2, 3, and 4 (Prior to Transplanting)

Tmt. No.	Treatment	lbs./A Cl	Time of Application	Replication				Average
				1	2	3	4	
				ppm 0" - 6"				
1	100 lbs. K ₂ O/A as K ₂ SO ₄	1.7	Prior to Transplant	10.8	2.5	20.8	10.8	11.2 cd*
2	300 lbs. K ₂ O/A as K ₂ SO ₄	5.0	Prior to Transplant	6.3	3.8	6.3	12.0	7.1 d
3	100 lbs. K ₂ O/A as KCl	40.0	Prior to Transplant	8.3	7.0	11.3	2.5	7.3 d
4	300 lbs. K ₂ O/A as KCl	119.0	Prior to Transplant	5.8	6.3	15.0	16.3	10.8 cd
5	100 lbs. K ₂ O/A as KCl	40.0	In February	18.3	8.8	18.8	31.3	19.3 ab
6	300 lbs. K ₂ O/A as KCl	119.0	In February	19.5	23.8	22.5	29.5	23.8 a
7	100 lbs. K ₂ O/A as KCl	40.0	In October	8.3	7.5	5.8	15.8	9.3 cd
8	300 lbs. K ₂ O/A as KCl	119.0	In October	10.0	8.8	13.8	10.8	10.8 cd
9	500 lbs. K ₂ O/A as KCl	198.0	In October	13.3	12.5	23.3	17.0	16.5 bc

*Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 9. Chloride Content in Soil Samples Obtained at the 6 to 12 Inch Depth after Potash Application in Treatments 5, 6, 7, 8, and 9 before Potash Application in Treatments 1, 2, 3, and 4 (Prior to Transplanting)

Tmt. No.	Treatment	lbs./A Cl	Time of Application	Replication				Average
				1	2	3	4	
				ppm 6" - 12"				
1	100 lbs. K ₂ O/A as K ₂ SO ₄	1.7	Prior to Transplant	9.5	5.0	7.0	12.0	8.4 d*
2	300 lbs. K ₂ O/A as K ₂ SO ₄	5.0	Prior to Transplant	5.0	3.8	13.3	15.8	9.5 d
3	100 lbs. K ₂ O/A as KCl	40.0	Prior to Transplant	13.8	16.3	10.8	7.5	12.1 cd
4	300 lbs. K ₂ O/A as KCl	119.0	Prior to Transplant	5.8	5.0	27.5	5.8	11.0 d
5	100 lbs. K ₂ O/A as KCl	40.0	In February	15.0	20.0	24.5	23.8	20.8 bc
6	300 lbs. K ₂ O/A as KCl	119.0	In February	22.0	42.0	42.5	39.5	36.5 a
7	100 lbs. K ₂ O/A as KCl	40.0	In October	12.0	23.3	15.0	16.3	16.6 cd
8	300 lbs. K ₂ O/A as KCl	119.0	In October	14.5	8.8	16.3	19.5	14.8 cd
9	500 lbs. K ₂ O/A as KCl	198.0	In October	29.5	25.8	25.8	26.3	26.8 b

*Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 10. Chloride Content in Soil Samples Obtained at the 0 to 6 Inch Depth Immediately after Harvest of Tobacco

Tmt. No.	Treatment	lbs./A Cl	Time of Application	Replication				Average
				1	2	3	4	
				ppm 0" - 6"				
1	100 lbs. K ₂ O/A as K ₂ SO ₄	1.7	Prior to Transplant	20.0	8.8	5.0	16.3	12.5 c*
2	300 lbs. K ₂ O/A as K ₂ SO ₄	5.0	Prior to Transplant	6.3	12.5	3.8	2.5	6.3 c
3	100 lbs. K ₂ O/A as KCl	40.0	Prior to Transplant	45.0	52.5	40.0	20.0	39.4 b
4	300 lbs. K ₂ O/A as KCl	119.0	Prior to Transplant	151.3	67.5	61.3	61.3	85.3 a
5	100 lbs. K ₂ O/A as KCl	40.0	In February	17.5	16.3	13.8	17.5	16.3 bc
6	300 lbs. K ₂ O/A as KCl	119.0	In February	37.5	35.0	15.0	22.5	27.5 bc
7	100 lbs. K ₂ O/A as KCl	40.0	In October	0.0	3.8	6.3	13.8	6.0 c
8	300 lbs. K ₂ O/A as KCl	119.0	In October	7.5	12.5	5.0	10.0	8.8 c
9	500 lbs. K ₂ O/A as KCl	198.0	In October	13.8	13.8	15.0	17.5	15.0 bc

*Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 11. Chloride Content in Soil Samples Obtained at the 6 to 12 Inch Depth Immediately after Harvest of Tobacco

Tmt. No.	Treatment	lbs./A Cl	Time of Application	Replication			Average
				1	2	3	
				ppm 6" - 12"			
1	100 lbs. K ₂ O/A as K ₂ SO ₄	1.7	Prior to Transplant	8.8	1.3	2.5	4.4 c*
2	300 lbs. K ₂ O/A as K ₂ SO ₄	5.0	Prior to Transplant	8.8	1.3	3.8	4.4 c
3	100 lbs. K ₂ O/A as KCl	40.0	Prior to Transplant	36.3	17.5	17.5	22.2 b
4	300 lbs. K ₂ O/A as KCl	119.0	Prior to Transplant	91.3	45.0	83.8	69.4 a
5	100 lbs. K ₂ O/A as KCl	40.0	In February	15.0	20.0	24.5	20.8 b
6	300 lbs. K ₂ O/A as KCl	119.0	In February	37.5	35.0	15.0	27.5 b
7	100 lbs. K ₂ O/A as KCl	40.0	In October	3.8	3.8	1.3	5.3 c
8	300 lbs. K ₂ O/A as KCl	119.0	In October	5.0	8.8	8.8	7.5 c
9	500 lbs. K ₂ O/A as KCl	198.0	In October	41.3	15.0	13.8	22.2 b

*Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

of significance between February and October applications of KCl and those fertilized with K_2SO_4 prior to transplant.

Soil chloride levels at the 6 to 12 inch depth obtained immediately after harvest (Table 11) also indicated that all treatments were significantly lower in chloride content than the 300 pounds of K_2O/A as KCl applied to transplant. Chloride levels in the October treatments of 100 and 300 pounds of K_2O as KCl were not significantly different from those treated with 100 and 300 pounds of K_2O/A as K_2SO_4 . The variability of the chloride ion in a soil system was evident.

Tobacco Leaf Chloride Determinations

The percent chloride content in tobacco leaves when sampled at harvest is shown in Appendix C, Tables 18, 19, 20, 21, 22, 23, 24, 25, and 26, respectively. A summary of these leaf values at harvest and stripping are shown in Table 12. The K_2SO_4 treatments which consisted of 100 and 300 pounds of K_2O/A , respectively (Tables 18, 19) remained well within the 0.50% tolerance levels of chlorides in smoking tobacco types. Few significant differences were found among the leaf positions of the various treatments. The general trend was for chloride levels in the leaves to decrease from the bottom of the stalk to the top. Leaf chloride levels indicated that the higher rates of muriate of potash applied prior to transplant resulted in the highest leaf chloride content. The dry winter of 1977 hindered leaching losses of the chloride ions and may have resulted in the leaf chloride content of those fertilized in October and February being higher than would normally occur.

Table 12. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest and at Stripping

Tmt. No.	Treatment	Time of Application	Leaves at Harvest	Leaves at Stripping
			----- % Cl -----	
1	100 lbs. K ₂ O/A as K ₂ SO ₄	Prior to Transplant	0.26 e*	0.50 e*
2	300 lbs. K ₂ O/A as K ₂ SO ₄	Prior to Transplant	0.30 e	0.48 e
3	100 lbs. K ₂ O/A as KCl	Prior to Transplant	1.61 b	1.50 bcd
4	300 lbs. K ₂ O/A as KCl	Prior to Transplant	2.28 a	3.16 a
5	100 lbs. K ₂ O/A as KCl	In February	1.43 bc	1.47 bcd
6	300 lbs. K ₂ O/A as KCl	In February	2.20 a	2.22 b
7	100 lbs. K ₂ O/A as KCl	In October	0.74 d	0.91 de
8	300 lbs. K ₂ O/A as KCl	In October	1.22 c	1.37 cd
9	500 lbs. K ₂ O/A as KCl	In October	1.64 b	1.90 bc

*Means of Samples Averaged across Six Leaf Subsamples.

The percent chloride content in tobacco leaves when sampled at stripping is shown in Appendix D, Tables 27, 28, 29, 30, 31, 32, 33, 34, and 35. The K_2SO_4 treatments when sampled at stripping remained close to the 0.50% chloride levels as expected (Tables 27, 28). Few significant differences were encountered among the leaf positions of the various treatments. The muriate of potash treatments increased chloride levels in all instances, regardless of time of application. Lower chloride content in the leaves was noted in the October application of 100 pounds K_2O/A as KCl (Treatment 7) (Table 12). In a year of normal rainfall this treatment would probably be comparable to the chloride levels found in the leaves fertilized with K_2SO_4 at transplanting. Generally chloride levels within the leaves decreased from the bottom of the stalk to the top. This is probably an indication of movement of the chloride ion out of the rooting zone due to leaching losses during the growing season and limited translocation of chloride within the leaves of the plant.

The calculated F-values for various treatment comparisons of chloride content in leaves and stalks at harvest and at stripping are shown in Table 13. The K_2SO_4 treatments of 100 and 300 pounds K_2O/A applied prior to transplanting were significantly lower in chloride content in the leaves, at both harvest and stripping, when compared to the KCl treatments applied prior to transplant and in February. The October application of 100 and 300 pounds K_2O/A as KCl had a significantly higher chloride content in the leaves at harvest, however no significant differences in leaf chloride content were noted at stripping. (Table 13)

Table 13. Calculated F-Values for Various Treatment* Comparisons of Chloride Content in Leaves and Stalks at Harvest and at Stripping

Treatment Comparisons	D. F.	F-Values			
		Leaves at Harvest	Leaves at Stripping	Stalks at Harvest	Stalks at Stripping
1,2 vs. 3,4	1	90.32**	21.38**	109.13**	38.19**
1,2 vs. 5,6	1	78.33**	11.68**	111.68**	28.31**
1,2 vs. 7,8	1	16.44**	2.65	29.89**	7.79**
3,5,7 vs. 4,6,8	1	19.97**	8.67**	9.66**	6.14**
3,4 vs. 5,6	1	0.42	1.46	0.02	0.74
3,4 vs. 7,8	1	29.69**	8.99**	24.79**	11.49**
5,6 vs. 7,8	1	22.99**	0.32	26.01**	6.39**
7,8 vs. 9	1	9.58**	2.46	13.65**	3.49

*Treatment 1 - 100 lbs. K_2O/A as K_2SO_4 (Prior to Transplant)
 Treatment 2 - 300 lbs. K_2O/A as K_2SO_4 (Prior to Transplant)
 Treatment 3 - 100 lbs. K_2O/A as KCl (Prior to Transplant)
 Treatment 4 - 300 lbs. K_2O/A as KCl (Prior to Transplant)
 Treatment 5 - 100 lbs. K_2O/A as KCl (In February)
 Treatment 6 - 300 lbs. K_2O/A as KCl (In February)
 Treatment 7 - 100 lbs. K_2O/A as KCl (In October)
 Treatment 8 - 300 lbs. K_2O/A as KCl (In October)
 Treatment 9 - 500 lbs. K_2O/A as KCl (In October)

**Means with Common Letters Are Not Significantly Different at the .05 Level of Probability.

Significant differences, as related to the 100 and 300 pound rate of K_2O/A as KCl , were found in the leaf chloride content at harvest or stripping. (Table 13)

The KCl treatments, applied prior to transplant, were comparable in leaf chloride content to the February KCl applications at harvest and stripping. Significant differences were encountered however, when the KCl treatments, applied prior to transplant, were compared to the October KCl treatments. This would indicate significantly lower leaf chloride content in the October treatments of 100 and 300 pounds K_2O due to leaching losses of the chloride ion in the soil system at harvest and stripping. (Table 13)

The KCl treatments of 100 and 300 pounds K_2O/A in February and October were significantly different in leaf chloride levels at harvest. At stripping however, no significant difference was observed. (Table 13)

The October applications of 100 and 300 pounds of K_2O/A as KCl were significantly lower than the 500 pounds of K_2O/A as KCl . However no significant difference was observed at stripping. (Table 13)

The calculated F-values from the analyses of variance of leaf and stalk samples by position obtained at harvest and stripping are shown in Tables 14, 15, and 16, respectively. Significant differences in percent chloride content in the leaves existed among fertilizer treatments at harvest and at stripping (Table 14). Chloride levels as related to leaf position exhibited significant differences in leaves at harvest. Fertilizer treatment $\times$ leaf position interaction was significant both at harvest and at stripping in the leaves.

Table 14. Calculated F-Values from Analyses of Variance of Chloride Content in Tobacco Leaf and Stalk Samples When Sampled at Harvest and at Stripping

Source	D. F.	F-Values			
		Leaves at Harvest	Leaves at Stripping	Stalks at Harvest	Stalks at Stripping
Fertilizer Treatment	8	48.68*	12.33*	57.94*	18.67*
Leaf Position	5	5.32*	2.69	689.47*	20.88*
Replication	3	4.62*	3.44*	0.64	1.76
Fertilizer Treatment × Leaf Position	40	1.54*	1.82*	0.91	1.16

*Indicates Significance at the .05 Level of Probability.

Table 15. Calculated F-Values from Analyses of Variance of Chloride Content in Tobacco Leaf and Stalk Samples from Treatments (1-4) Receiving K_2SO_4 and KCl at Two Rates Prior to Transplanting

Source	D. F.	F-Values			
		Leaves at Harvest	Leaves at Stripping	Stalks at Harvest	Stalks at Stripping
Potassium Source	1	102.00*	21.50*	1020.95*	37.58*
Potassium Level	1	9.77	6.51	9.14	8.18
Leaf Position	5	1.13	1.42	87.35*	7.79*
Replication	3	2.05	1.42	5.76	1.02
Potassium Source x Potassium Level	1	5.16	6.30	4.86	2.53
Potassium Source x Leaf Position	5	2.23	3.20*	1.79	0.67
Potassium Level x Leaf Position	5	1.54	1.48	1.07	1.97
Potassium Source x Potassium Level x Leaf Position	5	2.34	1.71	1.47	1.47

*Indicates Significance at the .05 Level of Probability.

Table 16. Calculated F-Values from Analyses of Variance of Chloride Content in Tobacco Leaf and Stalk Samples in the Muriate of Potash Treatments (3-8) Applied at Two Rates at Three Times of Application

Source	D. F.	F-Values			
		Leaves at Harvest	Leaves at Stripping	Stalks at Harvest	Stalks at Stripping
Potassium Level	1	284.27*	31.61*	42.96*	10.99*
Application Time	2	27.80*	8.05*	33.05*	10.76*
Leaf Position	5	5.30*	3.18*	255.04*	12.46*
Replication	3	2.35	2.70	0.41	1.30
Potassium Level x Application Time	2	0.59	2.19	2.36	1.70
Potassium Level x Leaf Position	5	2.47	2.58	1.27	1.51
Application Time x Leaf Position	10	0.89	1.94	1.04	0.89
Potassium Level x Application Time x Leaf Position	10	1.10	1.04	1.40	1.44

*Indicates Significance at the .05 Level of Probability.

The source of potash, as expected, resulted in significant differences in leaf chloride content at harvest and stripping in treatments 1, 2, 3 and 4 (Table 15). No significant differences as related to potassium level or leaf position were encountered in leaves at harvest or stripping. The potassium source $\times$ leaf position interaction sampled at stripping was significant. All other interactions showed no significant differences in leaf chloride levels at harvest or stripping.

The muriate of potash treatments 3, 4, 5, 6, 7 and 8 when sampled at harvest and at stripping (Table 16) differed significantly in chloride levels as related to potassium level, application time, and leaf position. No interactions were significant. Leaching losses of the chloride ions from the October and February treatments would have an important bearing on leaf chloride uptake and would account for some of the significant differences found.

Tobacco Stalk Chloride Determinations

The percent chloride content in tobacco stalks when sampled at harvest is shown in Appendix E, Tables 36, 37, 38, 39, 40, 41, 42, 43 and 44, respectively. A summary of these stalk values at harvest and stripping is shown in Table 17. Chloride levels as related to stalk position were significantly higher in the top of the stalk than in the bottom in every treatment tested. This was the inverse of the trend found in the leaves at harvest and stripping. The increase in chloride content from the base of the plant to the top would suggest free movement of the chloride ion within the tobacco stalk.

Table 17. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest and at Stripping

Tmt. No.	Treatment	Time of Application	Stalks at Harvest	Stalks at Stripping
			----- % Cl -----	
1	100 lbs. K ₂ O/A as K ₂ SO ₄	Prior to Transplant	0.83 e*	0.93 f*
2	300 lbs. K ₂ O/A as K ₂ SO ₄	Prior to Transplant	0.85 e	1.08 ef
3	100 lbs. K ₂ O/A as KCl	Prior to Transplant	1.75 bc	1.89 bc
4	300 lbs. K ₂ O/A as KCl	Prior to Transplant	1.91 ab	2.52 a
5	100 lbs. K ₂ O/A as KCl	In February	1.63 c	1.90 bc
6	300 lbs. K ₂ O/A as KCl	In February	2.06 a	2.18 ab
7	100 lbs. K ₂ O/A as KCl	In October	1.30 d	1.41 de
8	300 lbs. K ₂ O/A as KCl	In October	1.42 d	1.68 cd
9	500 lbs. K ₂ O/A as KCl	In October	1.79 bc	1.99 bc

*Means of Samples Averaged across Six Leaf Subsamples.

The percent chloride content in tobacco stalks sampled at stripping is shown in Appendix F, Tables 45, 46, 47, 48, 49, 50, 51, 52 and 53, respectively. The normal tendency in the stalks sampled at stripping, were for chloride levels to be higher in the top of the stalk than in the bottom. Few significant differences in percent chloride, as related to stalk position, were found in samples taken at stripping within individual treatments.

The calculated F-values for various treatment comparisons of chloride content in the stalks at harvest and at stripping are shown in Table 13, page 30. The K_2SO_4 treatments of 100 and 300 pounds K_2O/A applied prior to transplanting were significantly lower in chloride content in the stalks, at both harvest and stripping, when compared to the KCl treatments prior to transplanting. Chloride levels in the K_2SO_4 treatments remained significantly lower than the February and October applications of 100 and 300 pounds of K_2O/A as KCl .

Significant differences, as related to the 100 or 300 pound rate of K_2O/A as KCl , were shown in the stalk chloride content at harvest and stripping. (Table 13, page 30)

The KCl treatments, applied prior to transplant, did not differ significantly in stalk chloride levels, from the February applications of KCl at either harvest or stripping. (Table 13, page 30) Significant differences however, were found between the KCl treatments applied prior to transplant and the KCl treatments of 100 and 300 pounds K_2O/A applied in October at harvest and stripping. Lowered stalk chloride levels would indicate leaching of the chloride ions out of the rooting zone when applied in October.

Upon comparing the February and October applications of KCl at rates of 100 and 300 pounds K_2O/A , significant differences in stalk chloride levels were observed at both harvest and at stripping.

(Table 13, page 30)

The October applications of 100, and 300 pounds of K_2O/A as KCl were significantly lower in stalk chloride levels than the 500 pound rate of K_2O/A as KCl at harvest. However, no significant differences were observed in chloride content in the stalks at stripping. (Table 13, page 30).

The calculated F-values from the analyses of variance of stalk position samples when sampled at harvest and stripping are shown in Tables 14, 15, 16, pages 32-34, respectively. Significant differences in percent chloride content in the stalks existed among fertilizer treatments at harvest and stripping (Table 14, page 32). Chloride levels as related to stalk position exhibited significant differences at both harvest and stripping (Table 14, page 32). There was no significant fertilizer treatment $\times$ leaf position interaction at either harvest or stripping (Table 14, page 32).

The sulfate and muriate forms of potash differed significantly in chloride content in treatments 1, 2, 3 and 4 (Table 15, page 33) at harvest and stripping. The affinity of the chloride ion for the tobacco plant is readily apparent. Significant differences as related to potassium source and stalk position were exhibited at harvest and stripping. The effects of potassium level and all interactions were not significant.

Chloride content as related to stalk position at harvest and stripping (Table 16, page 34) differed significantly as related to potassium level, application time, and stalk position. No interactions were significant. Loss of the chloride ions out of the rooting zone from the October and February treatments would account for some of the differences in stalk chloride uptake.

CHAPTER V

SUMMARY

Burley 37 was grown in a randomized complete block design on a Waynesboro soil at the Tobacco Experiment Station in 1977 utilizing different rates and times of application of KCl with K_2SO_4 as the standard fertilizer. Ninety pounds of P_2O_5/A and 150 pounds of N/A were also applied.

Soils samples from the 0 to 6 inch and the 6 to 12 inch levels were collected several times for chloride analysis. Leaf and stalk samples were collected at harvest and stripping for chloride analysis.

Tobacco leaf chloride determinations indicated that the general trend was for chloride levels to decrease from the bottom of the stalk to the top at harvest and at stripping. Regardless of time of application, the KCl treatments increased chloride levels in all instances. Generally the leaf chloride levels indicated that the higher rates of KCl applied in February and prior to transplant resulted in the highest leaf chloride content. Lower leaf chloride levels were noted in the October application of 100 pounds K_2O/A as KCl.

Tobacco stalk chloride determinations indicated that chloride content was significantly higher in the top of the stalk than in the bottom at harvest. This trend was also evident in the stalks at stripping.

Generally stalk chloride levels indicated that the higher rates of KCl applied in February and prior to transplant resulted in the highest stalk chloride content. Regardless of time of application, the KCl treatments increased chloride levels in all instances.

Soil chloride levels were highest in the 100 and 300 pounds K_2O/A as KCl, applied prior to transplant. A substantial loss of chloride was noted in the October applications of 100 and 300 pounds K_2O/A as KCl, which were comparable to the soil chloride levels of the plots fertilized with K_2SO_4 prior to transplant.

Cured tobacco leaf yields indicated that the sulfate and muriate forms of potash resulted in comparable yields. There was no trend in yield levels as related to time or source of potash application.

The dollar per acre and dollar per hundred weight values, which were used as quality indicators in this study, showed no significant differences as related to source or time of potash application. The poor growing season of 1977 favored lower leaf quality regardless of the source or time of potash application.

Late fall or early winter application of muriate of potash may be considered an alternative to the standard application of potassium sulfate at transplanting in burley tobacco. Further studies need to be conducted to determine the status of chloride in the soil profile as related to fertilizer rates, time of application and seasonal variations in rainfall.

LITERATURE CITED

LITERATURE CITED

1. Attoe, O. J. 1946. Leaf burn of tobacco as influenced by content of potassium, nitrogen and chlorine. J. Am. Soc. Agron. 38: (No. 2) 186-196.
2. Barr, A. J., J. H. Goodnight, J. P. Sall and J. T. Helwig. 1976. A User's Guide to Sas 76 1-321.
3. Bowling, J. D., and D. E. Brown. 1947. Rates of potash in growth and nutrition of Maryland tobacco. U.S. Dept. Agr. Tech. Bull. 933:13-14.
4. Bowman, D. R., B. C. Nichols and R. N. Jeffrey. 1958. Time of harvest—its effect on the chemical composition of individual leaves of burley tobacco. Tn. Agr. Exp. Sta. Bull. 291:13.
5. Broyer, T. C., A. B. Carlton, C. M. Johnson and P. R. Stout. 1954. Chlorine, a micronutrient element for higher plants. Plant Physiol. 29:526-532.
6. Clark, F. 1953. Fertilizer tests with flue-cured tobacco. Fla. Agr. Exp. Sta. Bull. 512:19-20.
7. Elliot, J. M., and L. S. Vickery. 1956. Ontario flue-cured tobacco soils and their fertilizer requirements. Can. Dept. Agr. Bull. 987:6-9.
8. Garner, W. W., J. E. McMurtrey, Jr., J. D. Bowling and E. G. Moss. 1930. Role of chlorine in nutrition and growth of the tobacco plant and its effect on the quality of the cured leaf. J. Agr. Res. 46-54.
9. Neas, I. 1959. Factors relating to offtype tobacco. Rhod. Tob. 19:6-8.
10. Negbi, M., M. Black and J. D. Bewley. 1975. Far-red sensitive dark processes essential for light and gibberellin-induced germination of lettuce seed. Plant Physiol. 43:35.
11. Nesslerer, J. 1883. Dungungeriersuche zu tabak. Landw. Vors. Sta. 29:309-312.
12. Nesslerer, J. 1889. Über die wirkung des bodens und der dungung auf die verbrennlichkeit des tabaks. Agr. Chem. 18:488-494.

13. Nichols, B. C., D. R. Bowman and J. E. McMurtrey, Jr. 1956. Fertilizer tests with burley tobacco with special reference to potash. Tn. Agr. Exp. Sta. Bull. 252:27-28.
14. Nichols, B. C., D. R. Bowman and J. E. McMurtrey, Jr. 1958. Response of burley tobacco to fertilization in the central basin. Tn. Agr. Exp. Sta. Bull. 280:16-17.
15. Nichols, B. C., R. L. Davis, D. R. Bowman and J. E. McMurtrey, Jr. 1962. Further studies on fertilizing burley tobacco in the Tennessee central basin. Tn. Agr. Exp. Sta. Bull. 341:17-20.
16. Johnson, J. 1941. Experiments on the burn of cigars. Wis. Agr. Exp. Sta. Res. Bull. 140.
17. Johnson, J., W. B. Ogden and O. J. Attoe. 1944. Experiments on the leaf burn of tobacco. Wis. Agr. Exp. Sta. Res. Bull. 153:1-70.
18. Le Clerg, E. L., W. H. Leonard and A. G. Clark. 1962. Field Plot Technique. 71-161.
19. Mayer, A. E. 1890. Uber die Uerbrennlichkeit des Tabaks. Landw. Vers. Sta. 38:127-139.
20. McMurtrey, J. E., Jr., M. W. Lunn and D. E. Brown. 1934. Fertilizer tests for tobacco. Md. Agr. Exp. Sta. Bull. 358:255-290.
21. Moss, E. G., J. E. McMurtrey, Jr., M. W. Lunn and J. M. Carr. 1927. Fertilizer tests with flue-cured tobacco. U.S. Dept. Agr. Tech. Bull. 12:1-59.
22. Myhre, D. H., O. J. Attoe and W. B. Ogden. 1956. Chlorine and other constituents in relation to tobacco leaf burn. Soil Sci. Soc. Am. Proc. 4:547-551.
23. Peterson, L. A. and T. W. Tibbitts. 1964. Chemical composition of tobacco in relation to leaf-burn and quality. Int. Sci. and Tech. 46-54.
24. Piper, C. W. 1944. Soil and plant analysis. Intersci. Pub., Inc. 39-46.
25. Reisenauer, H. M. and W. E. Colwell. 1950. Some factors affecting the absorption of chlorine by tobacco. Soil Sci. Soc. Am. Proc. 15:222-229.
26. Snedecor, G. W. and W. G. Cochran. 1976. Statistical Methods. 11:309.

27. Steel, R. and J. H. Torrie. 1960. Principles and Procedures of Statistics—with Special Reference to the Biological Sciences. 83.
28. Swanback, T. R. and P. J. Anderson. 1947. Fertilizing Connecticut tobacco. Conn. Agr. Exp. Sta. Bull. 503:26.
29. Tisdale, S. W. and W. L. Nelson. 1975. Soil fertility and fertilizers. 267-268.
30. Turrentine, J. W. 1948. The chemical composition of agricultural potash salts. Am. Pot. Inst. Bull. 1-4.
31. Vickery, H. B., G. W. Pucher, A. J. Wakeman and C. S. Leavenworth. 1940. Chemical investigation of the tobacco plant: The effect upon the composition of the tobacco plant of the form in which nitrogen is supplied. Conn. Agr. Exp. Sta. Bull. 442.

APPENDICES

APPENDIX A

- I. Procedure for the extraction of plant tissue for the determination of water-soluble chloride.
 1. Dry plant tissue at 70° C, grind into fine particles (2mm screen), and store in airtight plastic bags.
 2. Weigh a 0.1000 gram sample and place in a 250 ml Erlenmeyer flask.
 3. Add a small portion of activated charcoal and 25 ml of deionized water.
 4. Place on shaker for 10 minutes and then remove.
 5. Filter the supernatant through Whatman's No. 42 filter paper.
 6. The filtrate is ready for analysis on the Technicon Auto-analyzer.
- II. Procedure for the extraction of soils for the determination of chloride.
 1. Air dry soil samples and grind to pass through a 2 mm screen; store in paper sacks.
 2. Weigh a 5.000 gram sample and place in a 250 ml Erlenmeyer flask.
 3. Add 25 ml of 1 N KNO_3 .
 4. Place on shaker for 15 minutes and then remove.
 5. Filter the supernatant through Whatman's No. 42 filter paper.
 6. The filtrate is ready for analysis on the Technicon Auto-analyzer.

APPENDIX B

Automated colorimetric determination of chloride in soils and plant tissues.

1. The instrumentation for the Technicon Autoanalyzer used consisted of 5 separate modules as follows: automatic sampler equipped with a liquid wash system; one positive displacement proportioning pump; one colorimeter equipped with a continuous tubular flow cell; one recorder; and one range expander.

2. The sample stream goes through one dilution with water.

3. The diluted sample stream after passing through the debubbler is joined by a stream of 6% $\text{FeNH}_4(\text{SO}_4)_2$ in 6 N HNO_3 and a saturated solution of $\text{Hg}(\text{CNS})_2$.

4. Mercuric thiocyanate is only very slightly ionized in solution; the intense red iron thiocyanate complex does not form when ferric iron is present. The chloride ions will quantitatively liberate thiocyanate ions from mercuric thiocyanate. These thiocyanate ions react with the iron to form the colored complex. The color intensity is proportional to chloride concentration.

5. The chloride concentration of samples is determined by comparing with the semi-log plot of percent transmittance vs. ppm chloride of a group of standards containing .1, 1, 5, 10, 20, 40, 80, and 100 ppm chloride as Cl^- .

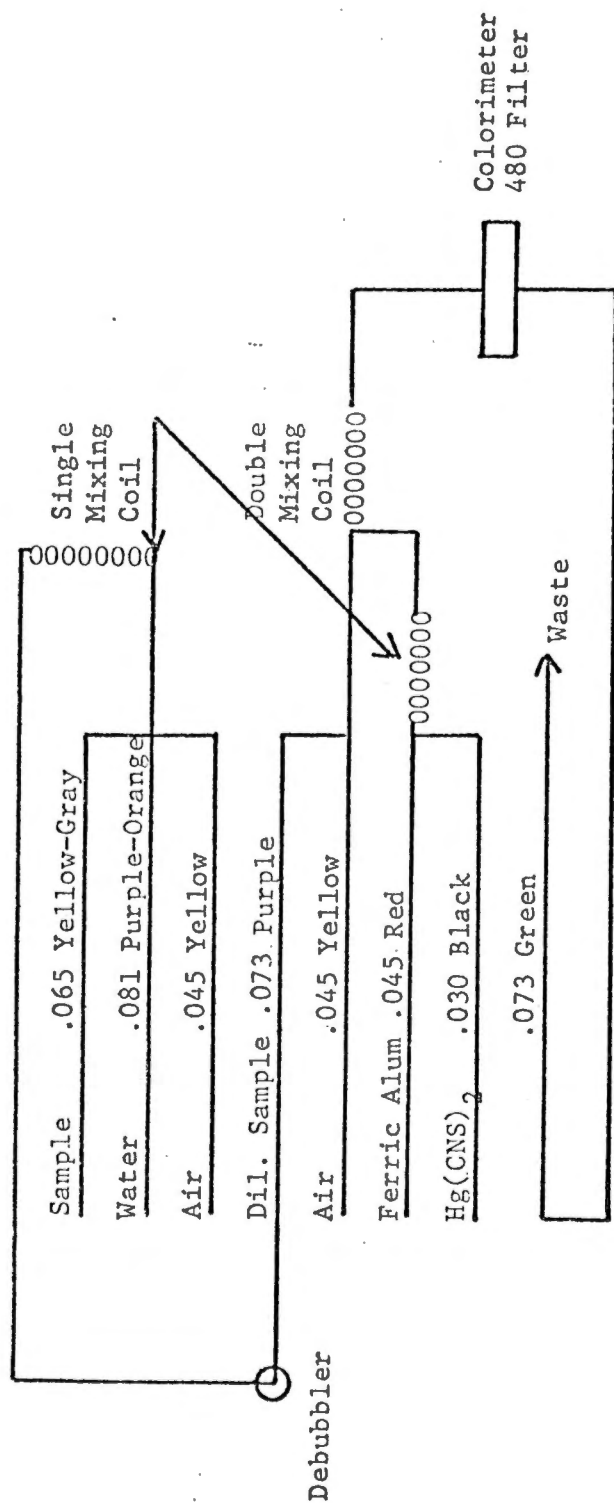


Figure 1. Manifold for Chloride Determinations

APPENDIX C

Table 18. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as K_2SO_4 (Treatment 1)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% CL</u>		
1	0.18	0.18	0.38	0.44	0.30 a**
2	0.21	0.05	0.51	0.48	0.31 a
3	0.20	0.10	0.39	0.41	0.28 a
4	0.18	0.07	0.43	0.50	0.30 a
5	0.06	0.05	0.36	0.23	0.17 a
6	0.05	0.20	0.37	0.30	0.23 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 19. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as K_2SO_4 (Treatment 2)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	0.49	0.35	0.38	0.33	0.39 a**
2	0.21	0.26	0.40	0.28	0.29 a
3	0.18	0.15	0.30	0.24	0.22 a
4	0.19	0.38	0.28	0.38	0.31 a
5	0.19	0.46	0.24	0.28	0.30 a
6	0.23	0.56	0.14	0.25	0.29 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 20. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 3)

Leaf Position	Replication				Average
	1	2	3	4	
			% Cl		
1	1.13	1.21	1.74	1.63	1.43 a**
2	1.49	1.45	1.92	1.73	1.65 a
3	1.43	1.09	1.76	1.98	1.57 a
4	1.49	1.42	2.00	1.69	1.65 a
5	1.58	1.54	1.82	1.83	1.69 a
6	1.65	1.23	2.00	1.73	1.65 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 21. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 4)

Leaf Position	Replication				Average
	1	2	3	4	
			% Cl		
1	1.56	1.74	1.98	2.15	1.86 c**
2	1.71	1.82	2.18	2.36	2.02 c
3	1.44	2.23	2.52	2.51	2.18 bc
4	1.90	2.10	2.28	2.74	2.26 ab
5	1.87	2.09	2.62	3.50	2.52 a
6	1.68	1.99	2.33	2.66	2.16 bc

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 22. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 5)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	0.92	1.12	1.55	1.37	1.24 a**
2	1.15	1.43	1.60	1.26	1.36 a
3	1.22	1.46	1.43	1.68	1.45 a
4	1.09	1.54	1.67	1.58	1.47 a
5	1.30	1.83	1.51	1.59	1.56 a
6	1.65	1.43	1.46	1.41	1.49 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 23. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 6)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	2.07	1.76	1.90	1.92	1.91 a**
2	2.22	2.00	2.06	2.13	2.10 a
3	2.19	2.30	2.28	2.25	2.25 a
4	2.38	2.11	2.45	2.37	2.33 a
5	2.38	2.19	2.58	2.12	2.32 a
6	2.38	2.05	2.45	2.32	2.30 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 24. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 7)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	0.71	0.46	0.69	1.05	0.73 a**
2	0.54	0.53	0.64	1.01	0.68 a
3	0.79	0.43	0.70	1.03	0.74 a
4	0.93	0.74	0.82	1.02	0.88 a
5	0.86	0.65	0.58	0.96	0.76 a
6	0.62	0.78	0.44	0.87	0.68 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 25. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 8)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.04	0.89	1.29	0.96	1.04 a**
2	1.07	1.37	1.28	1.00	1.18 a
3	1.38	1.27	1.34	1.18	1.29 a
4	1.00	1.64	1.33	1.19	1.29 a
5	1.36	1.54	1.66	1.28	1.46 a
6	0.88	0.76	1.23	1.40	1.07 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 26. Percent Chloride Content in Tobacco Leaves When Sampled at Harvest in Positions 1-6* and Fertilized with 500 Pounds K_2O/A as KCl (Treatment 9)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.31	1.52	1.48	1.63	1.49 a**
2	1.40	1.46	1.54	2.08	1.62 a
3	1.45	1.62	1.60	1.95	1.65 a
4	1.51	1.50	1.88	2.00	1.72 a
5	1.55	1.84	1.53	1.98	1.72 a
6	1.36	1.74	1.63	1.82	1.64 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

APPENDIX D

Table 27. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as K_2SO_4 (Treatment 1)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	0.72	0.36	0.59	0.65	0.58 a**
2	0.57	0.28	0.54	0.64	0.51 a
3	0.61	0.22	0.39	0.59	0.45 a
4	0.66	0.27	0.56	0.62	0.53 a
5	0.50	0.30	0.78	0.64	0.55 a
6	0.35	0.22	0.43	0.53	0.38 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 28. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as K_2SO_4 (Treatment 2)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	0.61	0.43	0.55	0.46	0.51 a**
2	0.58	0.30	0.48	0.72	0.52 a
3	0.55	0.35	0.37	0.49	0.43 a
4	0.49	0.44	0.44	0.89	0.57 a
5	0.54	0.37	0.35	0.36	0.41 a
6	0.50	0.43	0.37	0.59	0.47 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 29. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 3)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.45	1.16	1.47	1.74	1.46 a**
2	1.44	1.16	1.33	1.73	1.42 a
3	1.32	1.37	1.48	1.85	1.50 a
4	1.46	1.29	1.59	1.65	1.50 a
5	1.54	1.08	1.61	1.86	1.52 a
6	1.60	1.06	1.88	1.88	1.60 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 30. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 4)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	2.06	1.96	2.41	2.69	2.28 c**
2	2.29	2.15	2.48	5.00	2.98 b
3	2.05	2.11	3.17	5.88	3.30 b
4	1.94	2.14	2.56	6.05	3.17 b
5	2.30	2.23	4.66	6.05	3.81 a
6	2.21	2.34	2.64	6.40	3.40 ab

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 31. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 5)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.25	1.35	1.33	1.99	1.48 a**
2	1.34	1.56	1.13	2.20	1.56 a
3	1.41	1.27	1.04	1.93	1.41 a
4	1.33	1.32	1.23	1.91	1.45 a
5	1.44	1.58	1.19	2.07	1.57 a
6	1.50	1.23	1.17	1.60	1.37 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 32. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 6)

Leaf Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.94	1.89	1.90	2.30	2.01 a**
2	2.29	2.14	1.93	2.42	2.19 a
3	1.95	2.24	2.06	2.48	2.18 a
4	2.04	2.37	1.98	2.50	2.22 a
5	2.17	2.51	2.21	2.74	2.41 a
6	2.34	2.37	1.99	2.67	2.34 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 33. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 7)

Leaf Position	Replication				Average
	1	2	3	4	
			% Cl		
1	0.89	1.07	0.65	1.40	1.00 a**
2	0.94	0.94	0.70	1.18	0.94 a
3	0.79	0.96	0.70	1.31	0.94 a
4	0.88	0.81	0.91	1.24	0.96 a
5	0.71	0.96	0.81	0.96	0.86 a
6	0.56	0.79	0.46	1.21	0.75 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 34. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 8)

Leaf Position	Replication				Average
	1	2	3	4	
			% Cl		
1	1.26	1.30	1.38	1.37	1.33 a**
2	1.39	1.57	1.46	1.35	1.44 a
3	1.64	1.11	1.27	1.47	1.37 a
4	1.61	1.25	1.28	1.53	1.42 a
5	1.68	1.33	1.24	1.45	1.43 a
6	1.41	1.14	1.04	1.27	1.21 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 35. Percent Chloride Content in Tobacco Leaves When Sampled at Stripping in Positions 1-6* and Fertilized with 500 Pounds K_2O/A as KCl (Treatment 9)

Leaf Position	Replication				Average
	1	2	3	4	
			% Cl		
1	2.19	1.48	1.52	2.12	1.83 a**
2	2.25	1.39	1.66	2.20	1.87 a
3	2.38	1.46	1.88	2.05	1.94 a
4	2.30	1.40	1.61	2.25	1.89 a
5	2.26	1.67	1.78	1.90	1.90 a
6	2.31	1.83	1.83	1.94	1.98 a

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

APPENDIX E

Table 36. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as K_2SO_4 (Treatment 1)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.32	1.48	1.54	1.42	1.46 a**
2	0.82	1.11	1.03	1.20	1.04 b
3	0.52	0.64	0.87	1.07	0.77 c
4	0.29	0.60	0.68	0.70	0.57 cd
5	0.35	0.51	0.42	0.49	0.44 c
6	0.96	0.69	0.59	0.50	0.69 c

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 37. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as K_2SO_4 (Treatment 2)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.50	1.62	1.61	1.42	1.54 a**
2	1.02	1.00	1.03	1.11	1.04 b
3	0.69	0.86	0.88	0.92	0.83 bc
4	0.44	0.74	0.71	0.53	0.61 cd
5	0.34	0.55	0.54	0.39	0.45 d
6	0.47	0.69	0.81	0.62	0.65 cd

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 38. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 3)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	2.15	2.08	2.31	2.39	2.23 a**
2	1.68	1.78	1.87	1.89	1.80 b
3	2.01	1.53	1.75	1.98	1.82 b
4	1.65	1.43	1.45	1.74	1.57 c
5	1.31	1.31	1.51	1.38	1.38 d
6	1.47	2.05	1.78	1.54	1.71 bc

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 39. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 4)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	2.45	2.44	2.54	2.71	2.54 a**
2	1.99	2.29	1.83	2.47	2.14 b
3	1.70	1.71	1.74	2.00	1.99 c
4	1.36	1.52	1.73	1.61	1.79 d
5	1.25	1.60	1.61	1.42	1.55 d
6	1.68	2.35	1.96	1.99	1.47 b

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 40. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 5)

Stalk Position	Replication				Average
	1	2	3	4	
			% Cl		
1	2.13	2.49	2.40	2.16	2.30 a**
2	1.67	2.21	2.00	1.78	1.91 b
3	1.30	2.00	1.65	1.50	1.61 c
4	1.07	1.66	1.23	1.31	1.32 d
5	1.15	1.40	1.19	1.00	1.19 e
6	1.48	1.41	1.54	1.28	1.43 d

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 41. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 6)

Stalk Position	Replication				Average
	1	2	3	4	
			% Cl		
1	2.74	2.64	2.36	2.54	2.57 a**
2	2.45	2.36	2.24	2.24	2.32 b
3	2.06	2.01	2.15	2.03	2.06 c
4	1.82	1.85	1.82	2.00	1.87 d
5	1.69	1.58	1.57	1.63	1.62 e
6	2.06	2.16	1.73	1.78	1.93 cd

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 42. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 7)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	2.03	1.84	1.68	2.13	1.92 a**
2	1.60	1.63	1.25	1.52	1.50 b
3	1.23	1.52	0.98	1.32	1.26 c
4	1.10	1.26	0.76	1.23	1.09 c
5	0.95	0.98	0.74	0.99	0.91 d
6	1.41	1.19	0.75	1.07	1.11 c

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 43. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 8)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	2.08	1.96	2.24	2.04	2.08 a**
2	1.69	1.75	1.86	1.44	1.69 b
3	1.47	1.35	1.45	1.24	1.38 c
4	1.44	0.96	1.16	1.07	1.16 de
5	1.27	0.80	1.00	0.98	1.01 e
6	1.20	0.88	1.24	1.56	1.22 cd

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 44. Percent Chloride Content in Tobacco Stalks When Sampled at Harvest in Positions 1-6* and Fertilized with 500 Pounds K_2O/A as KCl (Treatment 9)

Leaf Position	Replication				Average
	1	2	3	4	
			% Cl		
1	2.20	2.46	2.22	2.51	2.35 a**
2	2.11	1.92	1.92	1.84	1.95 b
3	1.83	1.87	1.92	1.62	1.81 bc
4	1.61	1.50	1.66	1.53	1.57 cd
5	1.30	1.27	1.31	1.68	1.39 d
6	1.68	1.45	1.72	1.83	1.67 cd

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

APPENDIX F

Table 45. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as K_2SO_4 (Treatment 1)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.04	1.34	1.48	1.18	1.26 a**
2	0.72	1.02	1.20	0.93	0.97 a
3	0.63	1.09	1.03	0.80	0.89 a
4	0.69	0.96	1.09	0.84	0.89 a
5	0.82	0.91	0.96	0.73	0.85 a
6	0.44	0.78	0.86	0.66	0.69 a

*Composite Plant Samples for Chloride Analyses Were Stalk Positions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 46. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as K_2SO_4 (Treatment 2)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.33	1.50	1.58	1.27	1.42 a**
2	0.97	1.39	1.22	1.10	1.17 a
3	0.76	1.39	1.19	0.97	1.08 a
4	0.79	1.15	1.22	0.79	0.99 a
5	0.70	0.99	1.16	0.85	0.93 a
6	0.68	0.96	1.06	0.79	0.87 a

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 47. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 3)

Stalk Position	Replication				Average
	1	2	3	4	
			% Cl		
1	1.95	2.08	2.16	2.22	2.10 a**
2	1.88	1.79	1.90	2.02	1.90 a
3	1.73	1.72	1.89	1.90	1.81 a
4	1.79	2.06	1.91	1.94	1.93 a
5	1.82	1.87	1.92	1.91	1.88 a
6	1.68	1.62	1.80	1.84	1.73 a

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 48. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 4)

Stalk Position	Replication				Average
	1	2	3	4	
			% Cl		
1	2.21	2.55	2.77	5.15	3.17 a**
2	2.10	2.33	2.68	5.41	3.13 a
3	1.90	2.14	2.58	2.60	2.30 b
4	1.87	2.16	2.39	2.51	2.23 b
5	1.87	2.31	2.35	2.46	2.24 b
6	1.74	1.78	2.30	2.39	2.05 b

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 49. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 5)

Stalk Position	Replication				Average
	1	2	3	4	
			% Cl		
1	1.91	2.32	2.12	2.20	2.14 a**
2	1.88	2.15	1.98	1.94	1.99 a
3	1.69	2.05	1.78	1.72	1.81 a
4	1.69	2.09	1.85	1.90	1.88 a
5	1.64	1.91	1.93	1.92	1.85 a
6	1.55	2.24	1.68	1.36	1.71 a

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 50. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 6)

Stalk Position	Replication				Average
	1	2	3	4	
			% Cl		
1	2.24	2.33	2.33	2.40	2.32 a**
2	2.07	2.35	2.33	2.29	2.26 a
3	2.09	2.36	1.93	2.31	2.17 a
4	2.05	2.40	2.02	2.32	2.20 a
5	2.11	2.26	2.07	2.21	2.16 a
6	1.88	1.82	2.09	2.16	1.99 a

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter are Not Significantly Different at the .05 Level of Probability.

Table 51. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 100 Pounds K_2O/A as KCl (Treatment 7)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.79	2.06	1.58	1.92	1.84 a**
2	1.46	1.50	1.33	1.72	1.50 ab
3	1.47	1.00	1.20	1.58	1.31 b
4	1.51	1.32	1.06	1.39	1.32 b
5	1.64	1.78	1.07	1.23	1.43 ab
6	1.06	1.24	1.01	0.97	1.07 b

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 52. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 300 Pounds K_2O/A as KCl (Treatment 8)

Stalk Position	Replication				Average
	1	2	3	4	
			<u>% Cl</u>		
1	1.87	1.93	2.14	1.98	1.98 a**
2	1.78	1.78	1.76	1.64	1.74 ab
3	1.81	1.60	1.56	1.64	1.65 ab
4	1.62	1.54	1.51	1.77	1.61 ab
5	1.67	1.48	1.63	1.73	1.63 ab
6	1.35	1.48	1.36	1.70	1.47 b

*Composite Plant Samples for Chloride Analyses Were Stalk Portions Adjacent to Each Three Leaf Sampling Which Were Segmented into Six Groups from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

Table 53. Percent Chloride Content in Tobacco Stalks When Sampled at Stripping in Positions 1-6* and Fertilized with 500 Pounds K_2O/A as KCl (Treatment 9)

Leaf Position	Replication				Average
	1	2	3	4	
			% Cl		
1	2.03	2.09	2.49	2.53	2.28 a**
2	2.10	1.82	2.21	2.31	2.11 ab
3	1.92	1.59	2.10	2.11	1.93 ab
4	1.99	1.61	2.03	1.99	1.91 ab
5	2.05	1.97	2.05	1.86	1.98 ab
6	1.85	1.69	1.74	1.67	1.74 b

*Composite Plant Samples for Chloride Analyses Were Whole Leaves Segmented into Six Groups of Three Leaves Each from Top of the Stalk (Position 1) to the Bottom of the Stalk (Position 6).

**Means with Common Letter Are Not Significantly Different at the .05 Level of Probability.

VITA

Joseph Edward Moore, Jr., was born in Cookeville, Tennessee, on March 11, 1954. His parents are Mr. and Mrs. J. Edward Moore of Sparta, Tennessee. He attended elementary schools in Sparta, Tennessee, and was graduated from White County High School in May 1972. The following September he entered Tennessee Technological University, in Cookeville, Tennessee, and in June 1976 he received a Bachelor of Science degree in plant and soil science. In the fall of 1976 he began study toward a master's degree in plant and soil science while on a research assistantship from that department. This degree was awarded in August 1978.

The author is a member of Delta Tau Alpha and Gamma Sigma Delta honorary agricultural fraternities.