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To the Committee on Graduate Study:

I am submitting to you a thesis written by Chester Evan Evans entitled "The Response of Certain Crops to Potassium on Several Soil Types in Tennessee." I recommend that it be accepted for nine quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agronomy.

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Major Professor

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and recommend its acceptance:

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THE RESPONSE OF CERTAIN CROPS TO POTASSIUM ON SEVERAL SOIL TYPES IN TENNESSEE

A THESIS

Submitted to
The Committee on Graduate Study
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

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by

Chester Evan Evans

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-- Chester Evan Evans

INTRODUCTION

Current fertilizer recommendations are frequently based on the results of rapid chemical soil tests. These chemical tests are designed to measure the more readily soluble and hence supposedly "available" nutrients in the soil. The amounts of such available nutrients that must be present in the soil for satisfactory plant growth must be determined by actual field trials. Only when a sufficient body of data from both field and laboratory research has been correlated, can fertilizer recommendations be made safely on the basis of chemical tests alone. For example, if it is found by chemical test that a soil sample contains 150 pounds per acre of a given nutrient, and field trials over a period of years have shown that 200 pounds are necessary for proper growth of a certain crop, then fertilizer applications of that nutrient can be expected to give profitable returns on that crop.

Data of the above character have been accumulated by several investigators, though few of them have worked in Tennessee. Results obtained from other areas have limited application in this State since a variation in climatic factors as well as farming and cropping practices might well exert a marked influence on the crop response obtained from a given fertilizer.

A study of the effect of potassium fertilizers on certain crops grown on various soils of Tennessee was started in the spring of 1940 by Davidson (4). He correlated yields with soil tests. The studies he started were continued by the present author through the 1941 season in order to supplement the data available for this State.

PROCEDURE AND METHODS

The procedure and methods followed in this study were in general similar to those described by Davidson (4), therefore only a brief outline of them need be given here.

General Plan.

Four crops--alfalfa, corn, cotton, and tobacco--were studied. These were grown under farm conditions on selected areas of representative soil types. Adequate amounts of nitrogen and phosphorus were added to all plot areas. Different amounts of potassium were applied and the effect of increments of this element on yields was determined.

Location of Plot Areas.

The five alfalfa plots in Knox County which were selected in 1940 were retained for continued observation in 1941. Plots of corn were located in Cumberland and Maury Counties, cotton in Rutherford County, and tobacco in Montgomery and Robertson Counties.

Special care was taken to select areas that showed as little soil variation within their boundaries as possible.

The plot size chosen was 1/100 acre, except for alfalfa which was 1/40 acre. Ordinarily, plots of row crops were four rows wide and approximately 55 feet long, depending upon the width of the row. Three rates of potassium fertilization were used in triplicate making nine plots for each experimental plot area. Plots receiving the same treatment were never adjacent but followed a systematized arrangement (See Figure 1).

Crop_____ County_____

Soil type_____ Cooperator_____

Dimensions of plot_____

No. of rows per plot_____

1A	2A	3A
3B	1B	2B
2C	3C	1C

Figure 1. Plot area map showing systematized arrangement of plots*

* A, B, C = replicates

1, 2, 3 = treatments

Planting and Culture.

The various crops on each experimental plot area were planted and cultivated by the farmer at the time and in the same manner as the remainder of the field in which the plots were located.

Fertilization and Harvesting.

The following standard rate of application of nutrient elements was made to all plot areas planted to row crops: 40 pounds of nitrogen (N) per acre as ammonium sulphate, 62 pounds of P_2O_5 per acre as calcium metaphosphate, and sufficient ground limestone (200 pounds per acre) to neutralize the equivalent acidity of the nitrogen carrier. The rates of potassium application were different for each crop and therefore will be noted under the respective crops.

The weighing and mixing as well as the method of application of the fertilizer was identical with that used by Davidson (4).

In order to eliminate border effects, harvest of row crops included only the two center rows of the four-row plot.

The rates of potassium application, together with the methods of harvest, will be described for each crop separately.

Alfalfa. Muriate of potash (50% K_2O) was applied at rates of 0, 100, and 300 pounds per acre in March, 1940 by Davidson (4). In February, 1941, the applications of potassium were repeated and, in addition, borax was applied at the rate of 30 pounds per acre to half of each plot. All material was applied as a top dressing.

Three samples, each representing one ten-thousandth (1/10,000) acre, were harvested from each sub-plot. The samples were air-dried in the

laboratory and yields computed in tons of dry hay per acre.

Corn. Muriate of potash was applied at rates of 0, 50, and 150 pounds per acre. The corn was harvested in mid-October. Grain yields were computed by correcting field weights for shelling percentage and moisture.

Stand counts were taken in the field by determining the number of plants in the two center rows of each plot.

Cotton. Cotton received the same applications of potassium as did corn. Pickings were made on September 14 and October 11. Seed cotton was weighed in the field and yields computed on the acre basis. Lint determinations were made in the laboratory on approximately five pound samples from each plot of area 10 only.

Tobacco. Fertilizer applications were made after the rows had been marked, but before the plants had been set. Sulphate of potash (50% K_2O) was applied at rates of 0, 100, and 300 pounds per acre.

A total of 16 plants were harvested from the two center rows of each plot, except for one case, plot area 15, where the stand was irregular. Plants were harvested as they ripened, placed on sticks, and allowed to cure. The cured tobacco from each plot was stripped, arranged in three major classes--leaf, seconds, lugs--and weighed. Each class was then graded by a Federal tobacco grader and the grades evaluated according to the 1939 prices.

Collection and Preparation of Soil Samples.

Each plot within an experimental area was sampled before fertilization by taking two composite samples, one of the topsoil to a depth of six (6)

inches and one of the subsoil from six to fifteen (6-15) inches. Approximately eight borings with a soil auger were made to secure each composite.

Each sample was dried, crushed, passed through a 20-mesh sieve and mixed thoroughly before analyses were made.

Analytic Methods.

Analytic methods followed in this study were identical with those used by Davidson (4). Data on exchangeable potassium (K), available phosphorus (P_2O_5), and pH were obtained for each individual plot, whereas exchange capacities were determined only on a composite sample from each experimental plot area.

Soil reaction was determined with a Beckman glass electrode; available phosphorus by Truog's method (9), and replaceable potassium by extracting the soil with neutral sodium perchlorate and precipitating with sodium cobaltinitrite as outlined by Bray (2) with modifications by Davidson (4). Base exchange capacities were determined by leaching the soil with normal, neutral ammonium acetate as outlined by Olson and Bray (8).

DATA AND OBSERVATIONS

Results of laboratory analyses on composite soil samples taken from each experimental plot area are given in Table I. Detailed results of samples from each plot within an experimental area are included in Appendix I. Data include determinations of pH, available phosphorus (P_2O_5), and exchange capacity in addition to data for exchangeable potassium (K), since such additional information often proves helpful in evaluating crop response.

The exchangeable potassium ranged from 90 to 500 pounds per acre in the topsoil and from less than 80 to 220 pounds in the subsoil, except for one sample which had 300 pounds. Practically all subsoil samples had considerably less exchangeable potassium than the corresponding topsoils (Table I). Variation in amounts of potassium found among adjacent plots was great for some areas. For example, a variation in excess of 120 pounds of potassium per acre in both topsoil and subsoil was found among some of the plots of areas 6, 8, 11, and 12; other plot areas showed less variation (Appendix I).

The pH values of soil samples from the alfalfa plots were all above 6.0 for the topsoil and from 5.5 to 6.3 for the subsoil. The pH values for samples from other plot areas were lower, ranging from 5.0 to 5.9 in the topsoil and from 4.6 to 6.0 in the subsoil (Table I). Variation of pH values among plots of any given area was slight (Appendix I).

Available P_2O_5 of the soils ranged from 50 to 100 pounds in the topsoil and from 10 to 95 pounds per acre in the subsoil, except for the soils of Maury County. These soils, which were developed from phosphatic

TABLE I. DATA ON SOIL SAMPLES[a]

Crop	Exper. plot area	Cooperator	County	Soil series	Pounds K per acre		Exchange cap. M.E.		pH		Lbs. P_2O_5 per acre	
					A[b]	B[b]	A	B	A	B	A	B
Alfalfa[c]	1	J. C. Brown	Knox	Cumberland	280	80	5.6	7.3	6.8	5.5	75	20
	2	L. Livesay	Knox	Decatur	170	80	9.8	10.7	6.2	5.6	40	25
	3	G. H. Hatfield	Knox	Decatur	100	80	15.5	14.4	6.7	5.6	175	60
	4	H. Warwick	Knox	Sequoia	300	300	9.1	11.5	6.0	5.5	60	20
	5	U. of Tenn.	Knox	Cumberland	100	80	5.6	8.1	6.6	6.3	100	40
Corn	6	H. Bohannon	Cumberland	Hartsells	240	210	6.6	6.3	5.7	4.6	50	30
	7	C. Whittenburg	Cumberland	Hartsells	180	220	7.4	6.6	5.2	5.0	60	10
	8	C. Simms	Maury	Maury	190	90	12.4	13.3	5.5	5.6	190	200
	9	W. Lindsay	Maury	Wolftever	90	80	11.4	15.0	5.4	5.7	190	190
Cotton	10	H. Snell	Rutherford	Hagerstown	120	80	11.2	12.0	5.5	5.2	85	95
	11	K. Hutcheson	Rutherford	Hagerstown	210	130	8.7	8.9	5.5	6.0	70	25
Tobacco	12	B. F. Rosson	Montgomery	Cookeville	220	150	7.5	8.9	5.9	5.9	85	75
	13	E. Elliott	Montgomery	Lindside	110	80	6.7	6.2	5.0	5.2	40	35
	14	W. E. Campbell	Robertson	Dickson	230	150	6.3	9.0	5.0	4.8	50	20
	15	J. T. Matthews	Robertson	Cookeville	210	200	6.5	8.2	5.2	5.2	50	25

(a) Complete soil data for individual plots are included in Appendix I.

(b) A refers to topsoil (0-6"); B refers to subsoil (6-15").

(c) Soil data for alfalfa plots taken from Davidson, L. A., 1941. "The Response of Certain Crops to Potassium on Several Soil Types in Tennessee". U. T. Master's Thesis.

limestone residuum showed amounts of available P_2O_5 as high as 200 pounds per acre in both topsoil and subsoil (Table I).

Exchange capacity values ranged from 5.6 to 15.5 milliequivalents per 100 grams of air-dry soil. Subsoil values were in general somewhat higher than those of the corresponding topsoil (Table I).

Yield data and observations for each crop will be presented separately.

Alfalfa.

Results of experiments with alfalfa are reported in Table II. Data are reported for two plot areas only, since on the other plot areas irregularities as to stand and vigor of growth would have made quantitative interpretation unreliable. On neither plot area harvested were data for the first cutting collected because observed differences between treated and untreated plots were negligible at that time. However, the dry period that followed caused plants of untreated plots to exhibit extreme potash and boron deficiency symptoms. Potash and boron deficiency symptoms as they occur on alfalfa are described and illustrated by DeTurk (5).

The data on yields (Table II) show that response to potassium was exhibited only on plot area 3 located on Decatur silt loam. The potassium level in this soil was less than 100 pounds per acre in both topsoil and subsoil. The average yield increase for an application of 50 pounds of potash per acre was 0.21 tons or 14.0 percent for two cuttings, whereas the larger potash application (150 pounds) gave no further increase. The increase in yield due to potassium was greater when borax was also added.

TABLE II. RESULTS OF EXPERIMENTS WITH ALFALFA

Plot area	Soil series	Exchangeable K pounds per acre Topsoil	Subsoil	Plot No.	Potash[a] applied lbs./A	Yield of dry hay in tons per acre: Second cutting U[c]	Second cutting T[c]	Third cutting U	Third cutting T	Fourth cutting U	Fourth cutting T	Total[b] U	Total[b] T
5	Decatur	100	80	1A	0	.67	.85	.78	.87	-	-	1.50	1.65
				B	0	.83	1.05	.73	1.12	-	-		
				2A	50	.83	1.00	.88	1.30	-	-	1.71	2.34
				B	50	.93	1.22	.78	1.17	-	-		
				3A	150	.83	1.27	.82	1.27	-	-	1.71	2.60
				B	150	.78	1.33	1.00	1.33	-	-		
4	Sequoia	300	300	1	0	.93	1.33	1.14	1.14	.83	1.00	2.90	3.74
				2	50	.83	1.33	-	-	-	-		
				3	150	.93	1.18	-	-	-	-		

(a) Pounds of potash (K_2O) per acre applied in March, 1940. This same application was repeated in February, 1941.

(b) Total tons harvested during the season, average of duplicates.

(c) U refers to untreated borax plot; T refers to treated plot (30 lbs. borax per acre).

With borax the increase in yield of hay from two cuttings was 0.71 tons per acre or 45.5 percent for 50 pounds of potash and 0.97 tons per acre or 59.5 percent for 150 pounds of potash. Plots without potash treatment showed severe thinning of the four-year-old alfalfa stand while treated plots retained better stands. The yield data presented are in harmony with field observations on stand.

Data for plot area 4 on Sequoia silt loam show yields of hay greater than those already mentioned. Results and observations showed no response to applications of potash fertilizers. The potassium level of this soil was 300 pounds per acre in both topsoil and subsoil which is much higher than that of plot area 5 where some response to potash was observed. Striking differences in color and vigor of plants were observed between plots treated with borax and those not treated. Yields of 2.90 tons for untreated plots and 3.74 tons per acre or an increase of 29.0 percent for boron treated plots distinctly reflect these observed differences. During periods of optimum moisture the effects of borax were much less pronounced, and this is shown in equal yields (1.14 tons per acre) for both borax treatments at third cutting on plot area 4.

Corn.

The 1941 season was unfavorable for corn production in most regions of Tennessee. During the months of March and April there was limited rainfall; the months of May and June were extremely dry, and the latter portion of the growing season had scattered but inadequate rains.

All yield data are included in Tables III and IV. Experimental plot area 6 on Hartsells silt loam produced average yields of 56.5, 62.8, and 64.9 bushels per acre with potash applications of 0, 25, and 75 pounds per acre, respectively. The potassium level of this soil was 240 pounds in the topsoil and 210 pounds in the subsoil. Stand counts made on these plots (5.0×10^{-3} acre) varied from 25 to 33 plants. Firing of the plant leaves was observed during the tassel stage indicating that soluble forms of nitrogen may have been leached by some torrential rains of early July. Potash deficiency symptoms, as outlined by Hoffer (6), were also noted on two of the no-potash plots at this time.

The corn yields on experimental plot area 7, also on Hartsells silt loam, were somewhat lower than those mentioned above. Average yields of 40.1 bushels per acre were obtained for plots receiving 0 and 25 pounds of potash per acre. The plots receiving 75 pounds of potash produced an average yield of 46.2 bushels. However, this higher average includes one replicate yield of 59.0 bushels. The potassium level of this soil was 180 pounds for the topsoil and 220 pounds for the subsoil or slightly lower than that of the soil of plot area 6. Stand counts made on plots (5.0×10^{-3} acre) showed a variation between 17 and 27 plants. Potash deficiency symptoms were present but not pronounced on the plants of some plots when observed during the tassel stage.

Table IV shows that yields of corn for experimental plot areas 8 and 9 were lower than those above. On plot area 8 average yields of 29.5 bushels per acre were produced with all rates of potash used. However, yields of replicates varied from 19.7 to 37.7 bushels per acre.

TABLE III. RESULTS OF EXPERIMENTS WITH CORN

Plot	Soil series	Exchangeable K pounds per acre Topsoil	Subsoil	Plot No.	Potash applied lbs./A	Yield of shelled corn (bushels per acre) Each plot	Av. of replicates	Stand counts (a)
6	Hartsells	230	250	1A	0	67.5		29
		220	170	B	0	57.8		29
		260	180	C	0	43.6	56.3	28
		220	220	2A	25	69.2		25
		150	300	B	25	51.8		27
		200	180	C	25	67.3	62.8	30
		240	170	3A	75	59.8		27
		300	230	B	75	63.5		28
		200	240	C	75	71.4	64.9	33
7	Hartsells	180	170	1A	0	44.1		24
		230	200	B	0	41.0		22
		180	220	C	0	35.3	40.1	17
		120	180	2A	25	40.7		20
		180	230	B	25	37.9		21
		210	250	C	25	41.6	40.1	25
		180	170	3A	75	59.0		24
		140	230	B	75	39.3		25
		170	250	C	75	40.4	46.2	27

(a) Number of plants per plot area harvested (5.0×10^{-3} acre).

TABLE IV. RESULTS OF EXPERIMENTS WITH CORN

Plot area	Soil series	Exchangeable K pounds per acre Topsoil	Subsoil	Plot No.	Potash applied lbs./A	Yield of shelled corn (bushels per acre) Each plot	Av. of replicates	Stand counts(a)
8	Maury	180	110	1A	0	37.7		16
		180	80	B	0	19.7		8
		240	100	C	0	31.1	29.5	14
		180	120	2A	25	22.1		8
		180	110	B	25	31.4		14
		280	90	C	25	35.5	29.7	12
		210	80	3A	75	25.2		11
		140	80	B	75	26.6		12
		180	90	C	75	34.3	28.7	15
9	Wolftever	90	80	1A	0	34.2		20
		90	80	B	0	29.1		21
		90	80	C	0	22.0	28.4	20
		90	80	2A	25	36.4		27
		90	80	B	25	31.8		22
		90	80	C	25	29.3	32.5	21
		250	80	3A	75	36.4		25
		90	80	B	75	27.2		20
		90	80	C	75	30.0	31.2	22

(a) Number of plants per plot area harvested (5.0×10^{-3} acre).

It will also be noted that stand counts range from 8 to 16 plants per plot (5.0×10^{-3} acre) and that these counts correspond rather closely to the yield variations mentioned above. The corn on this plot area was replanted late in the season when dry weather probably inhibited uniform emergence. Field observations during the growing season showed little difference between plots treated with potash and those not treated.

The yields from plot area 9 on Wolftever silt loam were 28.4, 32.5, and 51.5 bushels per acre for potash applications of 0, 25, and 75 pounds per acre, respectively. Stand counts showed little variation among plots. Plants on the no-potash plots showed more pronounced potash deficiency symptoms during the growing season than did plants of other plots. At harvest it was observed that corn ears from the no-potash plots were less completely filled and that disease was more prevalent than on treated plots. However, these observable differences were not reflected in differences in yield. The observed lack of organic matter together with the presence of gravelly strata at shallow depths in some parts of the field suggests that the general productivity level of this area was low.

Cotton.

Results from all experiments with cotton are contained in Table V. On experimental plot area 10 located on Hagerstown silt loam, a small response was obtained from additions of potassium fertilizer. The average yield from the no-potash plot was 1,220 pounds of seed cotton per acre, as compared with 1,515 pounds for the 25 pound potash

TABLE V. RESULTS OF EXPERIMENTS WITH COTTON

Plot area	Soil series	Exchangeable K pounds per acre Topsoil	Subsoil	Plot No.	Potash applied lbs./A	Yield of seed cotton (pounds per acre) Each plot	Ave. of replicates	Percent lint
10	Hagerstown	120	110	1A	0	1020		40.8
		150	90	B	0	1420		40.1
		110	90	C	0	——	1220	40.5
		150	80	2A	25	1410		41.7
		150	100	B	25	1220		41.7
		90	90	C	25	——	1315	39.0
		150	80	3A	75	1420		39.6
		140	80	B	75	1500		39.9
		80	90	C	75	1500	1473	40.7
11	Hagerstown	260	280	1A	0	1380		——
		180	100	B	0	1240		——
		200	110	C	0	1370	1330	——
		250	170	2A	25	1190		——
		180	90	B	25	1360		——
		200	150	C	25	1340	1295	——
		250	160	3A	75	1360		——
		190	150	B	75	1360		——
		190	150	C	75	1420	1380	——

(a) Percent lint was determined only on samples from Plot Area 10.

application, and 1,475 pounds for the 75 pound potash application. These correspond to increases in yield of 8.0 and 21.0 percent for application of 25 and 75 pounds of potash, respectively. It is noted that variation between replicates is great and that yields for two replicates are not given. These replicates were harvested by the farmer due to a misunderstanding. Data show that potash additions did not influence lint percentage since the cotton from all plots averaged about 40 percent lint. Little difference was observed throughout the growing season between treated and untreated plots.

Cotton gave no response to the potash on Hagerstown silt loam (plot area 11) where the available potassium in the topsoil was 210 pounds and 150 pounds per acre in the subsoil. These levels of potassium were higher than those of the soil from plot area 10. Yields for all treatments averaged about 1,350 pounds of seed cotton per acre. No apparent differences were noted between plots during the growing season.

Tobacco.

Results of experiments with tobacco are given in Tables VI to IX, inclusive. Additional data on detailed grades and values of the tobacco are included in Appendix II. The 1939 price list used for evaluating the tobacco grades is given in Appendix III.

Experimental plot area 12 showed returns per acre of $201., $210., and $211. for potash treatments of 0, 50, and 150 pounds per acre, respectively. Average yields in pounds per acre were 1,425 for the no-potash treatment, 1,500 for the 50 pound potash application, and 1,565 for the 150 pound potash application. The exchangeable potassium for this soil,

TABLE VI. RESULTS OF EXPERIMENTS WITH TOBACCO
ON COOKEVILLE SILT LOAM (PLOT AREA 12)

Plot No.	Exchangeable K pounds per acre		Potash applied lbs./A	Plot basis(a)		Acre basis(b)			
						Yield in pounds		Total value	
	Topsoil	Subsoil		Total yield in pounds	Total value	Each treatment	Ave. of triplicates	Each treatment	Ave. of triplicates
1A	190	180	0	5.85	$ .77	1460		$ 195.	
B	180	170	0	5.90	.81	1475		204.	
C	220	170	0	5.35	.82	1540	1425	206.	$ 201.
2A	240	150	50	6.35	.78	1590		195.	
B	180	140	50	5.60	.79	1400		197.	
C	220	160	50	6.05	.96	1510	1500	239.	210.
3A	340	160	150	7.15	.86	1790		215.	
B	170	150	150	6.20	.89	1550		223.	
C	220	150	150	5.40	.78	1350	1565	195.	211.

(a) Aliquot of 16 plants (represents 4.0×10^{-3} acre).

(b) Computed on the basis of 4,000 plants per acre.

TABLE VII. RESULTS OF EXPERIMENTS WITH TOBACCO ON LINDSIDE SILT LOAM (PLOT AREA 15)

Plot No.	Exchangeable K pounds per acre		Potash applied lbs./A	Plot basis(a)		Acre basis(b)			
				Total yield in pounds	Total value	Yield in pounds		Total value	
	Topsoil	Subsoil				Each treatment	Ave. of triplicates	Each treatment	Ave. of triplicates
1A	100	80	0	7.65	$ 1.04	1700		$ 231.	$
B	130	80	0	7.75	1.02	1720		227.	
C	120	80	0	8.95	1.42	1980	1800	316.	258.
2A	120	80	50	8.25	1.31	1830		291.	
B	80	80	50	7.00	1.17	1550		260.	
C	80	80	50	8.00	1.27	1780	1720	282.	278.
3A	100	80	150	8.55	1.36	1900		302.	
B	130	80	150	9.05	1.51	2000		334.	
C	120	80	150	9.05	1.39	2000	1960	309.	315.

(a) Aliquot of 16 plants (represents 4.4×10^{-5} acre).

(b) Computed on the basis of 3600 plants per acre.

TABLE VIII. RESULTS OF EXPERIMENTS WITH TOBACCO
ON DICKSON SILT LOAM (PLOT AREA 14)

Plot No.	Exchangeable K pounds per acre		Potash applied lbs./A	Plot basis[a]		Acre basis[b]			
				Total yield in pounds	Total value	Yield in pounds		Total value	
	Topsoil	Subsoil				Each treatment	Ave. of triplicates	Each treatment	Ave. of triplicates
1A	300	220	0	6.15	$ .71	1540		$ 177.	$
B	220	150	0	6.70	.90	1680		224.	
C	170	110	0	7.00	.96	1750	1660	240.	214.
2A	250	170	50	5.15	.62	1290		155.	
B	230	150	50	7.45	1.01	1860		252.	
C	220	120	50	6.20	.83	1550	1570	207.	205.
3A	210	140	150	6.00	.75	1500		185.	
B	240	150	150	7.20	.93	1800		230.	
C	220	180	150	7.20	.81	1800	1700	203.	205.

(a) Aliquot of 16 plants (represents 4.0×10^{-3} acre).

(b) Computed on the basis of 4000 plants per acre.

TABLE IX. RESULTS OF EXPERIMENTS WITH TOBACCO
ON COOKEVILLE SILT LOAM (PLOT AREA 15)

Plot No.	Exchangeable K pounds per acre		Potash applied lbs./A	Plot basis[a]		Acre basis[b]			
						Yield in pounds		Total value	
	Topsoil	Subsoil		Total yield in pounds	Total value	Each treatment	Ave. of triplicates	Each treatment	Ave. of triplicates
1A	230	180	0	3.05	$ .46	1390		$ 209.	
B	190	190	0	3.00	.44	1370		199.	
C	200	200	0	3.00	.43	1370	1377	196.	$ 201.
2A	190	200	50	2.95	.42	1350		190.	
B	210	190	50	2.70	.35	1235		150.	
C	180	220	50	2.60	.42	1240	1275	195.	178.
3A	250	210	150	2.95	.40	1350		184.	
B	210	180	150	3.00	.42	1370		192.	
C	240	210	150	3.40	.54	1555	1425	247.	208.

(a) Aliquot of 7 plants (represents 2.2×10^{-3} acre).

(b) Computed on the basis of 3200 plants per acre.

Cookeville silt loam, was 220 pounds per acre in the topsoil and 150 pounds in the subsoil. During the growing season observed differences between plots were not striking and were probably overshadowed by irregularity in size of plants. The tobacco plants were rather badly damaged by a wind storm three days previous to the cutting. Hence, data may not be conclusive.

The highest level of production was obtained on plot area 13 located on Lindside silt loam. The return per acre where no potash was applied was $258., 50 pounds of potash increased the returns $20., or 7.8 percent, and 150 pounds of potash increased the return $57., or 22.1 percent. Yields of tobacco in pounds of leaf per acre were 1,800, 1,720, and 1,960 for potash applications of 0, 50, and 150 pounds per acre, respectively. The level of potassium in this soil was 100 pounds per acre in the topsoil and less than 80 pounds in the subsoil, which is considerably lower than that of the soil of plot area 12. The tilth and moisture relations on this area were favorable, thus vigorous plants were produced. Potash deficiency symptoms as outlined by McMurtrey (7) could not be detected on any of the plants when observed during the growing season.

Little difference in money value was observed between treatments on plot area 14. Average returns for treatments varied between $205. and $214. per acre; yields varied between 1,570 and 1,700 pounds per acre. Exchangeable potassium for this soil, Dickson silt loam, was 250 pounds per acre in the surface and 150 pounds in the subsoil. During the growing season this area exhibited the largest and most disease-resistant

tobacco of any plot area. However, the leaf texture deteriorated due to sweating during storage, hence the value of the tobacco was affected materially. In grading it seemed necessary to try to disregard the damage caused in the barn since the tobacco from all plots was not damaged to the same degree. Thus, there is doubt as to the validity of the grades placed on the tobacco from this plot area.

The tobacco on experimental plot area 15 exhibited an erratic response to applications of potash. The no-potash treatment gave a return of $201. per acre, the 50 pound application of potash only $178., and the 150 pound application of potash a return of $208. Yield data followed a similar trend. This irregularity was related to the lack of moisture at the time of setting. The furrowed rows were exposed and allowed to dry out for two weeks previous to tobacco setting. This caused an irregular stand, and resetting of many plants was necessary late in the season.

DISCUSSION

Correlations between increases in yield and results of chemical soil tests are desirable as a basis for predication of fertilizer response. Since the data here assembled are limited in amount and represent the results for but one season, correlations based on this data can be only tentative. Nevertheless, correlations will be attempted, and their limitations recognized. Where correlations agree with those derived by Davidson (4) during the previous season, or by other workers, more confidence can be placed in them. It should be recognized, however, that experiments which neglect to measure the exchangeable potassium in the subsoil are of uncertain value since most plants draw appreciable quantities of nutrients from the lower horizons. Where such results disagree with those reported here, they may well be discounted.

The discussion and development of correlations are presented separately for each crop.

Alfalfa.

Only the data from sub-plots where boron was applied will be considered since boron deficiencies were both prevalent and severe. Obviously, a deficiency of some other essential element, such as boron, might well confuse the interpretation of results from fertilizer trials with potassium.

The data clearly show that potash additions increased the yield where the supply in both topsoil and subsoil is 90 pounds or less of potassium per acre. Where 300 pounds of potassium per acre were found

in both topsoil and subsoil, no increases were obtained from added potash. Additions of potash can then be recommended where the potassium levels fall below those named and can be omitted above the higher level. No conclusion is warranted at present concerning levels between 90 and 300 pounds of potassium per acre. The amount of potash to apply to soils with 90 pounds or less of potassium per acre seems to be about 50 pounds since larger applications failed to increase the yields sufficiently above the smaller application to justify their use.

In contrast to other crops studied, alfalfa often seems to exhibit slight potash deficiency symptoms, and yet show little or no increase in yield from potash applications. Thus, the presence of such symptoms might often be used as the first indication of the need for potash fertilization.

Corn.

The data for corn are inconclusive because of abnormal climatic conditions. The frequent periods of unfavorable weather may account in part for the great variation in stand recorded. Correction of yields to a uniform stand basis was not attempted since the spread in feeding zone of irregularly spaced plants would have an effect on total yield difficult to estimate correctly. Therefore, where large variations in stand occurred, the yield data presented are of limited value.

No response to potassium was obtained on the two plot areas with the highest levels of exchangeable potassium--200 pounds per acre in both topsoil and subsoil. The season was more favorable in this region than elsewhere, and yields from the plot areas were relatively high, hence

applications of potash to soils with this level of exchangeable potassium or above would not be recommended.

In those regions where the season was less favorable, corn yields were much lower than those discussed above. Even though the exchangeable potassium in these soils was considerably below those mentioned above, no response to potash fertilizers was obtained. These results suggest that the applied potash may not have had a chance to exert its fullest effect due to the lack of water. However, since the data are erratic, definite conclusions are not warranted.

With a favorable season, Davidson (4) found increases in yield for applications of 25 pounds of potash per acre on soils with a potassium level of approximately 190 pounds in the topsoil and 90 pounds in the subsoil.

Cotton.

Small applications of potash to cotton failed to increase the yield when the potassium level was 210 pounds per acre in the topsoil and 130 pounds in the subsoil. Thus, applications of potash would not be suggested as a profitable procedure under these conditions.

At lower levels, 120 pounds in the topsoil and 80 pounds in the subsoil, small increases in yield, 8.0 percent increase for 25 pounds of potash and 21.0 percent increase for 75 pounds of potash, were obtained. It should be recalled, however, that on this plot area two replicates were not harvested and variation in yield among replicates were great. These influences necessarily minimize the reliability of the data obtained.

Davidson (4) noted response from a 75 pound application of potash

when the exchangeable potassium was 125 pounds in the topsoil and less than 80 pounds in the subsoil. He also obtained a small increase from a 25 pound potash application on a soil with 190 pounds of potassium in the topsoil and 160 pounds in the subsoil. However, he obtained no response from any applications of potash on a soil with an exchangeable potassium level of 320 pounds in the topsoil and 190 pounds in the subsoil.

Although response to additions of potash fertilizers was found by Davidson (4) on soils of slightly higher levels of exchangeable potassium than those reported in the present study, the differences are not great. It seems safe to conclude that cotton fails to respond to potash where the exchangeable potassium is as much as 210 pounds per acre in the topsoil and 150 pounds in the subsoil. The amount of potash to apply to soils with lower levels of exchangeable potassium varies somewhat with the season, but 75 pounds of potash would usually give profitable increases in yields on soils with less than 100 pounds of exchangeable potassium in both topsoil and subsoil. An application of 25 pounds of potash is suggested for soils containing approximately 150 pounds of potassium in both topsoil and subsoil.

The lack of potash deficiency symptoms where response to potassium was obtained suggests that such deficiency symptoms appear on cotton only when the potassium level of the soil is very low.

Tobacco.

Variation in quality of tobacco has such a marked effect on value and hence, net returns per acre, that total yield alone is inadequate for

comparison of the effects of the fertilizer treatments. Potash applications usually improve tobacco quality, especially on soils low in exchangeable potassium. Cooper (3) found larger amounts of potassium, calcium, and nicotine in the better grades of dark tobacco, whereas larger amounts of magnesium and chlorine were present in the poorer grades. On this account, the interpretation of the results of potassium applications on tobacco is complicated considerably. The best measure available appeared to be that of gross value of the crop when carefully graded.

Tobacco did not respond to applications of potash where the potassium level was 220 pounds in the topsoil and 150 pounds in the subsoil. Heavy wind damage before the time of cutting of the tobacco may limit the reliability of this data.

At lower levels of potassium, 140 pounds in the topsoil and less than 80 pounds in the subsoil, increases of 7.8 and 22.1 percent in gross value were obtained from the 50 and 150 pound applications of potash, respectively. Favorable environmental conditions prevailed on this area, hence, such increases might not be obtained with a less favorable season.

The tobacco crop on areas 14 and 15 was seriously affected by factors other than fertilizer treatment, hence it is questionable whether these data warrant consideration. However, the exchangeable potassium levels of these soils were greater than 200 pounds per acre in the topsoil, with appreciable amounts in the subsoil. At such levels, response to potash applications, as indicated from data of plot area 12, would not normally be expected.

Results by Davidson (4) with dark tobacco showed response to 50-pound applications of potash at potassium levels of 160 pounds per acre in the topsoil and 120 pounds in the subsoil. He found a response to larger applications only on soils with lower exchangeable potassium levels in the subsoil. On a soil with 220 pounds of potassium in the topsoil and 140 pounds in the subsoil, little effect was recorded from potassium fertilization. These findings agree with present data.

Bortner, et al (1) found that burley tobacco gave response to potassium applications when the level of exchangeable potassium was less than 325 pounds per acre. These data were obtained from a consideration of the amount of exchangeable potassium in the topsoil only, and hence cannot be accurately compared with the present data.

On the basis of the above evidence, it is probable that fertilizer applications of 150 pounds of potash per acre would be profitable on soils containing 100 pounds or less of potassium in both topsoil and subsoil. No applications seem necessary on soils containing as much as 200 pounds of potassium in the topsoil and 150 pounds in the subsoil. Tobacco on soils with exchangeable potassium levels between those mentioned should respond to smaller applications of potash (50 pounds per acre), but present data are insufficient to warrant a definite conclusion of this nature.

Deficiency symptoms on tobacco could not be detected in the field except where the potassium was very deficient. Even in the absence of deficiency symptoms, tobacco quality may be markedly lowered because of an inadequate supply of potassium. Thus, observation of the growing crop

is not a reliable guide to the need for potassium fertilization. This conclusion is in harmony with that reached by Davidson (4).

SUMMARY

The effect of potassium on the yields of alfalfa, corn, cotton, and tobacco was studied on several soils in Tennessee. The exchangeable potassium content of the soils was determined and the following correlations between exchangeable potassium and yield response to potassium fertilization were found:

Alfalfa.

Increases in yield of 45.5 and 59.5 percent were obtained from applications of 50 and 150 pounds of potash per acre, respectively, on a Decatur silt loam where the exchangeable potassium in both topsoil and subsoil was less than 100 pounds. No increases in yield were obtained from similar potash applications on a Sequoia silt loam where the exchangeable potassium was 300 pounds in both topsoil and subsoil. Boron, as suggested in a previous study, was found essential for the optimum growth of alfalfa on the soils studied.

Corn.

No increases in yield were obtained from potash applications on any of the soils studied. This lack of response was due in part to adverse weather conditions.

Cotton.

On a Hagerstown soil containing 120 pounds of exchangeable potassium per acre in the topsoil and 80 pounds in the subsoil, increases in seed cotton yield of 8.0 percent for a 25-pound application of potash and 21.0 percent for a 75-pound application were obtained. No response

was obtained from potash applications on the same soil series where the exchangeable potassium was 210 pounds per acre in the topsoil and 150 pounds in the subsoil.

Tobacco.

Applications of 50 and 150 pounds of potash per acre gave increases in gross value of leaf tobacco of 7.8 and 21.0 percent, respectively, on Lindside silt loam, which had exchangeable potassium levels of 100 pounds per acre in the topsoil and less than 80 pounds in the subsoil. Gross value increases from similar potash applications were negligible on Cookeville silt loam where the exchangeable potassium was 220 pounds per acre in the topsoil and 150 pounds in the subsoil.

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APPENDIX I

SOIL DATA FOR INDIVIDUAL PLOTS

Plot No.	pH		Lbs. P_2O_5 per acre		Lbs. K per acre		pH		Lbs. P_2O_5 per acre		Lbs. K per acre	
	A(a)	B(a)	A	B	A	B	A	B	A	B	A	B
	Plot Area 6, Hartsells Silt Loam						Plot Area 7, Hartsells Silt Loam					
1A	5.9	4.5	50	55	230	250	5.1	4.8	100	25	180	170
B	5.6	4.5	40	20	220	170	5.3	4.9	55	10	230	200
C	6.0	4.7	75	35	260	180	5.0	5.0	50	10	180	220
2A	5.8	4.5	25	20	220	220	4.9	5.0	100	60	120	180
B	5.6	4.7	70	40	150	300	5.2	5.0	25	10	180	230
C	5.8	4.7	80	35	200	180	5.1	5.0	25	10	210	250
3A	5.7	4.5	25	20	240	170	5.0	5.1	60	10	180	170
B	5.4	4.8	50	50	300	230	5.0	4.9	50	10	140	230
C	5.6	4.7	60	25	200	240	5.2	5.0	100	10	170	250
	Plot Area 8, Maury Silt Loam						Plot Area 9, Wolftever Silt Loam					
1A	5.5	5.8	175	200	180	110	5.4	5.5	160	175	90	80
B	5.4	5.6	185	200	180	80	5.3	5.7	190	200	90	80
C	5.5	5.6	200	200	240	100	5.5	5.8	200	200	90	80
2A	5.5	5.7	175	200	180	120	5.4	5.5	160	175	90	80
B	5.4	5.5	175	200	180	110	5.4	5.8	200	200	90	80
C	5.6	5.6	200	200	280	90	5.3	5.7	200	200	90	80
3A	5.4	5.6	175	200	210	80	5.0	5.5	175	175	250	80
B	5.5	5.7	200	175	140	80	5.5	5.7	200	200	90	80
C	5.3	5.6	200	200	180	90	5.3	5.7	200	200	90	80

(a) A refers to topsoil (0-6"), B refers to subsoil (6-15").

APPENDIX I (CONTINUED)

SOIL DATA FOR INDIVIDUAL PLOTS

Plot No.	pH		Lbs. P_2O_5 per acre		Lbs. K per acre		pH		Lbs. P_2O_5 per acre		Lbs. K per acre	
	A(a)	B(a)	A	B	A	B	A	B	A	B	A	B
	Plot Area 10, Hagerstown Silt Loam						Plot Area 11, Hagerstown Silt Loam					
1A	5.5	5.2	85	85	120	110	5.8	6.1	75	25	260	280
B	5.4	5.2	75	90	130	90	5.5	6.0	75	25	180	100
C	5.7	5.5	75	100	110	90	5.5	6.0	60	25	200	110
2A	5.5	5.1	85	85	150	80	5.7	6.0	75	25	250	170
B	5.4	5.1	80	100	150	100	5.4	5.9	65	25	180	90
C	5.5	5.2	90	100	90	90	5.6	6.1	75	25	200	150
3A	5.6	5.2	85	90	150	80	5.5	6.0	75	25	250	160
B	5.5	5.2	90	100	140	80	5.5	5.8	65	25	180	150
C	5.4	5.1	90	100	80	90	5.5	6.0	60	25	190	150
	Plot Area 12, Cookeville Silt Loam						Plot Area 13, Lindside Silt Loam					
1A	5.7	5.7	85	75	190	180	5.4	5.2	35	20	100	80
B	6.1	6.4	100	85	180	170	4.9	5.3	40	35	150	80
C	6.3	6.2	80	95	220	170	5.0	5.3	35	40	120	80
2A	5.9	6.0	100	60	240	150	4.9	5.4	75	25	120	80
B	5.9	6.1	75	80	180	140	5.2	5.1	25	20	80	80
C	6.2	5.7	90	75	220	160	5.1	5.4	40	35	80	80
3A	5.7	5.9	90	60	340	160	4.9	4.9	25	35	100	80
B	5.9	6.3	75	75	170	150	4.9	5.1	50	35	150	80
C	6.3	5.9	75	85	220	150	5.0	5.0	35	30	120	80

(a) A refers to topsoil (0-6"), B refers to subsoil (6-15").

APPENDIX I (CONTINUED)

SOIL DATA FOR INDIVIDUAL PLOTS

Plot No.	pH		Lbs. P_2O_5 per acre		Lbs. K per acre		pH		Lbs. P_2O_5 per acre		Lbs. K Per acre	
	A(a)	B(a)	A	B	A	B	A	B	A	B	A	B
	Plot Area 14, Dickson Silt Loam						Plot Area 15, Cookeville Silt Loam					
1A	5.0	4.8	75	15	300	220	5.6	5.2	65	40	230	180
B	5.1	4.7	80	20	220	150	4.9	5.2	40	15	190	190
C	5.0	4.7	30	15	170	110	5.2	5.0	60	25	200	200
2A	5.0	4.7	75	20	250	170	5.1	5.1	75	60	190	200
B	4.9	4.7	20	20	230	150	5.0	5.2	35	15	210	190
C	4.9	4.8	60	20	220	120	5.4	5.7	50	30	180	220
3A	4.9	4.7	30	20	210	140	5.4	5.2	65	25	230	210
B	5.1	4.9	30	15	240	150	5.0	5.0	35	15	210	180
C	4.9	4.7	75	20	220	180	5.1	5.1	50	30	240	210

(a) A refers to topsoil (0-6"), B refers to subsoil (6-15").

APPENDIX II

GRADES AND VALUES OF DARK-FIRED TOBACCO (TYPE 22) FROM PLOT AREA 12 LOCATED ON COOKEVILLE SILT LOAM

Plot number	Yield per acre in pounds	Lugs			Seconds			Leaf			Total value per plot	Total value per acre
		Pound weight	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents		
1A	1460	.80	X5D	4.60	.40	B4G45	4.60	2.60	B4D45	37.70	$ .77	$ 194
		.40	X3D	3.70				1.30	B3D45	24.70		
		.35	X4G	2.10								
1B	1475	.30	X5D	1.73	.90	B5D45	8.40	1.20	B4D45	17.40	.81	204
		1.30	X3D	12.03				2.20	B3D45	41.80		
1C	1340	.45	X5D	2.59	.85	B5D45	10.20	3.30	B3D45	62.70	.82	206
		.75	X3D	6.94								
Average	1425											201
2A	1590	.70	X5D	4.05	1.70	B5D45	20.40	2.85	B4D45	45.32	.78	195
		1.10	X3D	10.18								
2B	1400	.35	X5D	2.01	.80	B5D45	7.20	1.50	B4D45	21.75	.79	197
		.85	X3D	7.86				2.10	B3D45	39.90		
2C	1510	.50	X5D	2.88	.55	B5D45	6.60	3.90	B3D45	74.10	.96	239
		1.10	X2D	12.10								
Average	1500											210
3A	1790	.65	X5D	3.74	1.50	B5D45	18.00	1.30	B4D45	18.85	.86	215
		1.65	X3D	15.26				2.05	B4D46	30.24		
3B	1550	.20	X5D	1.15	1.25	B5D45	15.00	1.80	B4D45	26.10	.89	223
		.95	X3D	8.79				2.00	B3D45	38.00		
3C	1350	.50	X5D	2.88	.55	B5D45	6.60	1.25	B3F45	20.94	.78	195
		1.20	X3D	11.10				1.90	B3D45	36.58		
Average	1565											211

APPENDIX II (CONTINUED)

GRADES AND VALUES OF DARK-FIRED TOBACCO (TYPE 22) FROM PLOT AREA 15 LOCATED ON LINDSIDE SILT LOAM

Plot number	Yield per acre in pounds	Lugs			Seconds			Leaf			Total value per plot	Total value per acre
		Weight pounds	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents		
1A	1700	1.35	X4G	8.10	2.00	B4D45	29.00	5.00	B3D45	57.00	$1.04	$231
		1.30	X3G	9.75								
1B	1720	1.30	X4G	7.80	1.35	X1D	16.88	1.15	B3D45	21.85	1.02	227
		1.65	X3G	12.38				2.30	B3D46	43.28		
1C	1980	1.70	X3G	15.75	2.25	B4D45	32.63	1.60	B3D45	28.50	1.42	316
		.95	X4G	5.70				2.55	B2D45	59.93		
Average	1800											258
2A	1830	1.35	X4G	8.10	1.45	B4F45	19.21	4.00	B2D45	90.00	1.31	291
		1.45	X3D	13.41								
2B	1550	.55	X4G	3.30	2.05	B4D45	29.75	3.40	B2D45	76.50	1.17	260
		1.00	X3G	7.50								
2C	1780	.80	X4G	4.80	1.50	B4F45	19.88	3.25	B2D45	73.13	1.27	282
		1.50	X3G	11.25				.95	B3D45	18.05		
Average	1720											278
3A	1900	.80	X4G	4.80	1.90	B4D45	27.55	3.75	A3D46	80.63	1.56	302
		2.10	X2D	23.10								
3B	2000	.85	X4G	5.10	2.60	B4F46	35.75	4.10	B2D46	96.35	1.51	334
		1.50	X3D	13.87								
3C	2000	1.40	X4G	8.40	2.25	B4D45	32.63	2.50	B2D46	58.75	1.39	309
		1.35	X3G	10.13				1.55	B3D45	29.45		
Average	1960											315

APPENDIX II (CONTINUED)

GRADES AND VALUE OF DARK-FIRED TOBACCO (TYPE 22) FROM PLOT AREA 14
LOCATED ON DICKSON SILT LOAM

Plot number	Yield per acre in pounds	Lugs			Seconds			Leaf			Total value per plot	Total value per acre
		Weight pounds	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents		
1A	1540	1.50	X4L	12.38	1.10	C5F45	11.55	5.55	B4F45	47.04	$ .71	$177
1B	1680	1.20	X4F	9.60	1.00	C5F45	10.50	2.60	C3F45	37.70	.90	224
								1.90	B3F45	31.83		
1C	1750	1.50	X4F	12.00	.80	C5F45	8.40	5.34	B3F45	56.11	.96	240
								1.55	C3F45	19.58		
Average	1660											214
2A	1290	1.55	X4F45	12.40	.60	C5F45	6.30	1.50	C3F45	21.75	.62	155
								1.50	C3F44	21.36		
2B	1860	1.10	X4F	8.80	1.40	C5F45	14.70	2.00	C3F46	30.00	1.01	252
								1.70	B3F46	29.33		
								1.25	C3F45	18.13		
2C	1550	1.20	X4F	9.60	.85	C5F45	8.92	2.40	C3F45	34.80	.83	207
								1.75	B3F45	29.31		
Average	1570											205
3A	1500	1.80	X4L	14.85	.85	C5F45	8.40	2.50	C3F46	37.50	.73	183
								.85	C3F45	12.33		
3B	1800	1.35	X4F	10.90	1.70	C5F45	17.85	1.85	C3F45	26.83	.93	230
								1.20	C3F46	18.00		
								1.10	B3F46	18.98		
3C	1800	1.15	X4F	9.20	1.05	C5F45	11.02	2.60	B3F46	44.85	.81	203
								2.40	C3F46	26.00		
Average	1700											205

APPENDIX II (CONTINUED)

GRADES AND VALUES OF DARK-FIRED TOBACCO (TYPE 22) FROM PLOT AREA 15 LOCATED ON COOKEVILLE SILT LOAM

Plot number	Yield per acre in pounds	Lugs			Seconds			Leaf			Total value per plot	Total value per acre
		Weight pounds	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents	Weight pounds	U. S. grade	Value cents		
1A	1390	.60	X4F	4.80	.60	B4F45	7.95	1.35	B2F45	27.68	$ .46	$209
		.50	X2F	5.25								
1B	1570	.75	X4F	6.00	.50	B4F45	6.65	.40	B3F45	6.70	.44	199
		.35	X2F	3.68				1.00	B2F45	20.50		
1C	1570	.50	X5F	3.25	.65	B4F45	8.61	.60	B3F45	10.05	.45	196
		.40	X3F	3.70				.85	B2F45	17.45		
Average	1577											201
2A	1350	.90	X4F	7.20	.50	B4F45	6.65	1.15	B2F45	23.58	.42	190
		.40	X2F	4.20								
2B	1255	.70	X4F	5.60	.55	C4F45	6.60	.50	B3F45	8.38	.53	150
		.40	X2F	4.20				.55	C3F45	7.98		
2C	1240	.45	X4F	3.60	.80	B4F45	10.60	.50	B1F45	12.75	.42	194
		.30	X2F	3.15				.60	B2F45	12.50		
Average	1275											178
3A	1350	.40	X4F	3.20	.65	B4F45	8.61	.45	A3F46	9.45	.40	184
		.70	X2F	7.35				.80	C3F45	11.60		
3B	1570	.60	X4F	4.80	.25	B4F45	3.31	.35	C3F46	5.25	.42	192
		.70	X2F	7.35				1.05	A3F45	21.53		
3C	1555	.50	X5F	3.25	.90	B4F45	11.92	1.65	B2F45	35.48	.54	247
		.30	X2F	3.15								
Average	1425											208

APPENDIX III

AVERAGE PRICES OF GRADES OF TOBACCO FOR 1939 SEASON
"TYPE 22, FIRE-CURED"

U. S. grades	Average price per cwt.	U. S. grades	Average price per cwt.	U. S. grades	Average price per cwt.
Wrappers		**Heavy leaf (Cont'd.)**		**Thin leaf (Cont'd.)**	
A1F 46	$30.00	B4F 46	$15.75	C3L 45	$14.75
A1F 45	27.50	B4F 45	13.25	C3L 44	----
A1D 46	31.00	B4F 44	12.25	C3F 46	15.00
A1D 45	29.50	B4FV 46	13.25	C3F 45	14.50
A2F 46	26.00	B4FV 45	12.50	C3F 44	14.50
A2F 45	25.00	B4FV 44	11.50	C3FV 46	14.50
A2D 46	27.00	B4D 46	14.50	C3FV 45	13.75
A2D 45	26.00	B4D 45	14.75	C3FV 44	13.50
A3F 46	21.00	B4D 44	14.00	C3D 46	13.50
A3F 45	20.50	B4M 46	12.00	C3D 45	14.75
A3D 46	21.50	B4M 45	11.25	C3D 44	13.50
A3D 45	21.50	B4M 44	10.25	C3M 46	13.50
Heavy Leaf		B4G 46	12.00	C3M 45	12.50
B1F 46	27.50	B4G 45	11.50	C3M 44	12.25
B1F 45	25.50	B4G 44	10.50	C3G 46	13.50
B1D 46	27.00	B5F 46	11.75	C3G 45	12.50
B1D 45	26.00	B5F 45	11.00	C3G 44	11.50
B1D 44	22.00	B5F 44	10.00	C4L 46	12.75
B2F 46	21.50	B5FV 46	11.25	C4L 45	12.00
B2F 45	20.50	B5FV 45	10.25	C4L 44	11.25
B2F 44	18.00	B5FV 44	8.75	C4F 46	12.50
B2D 46	23.50	B5D 46	11.50	C4F 45	12.00
B2D 45	22.50	B5D 45	12.00	C4F 44	11.25
B2D 44	20.00	B5D 44	10.50	C4FV 46	12.00
B3F 46	17.25	B5M 46	9.50	C4FV 45	11.25
B3F 45	16.75	B5M 45	9.50	C4FV 44	10.25
B3F 44	15.25	B5M 44	8.50	C4D 46	12.50
B3FV 46	16.00	B5G 46	9.75	C4D 45	11.75
B3FV 45	15.00	B5G 45	9.00	C4D 44	11.25
B3FV 45	15.00	B5G 44	8.25	C4M 46	10.75
B3FV 44	14.25	**Thin Leaf**		C4M 45	10.50
B3D 46	19.25	C1F 46	----	C4M 44	9.75
B3D 45	19.00	C1F 45	21.50	C4G 46	10.50
B3D 44	17.00	C2F 46	18.50	C4G 45	9.50
B3M 46	14.50	C2F 45	17.75	C4G 44	8.75
B3M 45	13.50	C2F 44	17.75	C5L 46	11.00
B3M 44	12.75	C2D 46	18.75	C5L 45	10.25
B3G 46	16.00	C2D 45	18.00	C5L 44	9.00
B3G 45	15.50	C2D 44	15.75	C5F 46	11.00
B3G 44	14.00	C3L 46	15.75	C5F 45	10.50

APPENDIX III (CONTINUED)

AVERAGE PRICES OF GRADES OF TOBACCO FOR 1959 SEASON "TYPE 22, FIRE-CURED"

U. S. grades	Average price per cwt.
Thin leaf (Cont'd.)	
C5F 44	$ 9.75
C5FV 46	10.25
C5FV 45	10.00
C5FV 44	9.25
C5D 46	10.00
C5D 45	10.00
C5D 44	9.50
C5M 46	9.25
C5M 45	9.00
C5M 44	8.00
C5G 46	8.25
C5G 45	7.75
C5G 44	6.50
Short leaf	
T3f	15.00
T3D	12.50
T3M	11.50
T3G	11.00
T4F	9.50
T4D	9.75
T4M	8.25
T4G	7.75
Short leaf (Cont'd.)	
T5F	$-----
T5D	-----
T5M	6.25
T5G	5.25
Lugs	
X1L	-----
X1F	11.75
X1D	12.50
X2L	10.75
X2F	10.50
X2D	11.00
X3L	9.25
X3F	9.25
X3FV	8.75
X3D	9.25
X3M	8.25
X3G	7.50
Short leaf (cont'd.)	
X4L	8.25
X4F	8.00
X4FV	7.50
X4D	7.50
X4M	$ 6.75
X4G	6.00
X5L	6.75
X5F	6.50
X5FV	6.00
X5D	5.75
X5M	5.50
X5G	4.25
Nondescript	
N1B	----
N2B	----
N1X	4.50
N2X	3.75
N1G	4.00
N2G	3.25
N3G	2.50

KEY TO STANDARD GRADE MARKS FOR FIRE-CURED TOBACCO

A - Wrappers	1 - Choice	L - Light	46-24" to 28"	V-Greenish tinged
B - Heavy leaf	2 - Fine	F - Brown	45-20" to 24"	K-Varigated
C - Thin leaf	3 - Good	D - Dark	44-16" to 20"	U-Unsound or damaged under 20%
T - Short leaf	4 - Fair	M - Mixed		
X - Lugs	5 - Low	G - Green		W-Doubtful keeping order
N - Nondescript				OS-One sucker fire-cured