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Fertilization of Dark Tobacco

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SUMMARY AND CONCLUSIONS

The Madole variety of dark tobacco was grown on a different range each year in a 3-year tobacco, wheat, and pasture rotation. Only the tobacco received fertilizer.

Nitrogen, phosphorus, and potassium increased yield and dollar acre value of the tobacco, with the 120-100-180 treatment of N, P_2O_5, and K_2O appearing to be superior to the other treatments evaluated.

The effects of the different nutrient levels upon the tobacco grades may be summarized as follows:

Nitrogen had no great effect on leaf group or quality but greatly increased the percentage of dark leaf with a corresponding decrease in brown leaf. The percentage of green and greenish brown leaf increased about 10%.

Phosphorus increased the percentage of X and B leaf groups and decreased the percentage of C and A leaf groups, had little effect upon the quality, and greatly increased the percentage of brown leaf with a corresponding decrease in the dark leaf.

Potassium slightly increased the A and C leaf groups with a corresponding decrease in the X and B leaf groups, decreased the fine leaf with a corresponding increase in the good leaf, and increased the brown leaf with a corresponding decrease in the dark leaf.

Ten tons of barnyard manure per acre contributed to higher yields of dark tobacco and a higher dollar per acre income than for tobacco produced with normal fertilization without manure. The average value of the manure used with fertilizer on dark tobacco was $5 to $8 per ton.

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Fertilization of Dark Tobacco

by

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Introduction

An experiment on fertilization of the Madole variety of dark tobacco was conducted on a Dickson soil at the Highland Rim Experiment Station over a 9-year period. Three separate, but adjacent, experimental areas were used and tobacco was grown on each area only once in a 3-year period. Wheat followed tobacco and a clover-grass mixture was seeded in the wheat and remained on the area through the third year as a hay crop. Three cycles of the 3-year rotation (tobacco, wheat, clover-grass pasture) were completed.

The plot size was 21 x 50 feet (six 42-inch rows 50 feet long) and the plant spacing was 34 inches. Three replicates of a randomized block experimental design were used. Fertilizer treatments were applied to the tobacco crop only. With the exception of the first few years when a small amount of the fertilizer was applied in the row, the fertilizers were applied broadcast and disked into the soil before transplanting the tobacco. Starting with the 1958 crop, surface soil samples from each plot were obtained each year before applying fertilizer for the tobacco.

The four center rows in each plot were harvested for yield and quality data. The tobacco was cured and prepared for market using customary procedures. After stripping, the tobacco of each plot was graded by a Federal Tobacco Inspector. The dollar acre value was calculated from the average price received by farmers for the various grades of tobacco in the year that the tobacco was marketed. In this procedure, the price received for a given leaf grade might change from year to year, but the dollar acre value represents the normal market value of the tobacco for that year.

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Transplanting and Cutting Dates

The dates of transplanting and cutting of the tobacco are shown in Table 1. Generally the tobacco was transplanted in late May or early June and cut in late August or the first half of September. The length of time that the tobacco was in the field varied from 94 days in 1962 to 111 days in 1959.

Table 1. Transplanting and cutting dates of tobacco over the 9-year period

Year	Transplanting	Cutting	Total days transplanting to cutting
1956	May 25	September 12	110
1957	May 31	September 4	96
1958	June 4	September 8	96
1959	May 20	September 8	111
1960	June 2	September 19	109
1961	June 10	September 20	102
1962	May 26	August 28	94
1963	May 30	September 2	95
1964	May 20	August 28	100

Rainfall

The monthly rainfall for the Springfield Station and the 25-year average of the Springfield area for the growing season of dark tobacco are shown in Table 2. These data indicate that 1964 had the least rainfall and 1960 had the most rainfall during the years of the experiments. Only in 1956, 1961, and 1964 was the rainfall considerably below the 25-year average. It was just slightly below the average in 1963 and above average in all other years. Although the greatest precipitation occurred in the 1960 growing season, moisture distribution during that year was relatively poor for dark tobacco production. During 1960, May and June were excessively wet and July and August were relatively dry. Years with rainfall distribution similar to that in 1959 and 1964 apparently favor good yields of dark tobacco. On these years adequate moisture was available in May, followed by a somewhat drier June that apparently encouraged deeper rooting of the plants. Once the plants had started to grow and develop, adequate rainfall in July and August tended to produce a rather high yield of good quality tobacco.

Table 2. Monthly rainfall during the dark tobacco growing season from 1956 through 1964 and the 25-year average for the Springfield area

Month	1956	1957	1958	1959	1960	1961	1962	1963	1964	25-yr. av.
May	4.38	5.70	4.24	4.83	4.62	4.05	3.37	2.60	1.80	4.12
June	2.48	3.35	2.23	1.41	7.34	4.62	3.55	3.10	.72	3.36
July	4.57	2.61	7.08	3.58	3.28	3.46	5.80	5.99	2.22	4.16
August	2.79	2.07	2.99	5.31	1.53	1.39	2.36	4.37	4.37	3.26
September	.60	5.68	3.26	4.56	3.45	1.78	3.88	1.12	3.08	2.98
TOTAL	14.82	19.41	19.80	19.69	20.22	15.30	18.96	17.18	12.19	17.88

Effect of Different Rates of Nitrogen Upon Soil Test Values, Yield, Acre Value and Leaf Grade of Dark Tobacco

Soil test values for nitrogen treatments

Soil test values for samples taken from the plots each spring prior to fertilizer applications to the tobacco crop are shown in Table 3. These values represent the average of all three replications; the range in which the tobacco was grown each year is also indicated. The pH values range from 5.0 to 5.6 and pH values on Range C were slightly higher than those of the other two ranges. The phosphorus values range from 11 to 20 pounds per acre. These values would be classified in the medium to low category. The potassium values range from 100 to slightly over 250. Potassium soil test values for Range C were slightly higher than those for the other two ranges. During each year of the experiment, all the above treatments received 100 pounds of P_2O_5 and 180 to 200 pounds of K_2O per acre. Therefore, the above soil test

Table 3. Soil test values for nitrogen treatments

			Year and Range					
Lb. N/A	1958 C	Lb. N/A	1959 A	1960 B	1961 C	1962 A	1963 B	1964 C
			Soil pH values					
0	5.3	0	5.4	5.3	5.2	5.1	4.9	5.6
50	5.4	60	5.3	5.1	5.4	5.0	4.8	5.6
100	5.5	120	5.2	5.1	5.6	5.1	4.8	5.6
200	5.3	180	5.1	5.1	5.0	5.0	5.0	5.4
250	5.5	240	5.2	5.1	5.3	5.2	5.2	5.5
		300	5.4	5.1	5.0	5.0	5.1	5.2
			Pounds P per acre					
0	18	0	14	13	13	13	17	12
50	17	60	14	15	12	14	20	14
100	16	120	12	14	12	12	18	12
200	17	180	13	17	13	12	14	13
250	16	240	12	14	11	11	12	13
		300	12	16	15	11	14	17
			Pounds K per acre					
0	143	0	157	133	143	100	180	190
50	157	60	130	143	150	123	167	253
100	157	120	140	160	133	133	193	203
200	173	180	130	123	150	120	167	227
250	167	240	123	150	133	107	147	213
		300	150	143	150	127	163	187

values should reflect soil test changes on any range that were caused by applying these fertilizers once every third year.

Yield per acre

The yield of dark tobacco obtained from different rates of nitrogen are shown in Table 4. During the first 3 years of the experiment when the nitrogen rates were in 50-pound increments from 0 to 250 pounds of N per acre, a significant nitrogen response was obtained in 2 of the 3 years and for the 3-year average. During these 2 years, 100 pounds of nitrogen was significantly better than 50 pounds per acre, but rates higher than this did not produce significantly more pounds of tobacco per acre.

For the last 6 years of the experiment, when the nitrogen rates were in 60-pound increments—from 0 to 300 pounds of N per acre—a significant response to nitrogen was obtained in 3 of the years and for the 6-year average. In those 3 years when there was no significant difference among the different nitrogen treatments, a significant response to nitrogen occurred when nitrogen vs. no nitrogen comparisons are made. For the 6-year average the 120-pound per acre nitrogen rate was significantly better than the 60-pound rate. Yields at rates higher than 120 pounds per acre were not significantly better than the 120-pound per acre rate.

Dollar acre value

The dollar acre values which were calculated from the average values received for the different grades on the given year that the crop was marketed are also shown in Table 4. During the first 3 years of the experiment, a significant difference among nitrogen treatments occurred in 2 of the 3 years and for the 3-year average. These results indicate that the highest dollar acre value would be obtained from a nitrogen rate between 100 and 150 pounds of nitrogen per acre.

During the last 6 years of the experiment, a significant difference among the nitrogen treatments occurred in 3 of the years and for the 6-year average. However, during those 3 years when there was no significant difference among the nitrogen treatments, a significant response to added nitrogen was obtained each year. The data obtained during the last 6 years of the experiment indicate that 120 pounds of nitrogen was significantly better than

Table 4. Effect of nitrogen rates on yield and dollar acre value of dark tobacco

Lb. N/A	1956	1957	1958	3-yr. av.	Lb. N/A	1959	1960	1961	1962	1963	1964	6-yr. av.
						Pounds per acre						
0	1809	1403	1957	1603	0	1926	1533	1282	1405	1564	2117	1638
50	2016	1655	1775	1815	60	2252	1651	1645	1735	1813	2218	1886
100	1876	1999	2029	1968	120	2278	1953	1839	1782	2221	2518	2099
150	2153	1982	1904	2013	180	2331	1734	1759	1841	2084	2389	2023
200	2358	1961	1964	2094	240	2318	1759	1920	2019	1902	2336	2042
250	2029	2063	2037	2043	300	2231	1675	1737	1586	1822	2473	1921
L. S. D.												
(.05)	N.S.	180	236	183		N.S.	N.S.	199	N.S.	249	218	126
(.01)	....	256	....	245		....	....	282	....	353	....	167
						Dollar acre value						
0	674	594	655	641	0	808	688	561	583	620	1022	714
50	809	720	749	759	60	837	752	692	736	758	1054	805
100	759	880	904	848	120	865	892	842	759	936	1225	920
150	909	866	858	878	180	857	781	776	730	847	1155	858
200	1001	847	783	877	240	855	782	831	797	785	1099	858
250	892	963	809	888	300	850	731	779	585	735	1220	817
L. S. D.												
(.05)	203	311	N.S.	101		N.S.	N.S.	96	N.S.	113	118	59
(.01)	....	....	....	135		....	....	138	....	160	....	78

any of the other nitrogen rates in terms of total dollar acre value. In general, the application of 100 to 120 pounds of nitrogen per acre returned on the average approximately $200 per acre.

Leaf grade

As would be expected, increasing the nitrogen rates on dark tobacco produced a change in the leaf grade distribution. The average changes produced in the leaf groups, quality, and colors are shown in Figures 1, 2, and 3. The percentage distribution each year is shown in Table 11. Figure 1 shows the changes of leaf group distribution as affected by nitrogen rates. This figure indicates that as nitrogen rates were increased, a slight increase in the X leaf groups occurred. The B leaf groups decreased

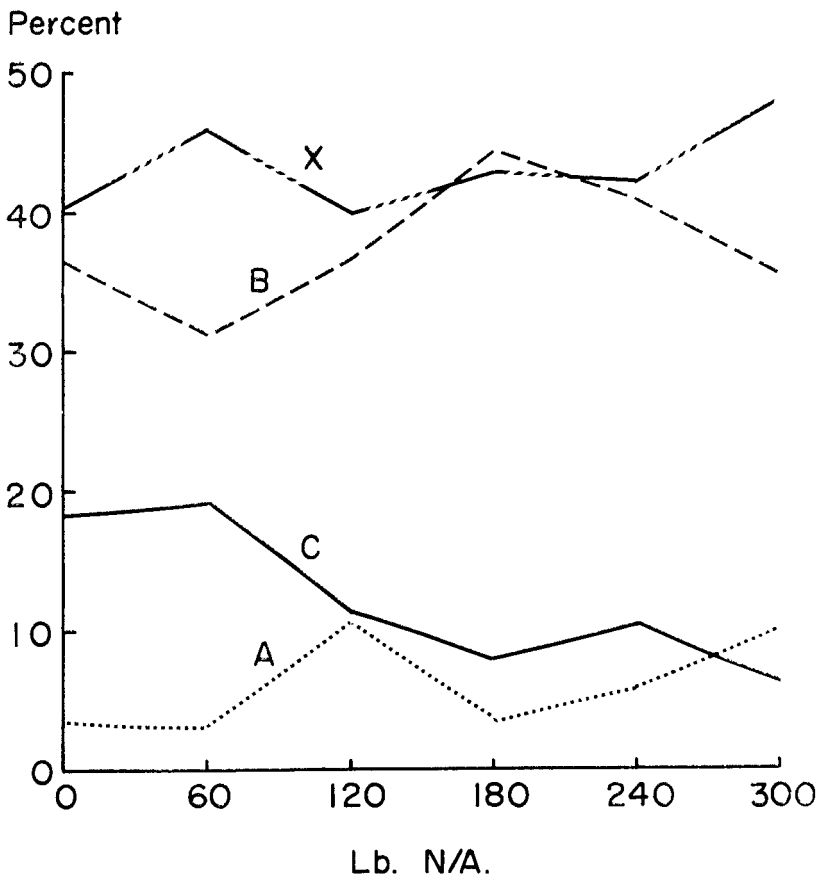

Figure 1. Effect of nitrogen levels on percent distribution of leaf groups (1959-1964).

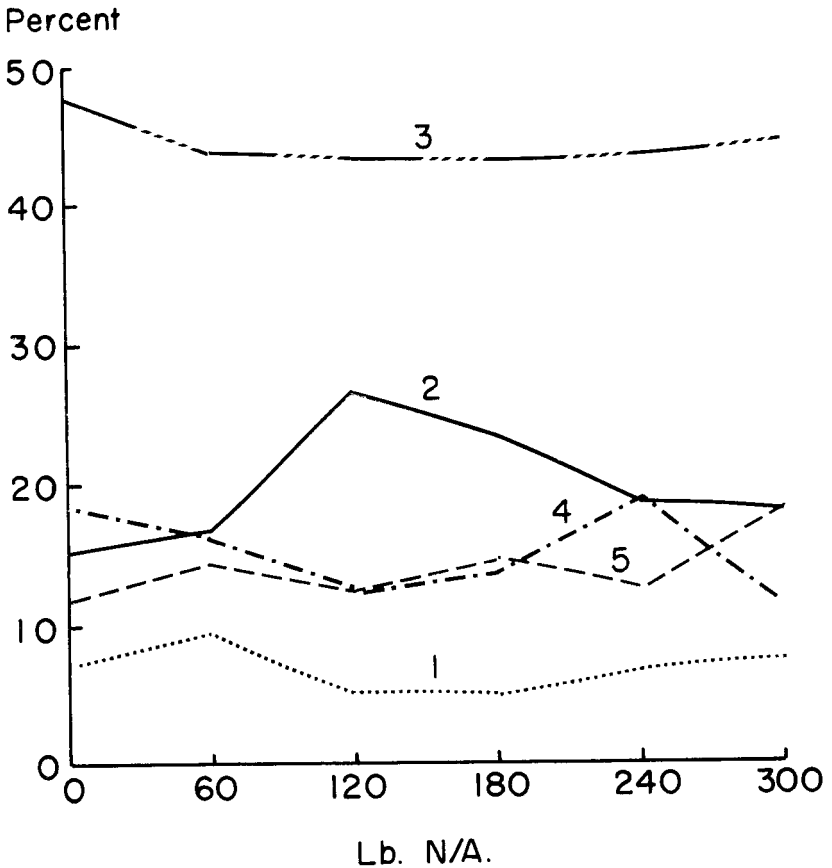

Figure 2. Effect of nitrogen levels on percent distribution of leaf quality (1959-1964 average).

slightly at 60 pounds of nitrogen per acre followed by an increase of up to 180 pounds of nitrogen per acre and then a decrease. Nitrogen resulted in a large decrease in the C leaf groups and some variability in the amount of A leaf produced. Figure 2 indicates that only about 5% to 9% of the leaf was of the 1 or choice quality regardless of nitrogen rate; however, 120 and 180 pounds of nitrogen per acre did produce a higher percentage of 2 (Fine) quality leaf than the other treatments. Nitrogen above or below this rate tended to decrease the percentage of leaf in this quality group.

Figure 3 indicates the relative influence of nitrogen upon the leaf colors. As would be expected, the D or dark leaf greatly increased as the nitrogen rates were increased, with the percent

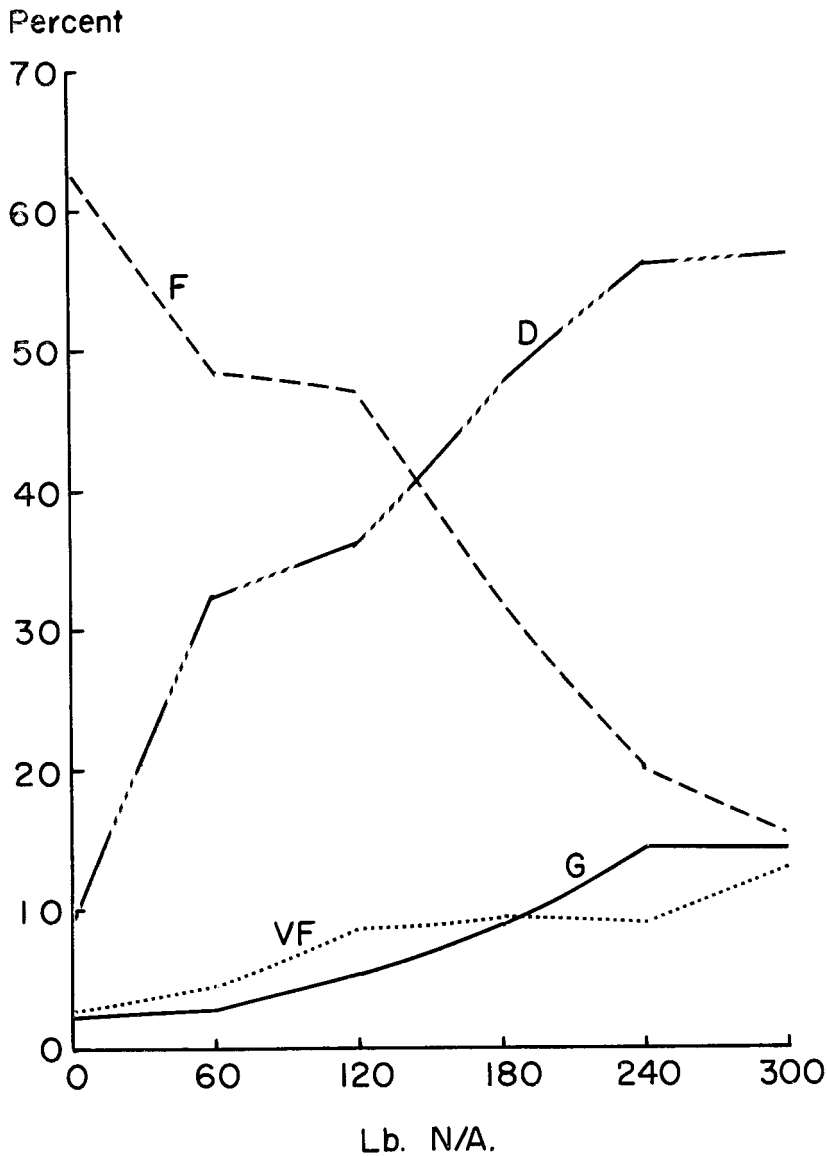

Figure 3. Effect of nitrogen levels on percent distribution of leaf color (1959-1964 average).

of D leaf ranging from about 9% at 0 nitrogen to almost 60% at 300 pounds of nitrogen per acre. As the percentage of D leaf increased, there was a corresponding decrease in the F or brown leaf. The percentage of the G (Green) and VF (Greenish brown) leaf increased from about 2% up to about 17% as the nitrogen rates increased.

Effect of Different Phosphorus Levels Upon Soil Test Value, Yield, Acre Value and Leaf Grade of Dark Tobacco

Soil test values for phosphorus treatments

Soil test values for the years 1958 through 1964 are shown in Table 5. These values represent an average of three replications of each treatment on the particular range as indicated each year. Soil pH values ranged from 4.8 to 5.6 and were higher on Range C than on the other two ranges. In 1958 the phosphorus soil test values ranged from 12 to 17. By 1964, after three cycles of the experiment, it was evident that the difference in soil test value between the 0 phosphate treatment and the 150 pounds per acre phosphate treatment level had increased.

Although there is some variability in the soil test values of potassium in the different phosphorus treatments, the values generally ranged from 150 to 200 pounds per acre before the application of 200 pounds of K per acre each year that tobacco was grown.

Yield per acre

The yield of dark tobacco produced for the different phos-

Table 5. Soil test values for phosphorus treatments

	Year and Range						
Lb. P_2O_5/A	1958 C	1959 A	1960 B	1961 C	1962 A	1963 B	1964 C
			Soil pH values				
0	5.3	5.5	5.1	5.3	5.2	5.1	5.5
50	5.4	5.2	5.1	5.4	5.1	5.0	5.6
100	5.5	5.2	5.1	5.6	5.1	4.8	5.6
150	5.2	5.3	5.1	5.2	5.0	5.2	5.4
			Pounds P per acre				
0	12	10	11	7	7	11	5
50	17	15	15	10	12	17	9
100	16	12	14	12	12	18	12
150	17	13	17	17	14	17	24
			Pounds K per acre				
0	190	157	100	207	180	183	243
50	170	117	157	183	130	183	247
100	157	140	160	133	133	193	203
150	163	133	150	143	137	167	203

phate levels is shown in Table 6. During the first 3 years of the experiment, a significant difference among the phosphate treatments occurred only in 1958. The 3-year average showed no significant difference among the different phosphate treatments; however, there was a significant response to applied phosphate when the phosphate vs. no phosphate comparison was made. During the last 6 years of the experiment a significant difference among the treatments occurred in only 2 of the 6 years and for the 6-year average. During this particular period, the 100-pound per acre P_2O_5 rate was significantly better than either the 0 or 50 pounds per acre treatments.

Dollar acre value

During the first 3 years, the trend of the dollar acre value (Table 6) was essentially the same as that of pounds per acre yield. A significant difference among the treatments occurred in only 1 of the 3 years. No significant difference was observed among the 50-, 100-, or 150-pound treatments for the 3-year average although there was a significant response to the applied phosphate. In 3 of the last 6 years of the experiment and for the 6-year average, there was a significant difference among the dollar acre values of the phosphate treatments. In each of these cases, except 1964, the 100-pound per acre treatment was significantly better than the 0- or 50-pound per acre treatments.

Leaf grade

The relationships between the different levels of phosphate and the percentage distribution of leaf groups, qualities, and colors are shown in Figures 4, 5, and 6. The percentage distribution for each year is shown in Table 12. In Figure 4, as pounds of P_2O_5 per acre were increased, the percentage of A and C leaf groups decreased and the percentage of B and X leaf groups increased.

The proportions of choice, fine, good, fair, and low quality tobacco were not greatly influenced by the different levels of phosphate (Figure 5).

Figure 6 shows the relative influence of the different levels of phosphate upon the leaf color. As the pounds of phosphate per acre increased to 100 pounds per acre, there was a great increase in the F or brown leaf color and a corresponding decrease in the D or dark leaf color. Accompanying these major changes in the F and D grades was a small decrease in the percentage of G and VF leaf colors.

Table 6. Effect of phosphorus rates on yield and dollar acre value of dark tobacco

Lb. P_2O_5/A	1956	1957	1958	3-yr. av.	Lb. P_2O_5/A	1959	1960	1961	1962	1963	1964	6-yr. av.
					Pounds per acre							
0	2104	1840	1311	1752	0	2266	1701	1091	1431	1626	1571	1614
50	2267	1669	1860	1932	50	2367	1639	1620	1863	1777	2317	1931
100	1876	1999	2029	1968	100	2278	1953	1839	1782	2221	2518	2099
150	2204	1893	1796	1964	150	2232	1773	1866	1844	2062	2177	1992
L. S. D.												
(.05)	N.S.	N.S.	299	N.S.		N.S.	N.S.	189	N.S.	N.S.	247	125
(.01)	....	....	454	....		....	....	287	....	....	374	167
					Dollar acre value							
0	904	831	580	772	0	904	809	454	590	657	698	685
50	1011	706	801	839	50	917	760	708	806	741	1135	845
100	759	880	904	848	100	865	892	842	759	936	1225	920
150	887	868	768	841	150	846	804	810	778	850	1018	851
L. S. D.												
(.05)	N.S.	N.S.	154	N.S.		N.S.	N.S.	105	N.S.	186	170	60
(.01)	....	....	....	....		....	....	159	....	....	257	80

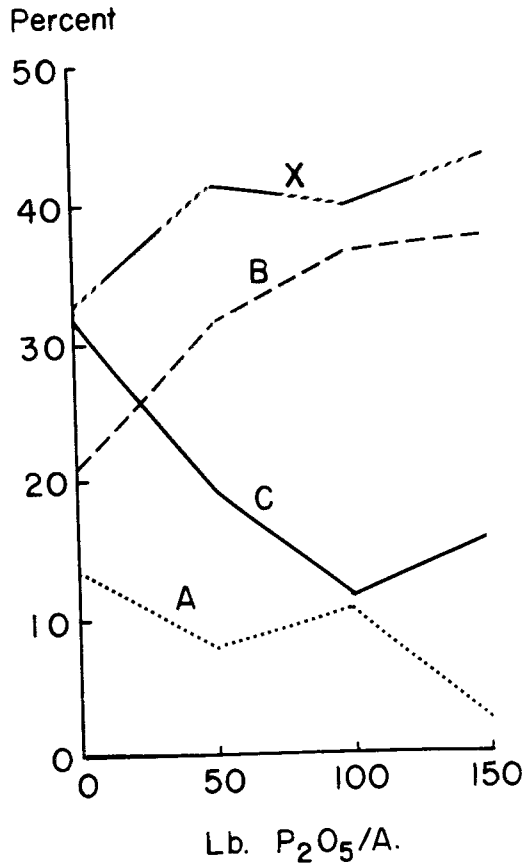

Figure 4. Effect of phosphate levels on percent distribution of leaf groups (1959-1964 average).

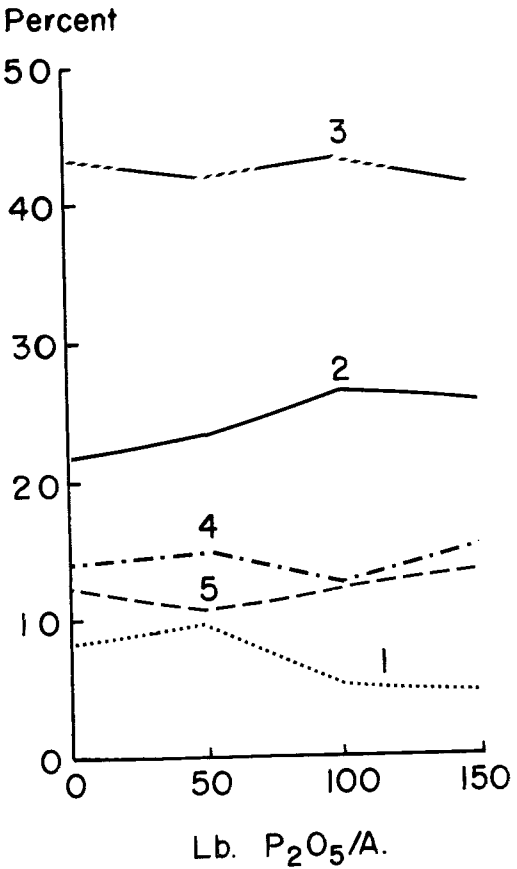

Figure 5. Effect of phosphate levels on percent distribution of leaf quality (1959-1964 average).

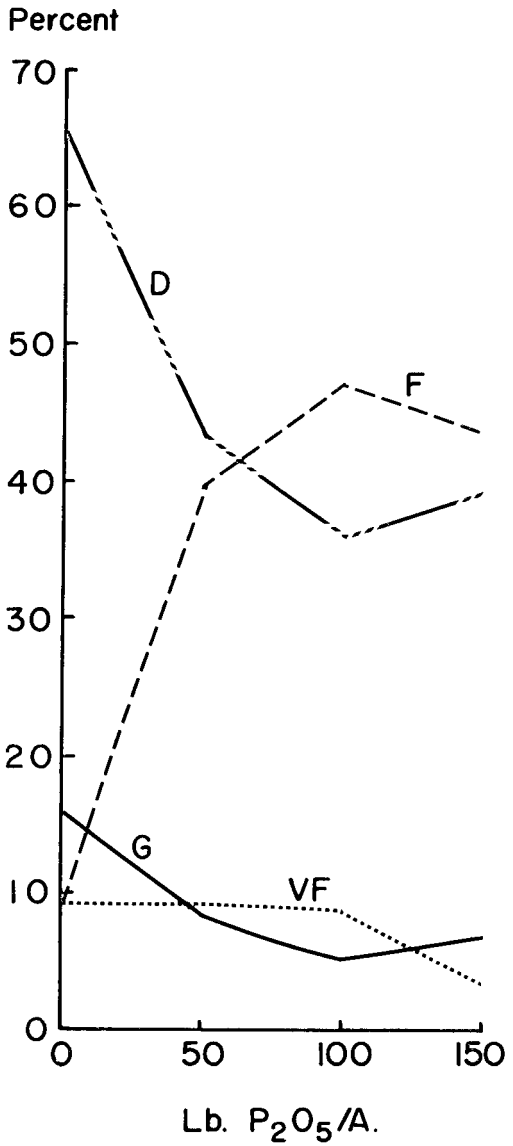

Figure 6. Effect of phosphate levels on percent distribution of leaf color (1959-1964 average).

The Effect of Different Potassium Levels on Soil Test Values, Yield, Acre Value and Leaf Grade of Dark Tobacco

Soil test values for potassium treatments

The average soil test values from the treatments receiving the different levels of potassium are shown in Table 7. These values represent an average of the three replications on each range on the particular year as indicated. The pH values range from 5.0 to 5.7 and the pH levels of Range C were somewhat higher than the pH values of the other two ranges.

The soil test P values ranged from 11 to 19 and would be classed in the medium to low category. These would reflect soil phosphate levels associated with applications of 100 pounds of P_2O_5 once every 3 years in a tobacco-wheat-pasture rotation.

In 1958, the range among plots of soil K test values was not great but as the experiment progressed the difference between the 0 treated plots and the higher potash treated plots gradually

Table 7. Soil test values for potassium treatments

			Year and Range					
Lb. K_2O/A	1958 C	Lb. K_2O/A	1959 A	1960 B	1961 C	1962 A	1963 B	1964 C
			Soil pH values					
0	5.4	0	5.2	5.0	5.5	5.1	5.0	5.6
50	5.3	60	5.5	5.1	5.2	5.2	5.0	5.4
100	5.3	120	5.3	5.1	5.4	5.2	5.0	5.5
200	5.5	180	5.2	5.1	5.6	5.1	4.8	5.6
250	5.4	240	5.2	5.1	5.3	5.1	5.0	5.6
		300			5.7	5.2	4.9	5.7
			Pounds P per acre					
0	17	0	12	15	12	10	17	11
50	18	60	12	17	14	13	18	14
100	19	120	13	14	14	13	14	15
200	16	180	12	14	12	12	18	12
250	19	240	11	14	14	13	13	14
		300			13	13	17	13
			Pounds K per acre					
0	150	0	103	140	110	70	147	137
50	127	60	120	157	120	100	147	163
100	130	120	133	180	133	110	187	197
200	157	180	140	160	133	133	193	203
250	140	240	143	147	157	170	183	217
		300			140	157	203	223

increased until it was about 100 pounds per acre at the end of the experimental period.

Yield per acre

The yield per acre and dollar acre value of dark tobacco produced at the different potassium treatments are shown in Table 8. No significant difference among any of the potassium treatments was observed during the first 3 years of the experiment. During the last 6 years of the experiment, a significant difference among potassium treatments occurred in 3 of the 6 years and for the 6-year average. In each of these cases the 180-pound per acre treatment produced significantly more tobacco per acre than either of the lower rates. However, rates above 180 pounds per acre did not produce further significant yield increases.

Dollar acre value

As was true for pounds per acre yield, there was no significant difference among the different potash treatments in the dollar acre value (Table 8) for the first 3 years or the 3-year average over that period. However, during the last 6 years of the experiment, adding potash produced a significant increase in dollar acre value for 5 of the 6 years and for the 6-year average. These data generally indicate that 180 pounds of K_2O per acre produced tobacco with a significantly higher dollar acre value than treatments receiving less potash. However, adding additional amounts of potassium above the 180-pound per acre rate did not result in further significant increases in dollar acre value.

Leaf grade

The relative effect of different potassium levels on the percentage distribution of the leaf groups, qualities, and leaf colors are shown in Figures 7, 8, and 9. The percentage distribution for each year is shown in Table 13. Figure 7 shows the relative effect of increasing potassium on the percent distribution of the leaf groups. Here it is evident that the percentage of X and B leaf groups decrease slightly, and that the percentage of A and C leaf groups increased as potassium was increased.

Perhaps the best average quality occurred at the 180-pound per acre potassium rate (Figure 8). An increase in the good (3) leaf was accompanied with a decrease in the fine (2) leaf and fair

Table 8. Effect of potassium rates on yield and dollar acre value of dark tobacco

Lb. K_2O/A	1956	1957	1958	3-yr. av.	Lb. K_2O/A	1959	1960	1961	1962	1963	1964	6-yr. av.
						Pounds per acre						
0	2201	1863	1683	1916	0	2219	1592	1609	1592	1875	2044	1822
50	2137	2049	1753	1980	60	2365	1794	1717	1934	1932	2241	1997
100	2217	1825	1975	2006	120	2398	1538	1678	2018	1810	2414	1976
200	1876	1999	2029	1968	180	2278	1953	1839	1782	2221	2518	2099
250	2293	1951	1981	2075	240	2375	1788	1627	1941	2112	2390	2039
					300	2499	1844	1841	1952	2098	2563	2133
L. S. D.												
(.05)	N.S.	N.S.	N.S.	N.S.		N.S.	242	N.S.	N.S.	209	146	93
(.01)	....	....	....	....		....	....	....	....	298	207	125
						Dollar acre value						
0	876	859	731	822	0	858	655	681	631	746	910	747
50	907	957	771	878	60	917	782	770	803	796	1071	857
100	936	786	856	859	120	907	678	739	819	751	1140	839
200	759	880	904	848	180	865	892	842	759	936	1225	920
250	972	837	786	865	240	914	835	741	835	886	1137	891
					300	945	846	843	837	903	1272	941
L. S. D.												
(.05)	N.S.	N.S.	N.S.	N.S.		N.S.	124	85	143	116	80	47
(.01)	....	....	....	....		....	176	....	203	....	115	86

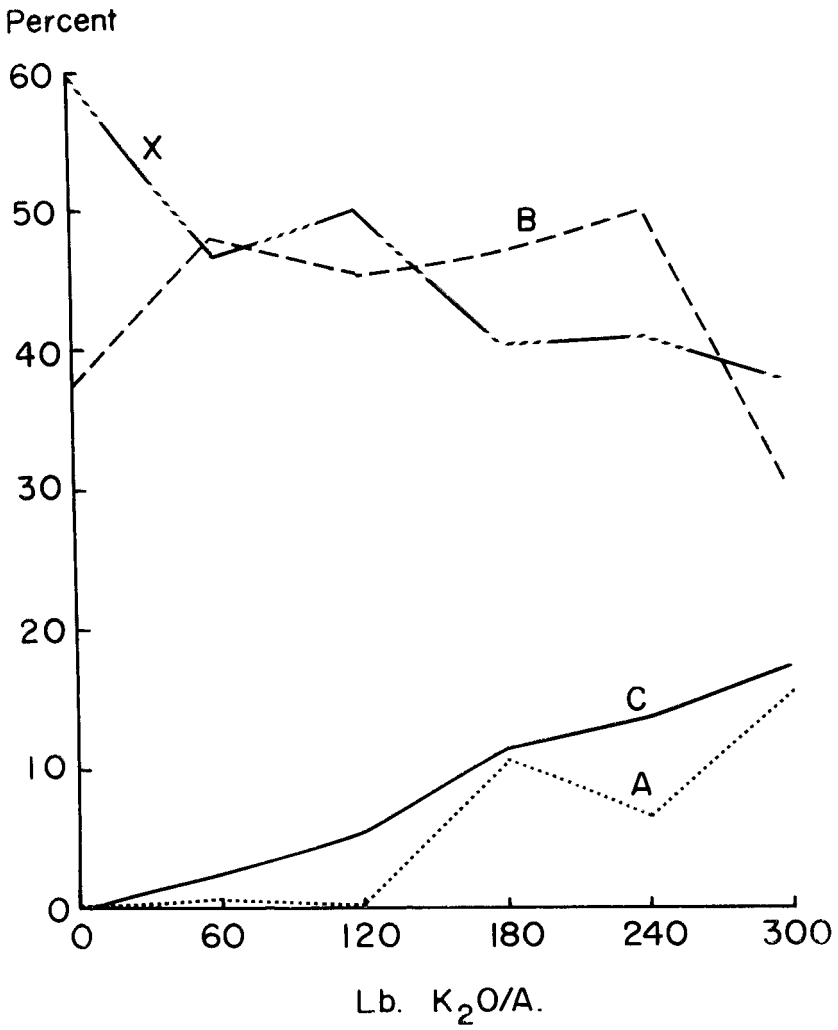

Figure 7. Effect of potash levels on percent distribution of leaf groups (1959-1964 average).

(4) leaf. However, there were no great changes in the 1 and 5 leaf qualities related to potassium rates.

Figure 9 shows the relative effect of potassium rates upon the leaf colors. The percentage of brown leaf (F) greatly increased and the percentage of D color (dark) greatly decreased as potassium levels increased. The percentage of VF (greenish brown) and G (green) grade groups varied only slightly.

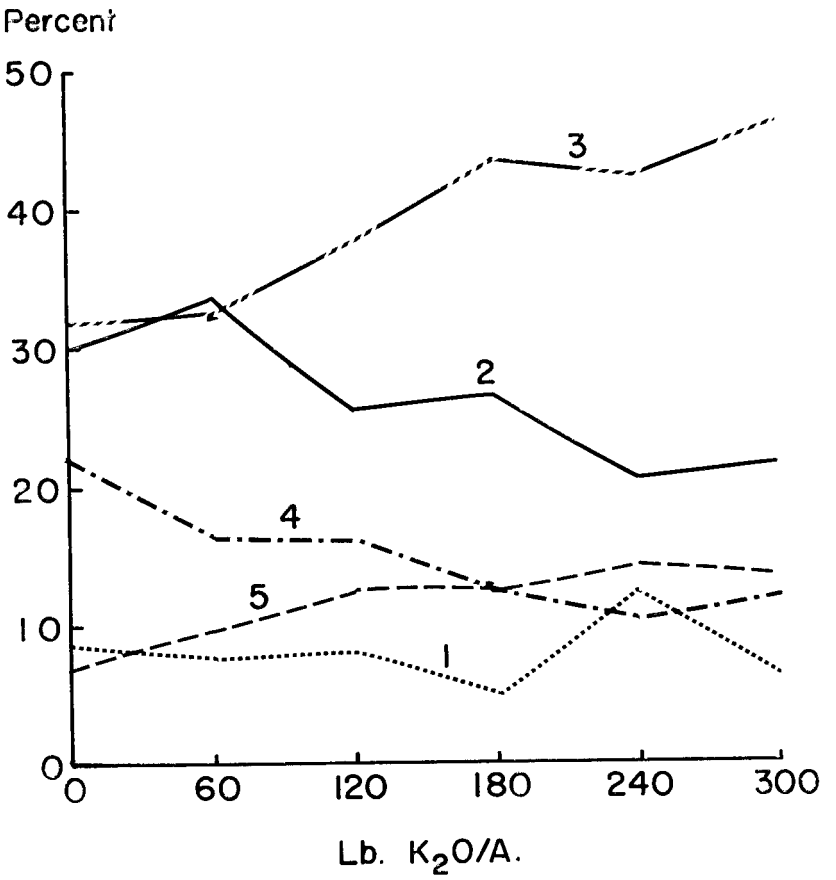

Figure 8. Effect of potash levels on percent distribution of leaf quality (1959-1964 average).

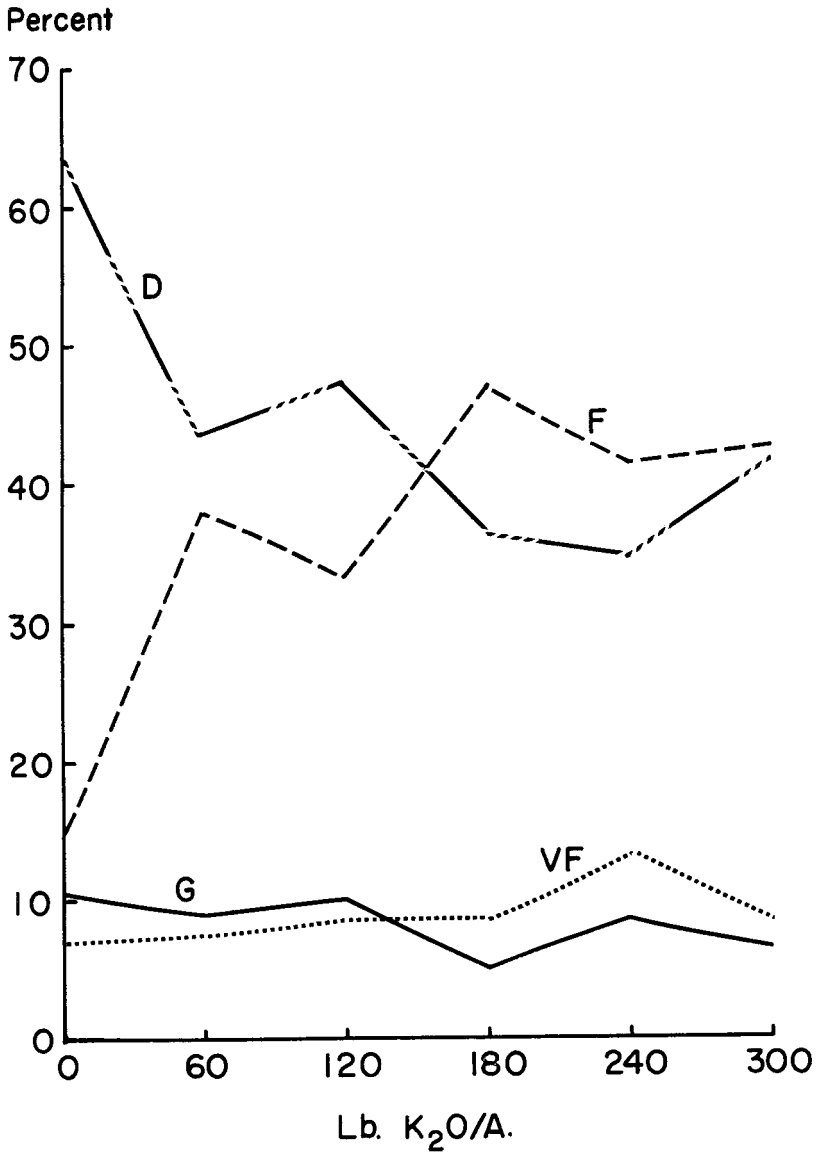

Figure 9. Effect of potash levels on percent distribution of leaf color (1959-1964 average).

Effect of Manure on Soil Test Values, Yield, Acre Value and Leaf Grade of Dark Tobacco

Soil test values for manure treatments

The soil test values for the different treatments are shown in Table 9. These data indicate that the pH on most of the plots involved in the experiment was between 5.0 and 5.5. The phosphate levels for most of the plots were medium or above with the exception of those receiving no fertilizer which were generally low most of the years and slightly declined through the years of the experiment. The potassium levels for the plots ranged from low to high with most of them being in the medium to high category with the exception of those plots receiving no fertilizer and no manure.

Yield per acre

The relative influence of 10 tons of barnyard manure on the yield and dollar acre value of dark tobacco is shown in Table 10. The upper portion of the table shows the relative effect of manure alone compared to no fertilizer. The average yield during the first 3 years of the experiment showed that manure increased the yield about 450 pounds per acre. During the last 6 years of the experiment, the average yield increase from the 10 tons of manure was

Table 9. Soil test values* each year for the different treatments

Treatment	1958	1959	1960	1961	1962	1963	1964
				pH			
0-0-0	5.4	5.2	5.1	5.4	5.1	5.1	5.6
0-0-0 + manure	5.6	5.4	4.9	5.7	5.4	5.0	5.9
120-100-180	5.5	5.2	5.1	5.6	5.1	4.8	5.6
120-100-180 + manure	5.3	5.3	5.1	5.3	5.3	4.9	5.4
				Pounds P per acre			
0-0-0	15	11	19	7	8	13	7
0-0-0 + manure	15	14	15	9	10	18	7
120-100-180	16	12	14	12	12	18	12
120-100-180 + manure	20	14	16	17	15	14	20
				Pounds K per acre			
0-0-0	120	123	150	103	107	160	147
0-0-0 + manure	147	106	160	133	113	200	197
120-100-180	157	140	160	133	133	193	203
120-100-180 + manure	177	137	177	187	167	233	243

*Each value represents an average for three replications.

Table 10. Effect of manure on the yield and dollar acre value of dark tobacco

Treatment	1956	1957	1958	3-yr. av.	Treatment	1959	1960	1961	1962	1963	1964	6-yr. av.
					Pounds per acre							
0-0-0	1686	1433	1276	1465	0-0-0	1516	1402	834	951	1228	1371	1217
0-0-0 + M	2237	1669	1822	1909	0-0-0 + M	2337	1666	1620	1665	1780	2229	1883
L. S. D.												
(.05)	291	N.S.	442	201		720	N.S.	241	641	543	553	127
(.01)	....	....	....	....		....	....	556	....	....	....	173
100-100-200	1876	1999	2029	1968	120-100-180	2278	1953	1839	1782	2221	2518	2099
100-100-200 + M	2467	2069	2177	2238	120-100-180 + M	2530	2088	2140	2283	2346	2603	2332
L. S. D.												
(.05)	N.S.	N.S.	N.S.	243		N.S.	N.S.	270	N.S.	67	N.S.	98
(.01)	....	....	....	....		....	....	....	....	....	....	134
					Dollar acre value							
0-0-0	661	620	550	610	0-0-0	613	615	316	348	480	590	494
0-0-0 + M	840	708	748	765	0-0-0 + M	870	738	683	709	731	1064	799
L. S. D.												
(.05)	138	N.S.	128	74		N.S.	N.S.	172	288	N.S.	273	48
(.01)	....	....	....	105		....	....	....	....	....	....	65
100-100-200	759	880	904	848	120-100-180	865	892	842	759	936	1225	920
100-100-200 + M	978	879	812	890	120-100-180 + M	925	963	928	961	946	1295	1003
L. S. D.												
(.05)	N.S.	N.S.	37	N.S.		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	42
(.01)	....	....	86	....		....	....	....	....	....	....	57

about 670 pounds of tobacco per acre per year. The largest yield increase occurred in 1964 which was also the year of the smallest rainfall, with only 1.8 and 0.7 inches of rain recorded in May and June, respectively. This effect could be attributed, in part, to the improvement in the soil moisture conditions brought about by the manure.

When the yields of manure plus fertilizer are compared to the plots receiving fertilizer alone, the results obtained were somewhat different from those comparing manure alone against no fertilizer. During the first 3 years of the experiment, an average increase of 270 pounds per acre occurred when manure plus fertilizer was compared to fertilizer alone. During the last 6 years of the experiment the average increase was 230 pounds per acre per year. Thus, the increase from manure used in association with the recommended fertilization practices resulted in approximately 250 pounds per acre per year. When the manure was applied alone and compared with no fertilizer, the yield increase averaged over 500 pounds per acre per year.

Dollar acre value

When the dollar acre value of the plots receiving manure and those not receiving manure are compared, the manure always increased the dollar acre value of the dark tobacco. However, the amount that it increased the acre value of the tobacco depended on whether it was used in association with fertilizers or used without fertilizers. When the manure was used with adequate fertilization, the average increase in acre value during the first 3 years was approximately $50, and during the last 6 years the average increase was approximately $80. When manure alone was compared to no fertilizer, the average increase during the first 3 years of the experiment was $150, and during the last 6 years of the experiment, the average increase was roughly $300 per acre per year. These data indicate that the average value for 10 tons of manure used on dark tobacco, along with adequate fertilizers, would range between $50 and $80 per acre per year.

Leaf grade

The percent distribution of the various factors of leaf grade are shown in Table 14. In this table it is seen that when dark tobacco is grown without manure and fertilizer most of it falls in the B and X group grades, has a quality of about "3" and is

generally dark (D) in color. The additions of 10 tons of manure tended to reduce the amount of B grade and increase the amount of C and X grades of tobacco produced. It also decreased the percent of 1 and 5 quality with a corresponding increase of 3 and 4 quality and greatly increased the amount of F tobacco with a reduction in the amount of D tobacco produced. Likewise, when manure was used along with fertilizers, the amount of B grade was reduced and the amount of C grade was increased. In quality, the percent of "2" leaf decreased and the percent of "4" leaf increased. This would tend to lower the over-all grade of the tobacco. In regard to the colors of the leaf, there were no great changes brought about by manure when used in association with fertilizers. However, manure used without fertilizer increased the percentage of brown (F) and reduced the percentage of dark (D) colors.

Table 11. Percent distribution within groups, quality, and color of dark tobacco as affected by nitrogen treatments

	Tmt. 2. 0-100-180							Tmt. 3. 60-100-180							Tmt. 4. 120-100-180						
	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.
Group																					
A	11.2	—	—	—	—	7.4	3.8	10.7	—	—	—	—	6.2	3.3	13.5	18.4	10.5	10.7	—	11.5	10.7
B	33.6	42.7	19.4	30.9	33.0	51.1	36.4	28.0	48.4	—	36.2	36.6	37.0	31.3	27.2	31.8	19.3	25.1	53.3	55.1	36.6
C	13.3	0.8	37.9	24.6	44.5	0.8	18.4	—	9.1	56.4	25.6	38.0	—	19.5	—	—	37.4	25.3	14.2	1.1	11.8
X	41.9	56.5	42.7	44.5	15.5	40.8	40.2	61.3	42.5	43.6	38.2	25.5	56.8	45.8	53.5	49.8	32.8	38.9	32.5	32.3	39.9
N	—	—	—	—	7.0	—	1.1	—	—	—	—	—	—	—	5.8	—	—	—	—	—	1.1
Quality																					
1	5.6	7.7	—	—	7.0	16.6	7.0	7.0	—	9.6	—	—	32.6	9.2	5.8	14.6	—	—	2.4	7.4	5.2
2	4.7	13.5	19.4	9.2	—	38.5	15.2	8.3	30.9	2.9	12.9	13.6	30.0	16.6	13.4	14.1	38.5	24.6	20.7	45.6	26.5
3	44.9	63.0	56.2	62.9	43.7	27.0	47.7	30.2	43.3	60.6	67.9	52.9	18.2	43.6	49.1	54.9	35.1	46.1	46.2	30.7	43.3
4	27.8	10.6	17.0	12.9	39.0	5.1	18.5	34.8	15.5	21.3	12.7	11.7	—	16.1	19.1	6.0	20.3	15.5	12.3	5.1	12.7
5	17.0	5.2	7.4	14.9	10.2	12.8	11.6	19.6	10.3	5.6	6.5	21.9	19.2	14.5	12.6	10.4	6.1	13.8	18.4	11.2	12.2
Color																					
R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.8	—	—	—	—	—	1.1
L	—	—	22.3	6.9	—	—	3.9	—	—	9.6	—	—	—	1.4	—	—	—	—	—	—	—
F	100.0	49.5	57.4	40.7	19.6	87.8	62.7	23.3	37.1	41.0	56.7	58.7	73.2	48.5	—	45.7	62.9	49.1	56.5	69.7	47.1
D	—	28.9	—	5.5	6.3	12.2	8.9	76.7	57.1	12.7	—	13.6	26.8	32.9	94.2	42.8	14.7	3.3	21.7	30.3	36.2
M	—	21.6	20.3	25.0	61.8	—	19.4	—	—	36.8	24.2	4.9	—	9.8	—	—	5.1	7.8	—	—	1.8
G	—	—	—	8.1	7.0	—	2.3	—	—	—	6.5	11.0	—	2.8	—	—	6.1	13.8	12.7	—	5.1
VF	—	—	—	13.9	5.3	—	2.8	—	5.8	—	12.6	11.8	—	4.7	—	11.5	11.2	26.0	9.1	—	8.7

Table 11. (continued)

	Tmt. 5. 180-100-180							Tmt. 6. 240-100-180							Tmt. 7. 300-100-180						
	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.
Group																					
A	2.7	—	—	—	—	15.4	3.5	—	9.0	16.4	—	—	9.9	5.7	10.5	—	16.2	—	—	26.6	10.2
B	39.6	51.0	29.9	48.1	46.9	50.1	44.4	46.6	35.6	31.3	52.7	51.3	27.9	40.8	37.7	48.3	36.7	29.4	28.6	32.0	35.3
C	—	—	28.4	8.2	14.3	1.2	8.1	—	10.0	14.8	12.3	7.7	16.5	10.1	—	—	—	7.9	31.5	2.1	6.5
X	57.8	49.0	41.7	43.7	32.0	33.3	42.8	53.4	45.4	37.4	34.9	34.0	45.7	42.2	51.9	51.7	47.0	62.7	39.9	39.4	48.0
N	—	—	—	—	6.8	—	1.2	—	—	—	—	7.0	—	1.1	—	—	—	—	—	—	—
Quality																					
1	—	4.6	8.8	—	6.8	8.4	4.8	—	6.8	—	—	7.0	23.5	6.6	5.3	8.5	8.6	—	—	17.2	7.2
2	11.9	38.8	34.0	5.2	15.8	36.1	23.4	6.4	24.5	18.3	—	31.0	32.5	18.6	5.4	6.9	36.1	5.0	27.6	26.9	18.3
3	34.6	32.3	31.9	71.1	53.7	37.3	43.2	42.4	36.8	49.4	68.7	39.4	27.1	43.6	40.6	53.3	31.5	66.2	43.6	39.7	44.9
4	35.4	7.8	20.5	7.9	10.8	—	13.9	38.6	16.6	32.4	15.9	9.5	—	18.9	30.2	12.8	6.4	11.5	7.5	—	11.4
5	18.1	16.5	4.8	15.8	12.9	18.2	14.7	12.6	15.3	—	15.4	13.1	16.9	12.4	18.5	18.4	17.4	17.3	21.3	16.2	18.1
Color																					
R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F	—	6.0	49.6	44.6	40.4	50.6	31.7	—	—	23.8	50.9	6.8	35.6	20.0	—	8.5	6.4	20.9	24.4	30.6	15.5
D	100.0	63.9	28.3	11.7	25.1	46.1	47.6	100.0	84.7	35.5	2.7	53.0	58.0	56.4	93.4	58.8	65.0	21.4	31.4	58.3	56.9
M	—	—	15.1	—	—	—	2.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
G	—	4.5	—	27.6	24.2	—	9.0	—	10.1	18.5	33.9	30.7	—	14.7	6.6	5.5	22.8	33.5	26.4	—	14.3
VF	—	25.6	7.0	16.1	10.3	3.3	9.5	—	5.1	22.2	12.5	9.5	6.4	9.0	—	27.3	5.9	24.1	17.8	11.1	13.4

Table 12. Percent distribution within groups, quality, and color of dark tobacco as affected by phosphorus treatments

	Tmt. 8. 120-0-180							Tmt. 9. 120-50-180							Tmt. 4. 120-100-180						
	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.
Group																					
A	30.7	27.9	—	9.0	—	—	13.4	4.3	—	—	29.2	—	12.0	8.0	13.5	18.4	10.5	10.7	—	11.5	10.7
B	31.5	26.3	—	24.5	26.7	5.4	21.0	47.1	40.9	8.5	6.7	38.8	39.1	31.5	27.2	31.8	19.3	25.1	53 3	55.1	36.6
C	—	7.6	77.4	38.1	40.2	58.6	31.9	—	11.3	57.5	28.5	22.8	8.5	19.4	—	—	37.4	25.3	14.2	1.1	11.8
X	37.7	38.2	22.6	28.4	27.4	36.1	32.7	48.6	47.8	34.0	35.6	38.4	40.4	41.1	53.5	49.8	32.8	38.9	32.5	32.3	39.9
N	—	—	—	—	5.7	—	1.0	—	—	—	—	—	—	—	5.8	—	—	—	—	—	1.1
Quality																					
1	—	—	—	—	15.1	35.6	8.3	—	31.1	—	—	—	26.7	9.7	5.8	14.6	—	—	2.4	7.4	5.2
2	6.0	29.6	45.2	15.3	34.7	12.7	21.8	11.8	12.5	38.9	10.9	37.9	29.4	23.1	13.4	14.1	38.5	24.6	20.7	45.6	26.5
3	60.7	52.1	22.7	61.7	19.5	30.6	43.3	52.3	39.2	36.4	71.6	23.5	26.6	41.8	49.1	54.9	35.1	46.1	46.2	30.7	43.3
4	19.7	8.4	20.7	11.2	24.4	—	14.1	24.3	—	24.7	6.1	18.0	11.7	14.5	19.1	6.0	20.3	15.5	12.3	5.1	12.7
5	13.6	9.9	11.4	11.8	6.3	21.0	12.4	11.6	17.2	—	11.4	20.5	5.5	10.9	12.6	10.4	6.1	13.8	18.4	11.2	12.2
Color																					
R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.8	—	—	—	—	—	1.1
L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F	—	23.4	11.5	21.2	—	—	8.5	—	39.1	44.2	56.3	40.9	62.2	39.5	—	45.7	62.9	49.1	56.5	69.7	47.1
D	89.8	54.1	45.2	28.8	69.9	87.6	65.8	100.0	43.7	40.4	—	22.4	37.8	43.3	94.2	42.8	14.7	3.3	21.7	30.3	36.2
M	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.1	7.8	—	—	1.8
G	10.2	4.3	31.9	30.7	30.1	—	16.3	—	—	9.7	17.5	25.7	—	8.1	—	—	6.1	13.8	12.7	—	5.1
VF	—	18.1	11.4	19.3	—	12.4	9.3	—	17.2	5.6	26.1	11.0	—	9.1	—	11.5	11.2	26.0	9.1	—	8.7

Table 12. (continued)

	Tmt. 10. 120-150-180						
	1959	1960	1961	1962	1963	1964	6-yr. av.
Group							
A	—	—	—	10.1	—	7.3	2.9
B	45.2	47.3	1.9	34.7	51.5	42.1	37.7
C	3.3	—	64.7	14.5	7.3	8.8	15.8
X	51.5	52.7	33.3	40.8	41.2	41.8	43.6
N	—	—	—	—	—	—	—
Quality							
1	—	13.1	—	—	—	14.8	4.6
2	13.4	43.4	24.6	10.7	31.0	33.6	25.9
3	36.5	28.5	47.7	67.8	37.0	32.8	41.3
4	39.0	—	27.7	1.7	11.7	6.6	15.1
5	11.1	15.0	—	19.8	20.4	12.2	13.1
Color							
R	—	—	—	—	—	—	—
L	—	—	—	—	—	—	—
F	—	28.0	64.6	52.5	52.5	67.2	43.6
D	100.0	61.3	1.9	15.0	16.3	32.8	39.2
M	—	5.6	29.5	7.6	—	—	6.6
G	—	—	3.9	12.1	25.5	—	6.9
VF	—	5.1	—	12.7	5.7	—	3.7

Table 13. Percent distribution within groups, quality, and color of dark tobacco as affected by potassium treatments

	Tmt. 11. 120-100-0							Tmt. 12. 120-100-60							Tmt. 13. 120-100-120						
	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.
Group																					
A	—	—	—	—	—	—	—	—	2.2	—	—	—	—	0.3	—	—	—	—	—	—	—
B	40.4	13.2	37.3	49.1	46.5	35.3	37.4	44.8	38.1	46.2	58.5	50.3	49.4	48.0	40.8	42.2	34.8	53.2	44.9	51.1	45.0
C	—	—	—	—	—	1.1	0.2	—	—	5.3	3.1	7.9	—	2.5	—	0.5	16.6	3.4	14.6	—	5.2
X	59.6	86.8	62.7	50.9	38.5	63.7	59.9	55.2	59.7	48.5	38.4	27.7	50.6	46.9	59.2	57.3	48.7	43.4	40.5	48.9	49.8
N	—	—	—	—	14.9	—	2.6	—	—	—	—	14.1	—	2.3	—	—	—	—	—	—	—
Quality																					
1	—	17.5	—	—	14.9	18.7	8.6	—	—	7.0	—	18.5	18.1	7.4	—	16.9	—	—	—	28.9	8.1
2	29.5	14.7	30.9	28.7	38.6	35.5	30.1	32.4	25.6	47.3	24.0	38.4	36.7	33.9	20.1	27.3	49.3	11.0	30.0	21.8	25.4
3	39.0	25.9	47.1	40.2	22.7	19.6	32.0	33.8	37.4	23.6	53.9	20.6	24.9	32.3	43.3	18.8	28.0	60.9	42.2	28.7	37.8
4	7.9	19.9	—	—	14.6	—	7.0	12.5	17.7	14.5	—	15.0	—	9.6	18.1	20.6	10.0	12.7	6.9	7.7	12.5
5	23.6	22.0	21.9	31.1	9.2	26.2	22.2	21.3	19.4	7.7	22.0	7.5	20.3	16.3	18.6	16.4	12.7	15.5	20.9	12.9	16.1
Color																					
R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F	—	5.0	21.1	6.3	2.7	49.7	14.5	—	17.5	45.7	54.2	40.5	72.5	38.0	—	9.8	50.6	48.2	24.3	63.3	33.3
D	100.0	65.0	44.1	62.5	68.8	40.4	64.7	100.0	58.6	26.5	8.6	29.5	27.5	43.6	100.0	69.2	24.4	11.2	33.8	36.7	47.2
M	—	—	7.1	—	—	9.9	2.9	—	—	14.5	—	—	—	2.1	—	—	6.1	—	—	—	0.9
G	—	—	14.8	31.1	24.2	—	10.9	—	6.0	7.7	22.0	21.6	—	9.0	—	—	12.7	23.5	27.8	—	10.0
VF	—	30.0	12.8	—	4.3	—	7.0	—	17.9	5.6	15.1	8.4	—	7.3	—	21.1	6.1	17.1	14.2	—	8.7

Table 13. (continued)

	Tmt. 4. 120-100-180							Tmt. 14. 120-100-240							Tmt. 15. 120-100-300						
	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.
Group																					
A	13.5	18.4	10.5	10.7	—	11.5	10.7	17.1	—	10.8	11.2	—	—	6.5	11.7	25.1	23.6	17.5	—	18.8	15.7
B	27.2	31.8	19.3	25.1	53.3	55.1	36.6	45.9	56.2	4.0	40.1	40.9	42.5	39.4	32.7	11.8	7.8	40.4	39.8	40.0	29.9
C	—	—	37.4	25.3	14.2	1.1	11.8	—	—	44.2	9.6	34.8	1.3	13 7	—	29.1	36.8	3.6	34.9	8.0	17.4
X	53.5	49.8	32.8	38.9	32.5	32.3	39.9	37.1	43.8	40.9	39.1	24.3	56.2	40.4	55.6	33.9	31.7	38.6	25.4	33.1	37.0
N	5.8	—	—	—	—	—	1.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quality																					
1	5.8	14.6	—	—	2.4	7.4	5.2	—	24.2	8.8	—	—	40.1	12.5	—	11.1	—	—	—	24.8	6.6
2	13.4	14.1	38.5	24.6	20.7	45.6	26.5	8.5	6.8	42.9	22.2	22.1	27.0	20.9	13.9	23.8	25.5	14.9	28.1	25.6	21.8
3	49.1	54.9	35.1	46.1	46.2	30.7	43.3	47.8	54.6	32.0	58.9	47.7	14.7	42.0	47.8	44.1	49.8	66.4	39.1	33.4	46.1
4	19.1	6.0	20.3	15.5	12.3	5.1	12.7	20.7	5.7	—	7.5	16.2	6.6	10.1	20.2	8.7	19.1	12.8	13.2	—	12.0
5	12.6	10.4	6.1	13.8	18.4	11.2	12.2	23.0	8.7	16.4	11.4	14.0	11.7	14.4	18.2	12.3	5.6	6.0	19.6	16.2	13.5
Color																					
R	5.8	—	—	—	—	—	1.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F	—	45.7	62.9	49.1	56.5	69.7	47.1	—	37.5	56.1	50.0	44.6	67.8	41.8	—	39.1	46.5	47.2	71.3	57.9	42.8
D	94.2	42.8	14.7	3.3	21.7	30.3	36.2	77.8	48.1	27.8	12.8	4.1	32.2	34.9	100.0	48.5	31.4	14.2	—	42.1	41.7
M	—	—	5.1	7.8	—	—	1.8	—	—	4.6	5.8	—	—	1.5	—	—	—	—	—	—	—
G	—	—	6.1	13.8	12.7	—	5.1	12.6	—	6.1	13.1	19.8	—	8.8	—	—	11.0	17.0	15.4	—	6.7
VF	—	11.5	11.2	26.0	9.1	—	8.7	9.6	14.4	5.5	18.3	31.4	—	13.0	—	12.3	11.0	21.6	13.3	—	8.8

Table 14. Percent distribution within groups, quality, and color of dark tobacco as affected by fertility treatments with and without manure

	Tmt. 1. 0-0-0							Tmt. 17. 0-0-0 + Manure						
	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.
	Manure Response													
Group														
A	—	—	—	—	—	—	—	—	—	—	11.2	—	—	1.7
B	51.5	44.8	24.9	37.1	66.9	64.3	50.3	42.0	60.4	24.5	34.2	30.9	38.3	38.6
C	—	—	34.3	30.2	6.0	0.8	9.0	—	—	47.6	24.0	29.5	24.6	19.9
X	22.3	55.2	31.3	32.7	17.8	35.0	32.6	58.0	39.6	27.9	30.5	35.6	37.1	39.3
N	26.2	—	9.5	—	9.3	—	8.1	—	—	—	—	4.0	—	0.6
Quality														
1	26.2	27.8	9.5	—	9.3	12.2	15.7	—	—	—	—	4.0	9.3	2.5
2	20.9	12.7	8.2	—	5.2	28.5	13.9	11.7	17.2	—	2.8	—	45.6	14.4
3	30.1	29.7	57.3	64.6	56.7	24.4	41.0	46.2	58.3	69.8	80.8	79.0	26.8	57.8
4	17.0	9.2	8.1	10.1	5.2	5.5	9.4	31.4	12.8	20.7	11.5	5.0	12.4	16.3
5	5.9	20.6	16.9	25.3	23.6	29.5	19.9	10.7	11.6	9.4	4.9	12.0	6.0	9.1
Color														
R	26.2	—	—	—	—	—	5.4	—	—	—	—	—	—	—
L	—	—	—	—	—	—	—	—	—	10.2	—	—	—	1.5
F	—	15.8	—	—	21.2	52.5	16.5	—	50.1	32.3	58.2	17.5	97.0	42.5
D	68.5	54.4	54.9	19.1	37.4	13.3	42.2	100.0	17.8	14.4	6.2	16.6	3.0	29.5
M	—	—	—	7.4	14.4	34.2	9.8	—	23.1	28.5	5.0	46.6	—	15.6
G	—	13.1	45.1	35.4	27.0	—	16.8	—	—	—	16.4	10.1	—	4.0
VF	5.3	16.6	—	38.1	—	—	9.3	—	9.0	14.5	14.2	9.1	—	6.9

Table 14. (continued)

	Tmt. 4. 120-100-180							Tmt. 16. 120-100-180 + Manure						
	1959	1960	1961	1962	1963	1964	6-yr. av.	1959	1960	1961	1962	1963	1964	6-yr. av.
							Manure Response							
Group														
A	13.5	18.4	10.5	10.7	—	11.5	10.7	—	16.5	—	26.9	—	23.1	11.2
B	27.2	31.8	19.3	25.1	53.3	55.1	36.6	51.0	30.8	1.0	18.4	36.3	36.5	29.9
C	—	—	37.4	25.3	14.2	1.1	11.8	—	27.4	73.5	21.9	35.0	4.0	25.5
X	53.5	49.8	32.8	38.9	32.5	32.3	39.9	44.3	25.3	25.4	32.7	28.7	36.3	32.6
N	5.8	—	—	—	—	—	1.1	4.7	—	—	—	—	—	0.8
Quality														
1	5.8	14.6	—	—	2.4	7.4	5.2	4.7	—	—	—	—	14.0	3.4
2	13.4	14.1	38.5	24.6	20.7	45.6	26.5	7.0	12.6	11.1	—	—	48.8	13.9
3	49.1	54.9	35.1	46.1	46.2	30.7	43.3	38.0	61.6	45.8	75.3	57.8	22.3	49.2
4	19.1	6.0	20.3	15.5	12.3	5.1	12.7	38.1	14.4	34.2	12.1	27.5	4.7	21.7
5	12.6	10.4	6.1	13.8	18.4	11.2	12.2	12.2	11.5	9.0	12.5	14.7	10.3	11.7
Color														
R	5.8	—	—	—	—	—	1.1	4.7	—	—	—	—	—	0.8
L	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F	—	45.7	62.9	49.1	56.5	69.7	47.1	—	42.1	73.8	46.8	43.1	59.5	43.5
D	94.2	42.8	14.7	3.3	21.7	30.3	36.2	89.6	50.1	12.8	10.9	—	40.5	35.0
M	—	—	5.1	7.8	—	—	1.8	—	—	9.1	—	—	—	1.4
G	—	—	6.1	13.8	12.7	—	5.1	5.7	—	4.3	27.2	24.3	—	10.2
VF	—	11.5	11.2	26.0	9.1	—	8.7	—	7.7	—	15.1	32.6	—	9.1

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