RESPONSES OF CORN VARIETIES AND HYBRIDS TO 2,4-D TREATMENTS

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TABLE OF CONTENTS

INTRODUCTION

Weeds have been a problem to man since he first began to plant seed and cultivate his crops. Many methods and devices have been used in efforts to control these unwanted competitors, and with the advent of scientific agriculture the agronomist turned to the chemist for help. 2,4-Dichlorophenoxy acetic acid, popularly known as 2,4-D, is a recently developed organic herbicide.

Within the short time since it was first released to commercial users 2,4-D has been investigated with respect to a number of different weeds and crops. Inasmuch as it has been studied only a very short time, data pertaining to variety resistance in corn are meager. Such information would be of value to corn breeders and farmers.

The objective of this experiment was to investigate the differential response of thirteen hybrids and three open pollinated varieties of corn. The effects of the maximum 2,4-D treatments recommended for corn in Oklahoma and some of the external characteristics of corn plants treated with 2,4-D were also studied.

REVIEW OF LITERATURE

2,4-D is generally prepared as a metallic salt, as an amine salt, or as one of several ester forms. Buckley (5)/1 and Buchholtz (2) tested these various forms of 2,4-D and found that injury was greatest with the ester forms and least with the sodium salts. Damage to corn plants by 2,4-D is expressed as bending and breaking of the stalks and proliferation of the brace roots.

/1 Figures in parenthesis refer to "Literature Cited", p. 25.

Buchholtz (2) noted severe burning of the leaves and, according to Buckley (5), the methyl ester causes the leaves to roll tightly about the tassel.

The stage of growth of corn at which the 2,4-D is applied also influences the extent of damage. The optimum seems to be somewhere between the 10 inch and 40 inch stages as reported by Buchholtz (3). Plants treated at these stages with 0.5 pound sodium salt (acid equivalent) per acre showed little proliferation. Heavier treatments caused 50% bending at the 10 inch stage but none at the 40 inch stage. Plants treated at the 20 inch stage showed greatest bending and breaking and yield reduction. Applications of 2.0 pounds per acre caused reduced yields at the 10 inch stage but not at the 40 inch stage. These observations are not in accord with Lee (7) who found that corn treated with 1.5 pounds sodium salt per acre at the 30 inch stage yielded less than that treated at the 12 inch stage.

Investigators agree that the higher the concentration of 2,4-D applied the greater will be the damage. Buchholtz (2) reports recovery from three rates applied in three forms. Only those plots treated with 1.5 pounds (acid equivalent) of the methyl ester showed greatly reduced stands. The methyl ester treated plots also showed less recovery. Willard (9) noted that applications of 1.0 pound per acre caused injury but that the corn outgrew it. He concludes that 2,4-D treatments of corn should not exceed 1.0 pound per acre, and preferably should be less. Elder (6) recommends for Oklahoma 0.5 pound of ester or 1.0 pound of salt or amine per acre for corn and sorghums and warns against heavier treatments.

Information is limited concerning the resistance of individual hybrids and varieties to 2,4-D. In a test involving five double cross hybrids, one single cross hybrid and one open pollinated variety, Buchholtz (4) found that Golden Cross Bantam yields were not affected by 2,4-D applied at the rate of

1.0 pound (acid equivalent) per acre. The yields of all the hybrids were below the sweet corn and the average of the double cross hybrids was above that of the single cross, in terms of the respective untreated control plots. In another experiment Buchholtz (3) noted a difference in the resistance of two single cross hybrids to bending, breaking and root proliferation. Anderson and Wolf (1) found that the rate of pre-emergence treatment did not affect the yield or percentage of moisture at harvest. Elder (6) suggests that some varieties may be more susceptible than others.

MATERIALS AND METHODS

These investigations were conducted on a site furnished by the Oklahoma Agricultural Experiment Station. The soil was primarily a Miller clay loam located approximately three and one-half miles east of Stillwater, Oklahoma. The plots were planted in a creek bottom adjacent to a drainage ditch extending the length of the field.

The sixteen varieties and hybrids were selected as representative of those best adapted to Oklahoma. Grouped according to maturity the strains were:

Early Maturing:	Ohio C-12, Ohio C-38 and U. S. 13.
Medium Maturing:	Illinois 200, Kansas 1639, Kansas 2234, Pioneer 332, Texas 18, and Midland Yellow Dent.
Late Maturing:	Funk G-711, Kansas 1585, Texas 12, Texas 9W, Texas 20, Oklahoma Silvermine and Reid Yellow Dent.

Spray materials were furnished by Mr. W. C. Elder, agronomist, in charge of weed control studies at the Oklahoma Agricultural Experiment Station. The material used was Weedone, a commercial 2,4-D ester. Treatments consisted of 0.5, 1.0 and 1.5 pounds (acid equivalent) applications of 2,4-D per acre and

an untreated control.

Each plot consisted of one row twenty hills long with 40 inches between hills and 42 inches between rows. The field design used was a split plot with treatment and variety differences confounded with block differences. The experiment was replicated four times.

The corn was planted April 16, 1948. Two hundred pounds of 16-20-0 fertilizer per acre was applied at the time of planting. All plots were thinned to a uniform stand before the treatments were applied.

Each quantity of 2,4-D was carefully weighed and added to 18 quarts of water per treatment. A knapsack sprayer equipped with two nozzles was used to apply the mixtures. Uniform applications were assured by moving the sprayer across the rows and maintaining pressure between 25 and 30 pounds per square inch. An effort was made to cover all parts of each plant. The 2,4-D was applied May 23 when the corn was 22 to 26 inches high except for two 1.5 pound treatments which were sprayed May 25. This delay was due to rains which made the field inaccessible.

A stand count was made of plants per hill and hills per plot shortly after spraying. All lodging and silk counts are reported as percentages of the stand counts. Data pertaining to the quality of ears, bending versus breaking, silking dates, and average lodging for four intervals are recorded as an average of four replications.

Lodging counts were made at five day intervals beginning five days after spraying and ending June 12. In these counts plants bending more than 45 degrees from the vertical were counted as lodged, while those that showed any breakage were counted as broken. Many plants counted as lodged later recovered and did not enter into later counts as lodged plants. Some, however, broke later and were counted as broken in later counts. Others counted

as broken also recovered and grew more or less upright since the stalks were not completely severed. A final lodging count was made just prior to harvesting.

Silk counts were made at six day intervals beginning June 19 and lasting until July 4. Silking dates were calculated from these counts with June 1 as the base date. A plot was considered to be in silk when 50% of the plants showed silk.

All plots were harvested by hand, the first replication on October 16 and the remaining three on October 18.

The ears from each plot were evaluated for quality and given a numerical rating according to the following standard:

Very Good	7.00
Good	6.00
Good to Medium	5.00
Medium	4.00
Medium to Poor	3.00
Poor	2.00
Very Poor	1.00

The grade was determined by the uniformity of ears, the amount of rotting and the number of nubbins in the sample.

An analysis of variance was made of yields and of lodging five days after spraying and at harvest.

RESULTS AND DISCUSSION

The average calculated silking dates of the sixteen strains are presented in Table 1. These data would indicate that 2,4-D sprays of 0.5 pound or less per acre do not influence silking dates, while those of 1.0 and 1.5 pounds tend to slightly delay silking.

An analysis of variance of yield is presented in Table 2 and yields per acre in Table 8 (appendix). Variety differences were highly significant.

Table 1.--Dates on which 50% of the plants of 16 corn varieties and hybrids were showing silk after being treated with 3 rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Variety or Hybrid	Treatments (lbs. per acre) 0.0	0.5	1.0	1.5	Average
Ohio C-38	19	17	19	19	19
Ohio C-12	20	18	21	19	20
U. S. 13	20	19	21	21	20
Illinois 200	21	21	21	21	21
Pioneer 332	19	18	20	21	20
Texas 18	23	23	26	26	25
Texas 12	26	25	25	27	26
Texas 20	25	24	27	29	26
Texas 9W	25	27	26	26	26
Kansas 2234	22	23	24	24	23
Kansas 1585	25	25	28	27	26
Kansas 1639	20	19	20	22	20
Funk C-711	26	26	27	29	27
Midland Yellow Dent	24	24	25	28	25
Reid Yellow Dent	27	29	31	31	30
Oklahoma Silvermine	31	31	32	34	32
Average	23	23	25	25	24

This difference in varieties was indicated by performance tests conducted at the Oklahoma Agricultural Experiment Station. The yield differences between treatments were also highly significant. The differences in the treatments are in line with the results obtained by Buchholtz (4) and Willard (9). Total yields of the 0.5 pound treatments are essentially the same as those of the untreated plots. The 1.0 and 1.5 pounds treatments reduced yields 12.68% and 24.57%, respectively, below the total of the control plots. Treatment x variety interaction was not significant.

The quality of ear corn produced by plants treated with 2,4-D requires further study. No literature on this subject was available at the time this experiment was undertaken. An attempt was made to evaluate the quality of the yields on the basis of a rather general classification (Table 3). Average quality of the strains decreased as the strength of the treatment increased.

The analysis of variance of lodging five days after treating is presented in Table 4 and the percent lodged in Table 9 (appendix). In this analysis the control plots were not considered in the calculations since the lodging was negligible and because a comparison of treatments was desired. In order to equalize the variances these percentages were transformed to angles corresponding to percentages (8). The analysis of variance of lodging was made on this basis. Variety and treatment differences were highly significant and were to be expected. Treatment x variety interaction was also highly significant. Kansas 2234 was influenced least by heavy applications of 2,4-D, having 12.07% lodged at the 0.5 pound and 24.39% lodged at the 1.5 pound level compared to an average of 24.25% and 57.43%, respectively, for all varieties (Table 9, appendix). Kansas 1639 was most sensitive to heavy applications having 25.78% lodged at the 0.5 pound level and 73.00% at the 1.5 pound level. These data illustrate the variations in response which may be expected when

Table 2.--Analysis of variance of yields of 16 corn varieties and hybrids treated with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Source	DF	Sum of Squares	Mean Square	F Values Calculated	F Values Required
Replications	3	1,322.23	440.7433		
Variety	15	23,403.17	1,560.2113	6.5903**	2.31
Error a	45	10,653.38	236.7418		
Plots of Variety	63	35,378.78			
Replications	3	1,322.23	440.7433		
Treatments	3	8,428.14	2,809.3800	14.4155**	6.99
Error b	9	1,753.98	194.8866		
Plots of Treatments	15	11,504.35			
Plots of Var.	63	35,378.78			
Dev. of Var. Plots from Replications	12	10,182.12			
Treat. x Var.	45	2,548.80	56.6400	1.0546	1.46
Error c	135	7,249.91	53.7030		
Total	255	55,359.61			

** Indicates significance at 1% level.

Table 3.--Quality of ear corn harvested from 16 corn varieties and hybrids treated with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Variety or Hybrid	Treatments (lbs. per acre) 0.0	0.5	1.0	1.5	Average
Ohio C-38	4.50	4.25	3.50	2.75	3.75
Ohio C-12	5.00	4.75	3.75	3.25	4.19
U. S. 13	5.25	4.00	3.75	3.75	4.19
Illinois 200	4.50	4.00	3.50	3.75	3.94
Pioneer 332	4.75	4.75	3.75	3.25	4.13
Texas 18	3.75	3.25	4.50	3.75	3.81
Texas 12	4.75	4.50	4.25	4.00	4.38
Texas 20	5.00	5.25	4.50	4.25	4.75
Texas 9W	5.50	5.25	5.25	5.00	5.25
Kansas 2234	4.50	5.25	4.75	3.75	4.56
Kansas 1585	4.50	4.50	3.75	3.75	4.13
Kansas 1639	3.75	4.75	3.75	3.25	3.88
Funk G-711	5.00	5.00	5.00	3.75	4.69
Midland Yellow Dent	3.75	3.25	4.25	3.00	3.81
Reid Yellow Dent	3.75	3.50	2.50	2.25	3.00
Oklahoma Silvermine	4.50	3.75	3.25	3.50	3.75
Average	4.54	4.37	4.00	3.56	4.14

different varieties are treated with different amounts of 2,4-D.

The high lodging rate as presented in Table 9 is possibly due in part to the advance stage of the plants when the treatments were applied. Heavy showers fell during the night following the day on which the plants were sprayed, both on May 23 and May 25. The rains may have concentrated the 2,4-D in the junctions formed by the leaves and stems, thus allowing more to be absorbed than would have been otherwise. The rains were accompanied by strong winds which undoubtedly blew over some plants. Other winds during the spring and early summer were also damaging.

The plants in Photo. 1 compose an untreated control unit. Both this photograph and Photo. 2 were made five days after the treatments were applied. The arrangement of the two is the same and the photographs were made from relative positions. The plants in the second photograph received 1.5 pounds (acid equivalent) of 2,4-D per acre. The plants in Photo. 3 illustrate the two forms of lodging. The bent plant is typical, and plants which bent no more than this frequently regained a vertical position. Another plant in this photograph shows typical breakage. In many cases, as in this one, the stalks were not completely severed and the plant continued to grow. Such plants often extended along the ground then grew upright, and, if the silks were not on the ground, produced ears.

Tables 5 and 10, respectively, contain the results and the analysis of variance of the lodging count made at harvest. These percentages were also transformed to angles corresponding to percentages (8). As in the previous analyses the differences among treatments and among varieties were highly significant. The treatment x variety interaction was not significant.

It is apparent from an inspection of Tables 2, 4 and 5 that there is a difference between varieties in yield and lodging, and between treatments.

Table 4.--Analysis of variance of lodging five days after treating 16 hybrids and hybrids of corn with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Source	DF	Sum of Squares	Mean Square	F Values Calculated	F Values Required
Replications	3	2,607.97	869.3233		
Variety	15	9,751.72	650.1146	6.3646**	2.31
Error a	45	4,596.55	102.1455		
Plots of Variety	63	16,965.24			
Replications	3	2,607.97	869.3233		
Treatments	2	15,071.21	7,535.6050	32.5491**	10.92
Error b	6	1,389.09	231.5150		
Plots of Treatments	11	19,068.27			
Plots of Var.	63	16,965.24			
Dev. of Var. Plots from Replications	8	16,460.30			
Treat. x Var.	30	2,580.50	86.0166	2.8461**	1.88
Error c	90	2,720.06	30.2228		
Total	191	38,726.10			

** Indicates significance at 1% level.

Treatment x variety interaction for lodging five days after treatment is highly significant. The like value at harvest is not significant. It would appear that there is a differential response to lodging, but that it is nullified as the varieties recover over a period of time.

The plants pictured in Photos. 4 and 5 illustrate the recovery made by many plants which lodged after being treated with 2,4-D. Both pictures were made in early July. The plant shown in Photo. 5 has made exceptionally good recovery.

A comparison of the average percentages of the stalks broken and bent for each treatment at five day intervals is presented in Table 6. In any one treatment it will be noted that generally as breakage increases bending decreases. The number of bent and broken plants increases with the strength of the treatment. This is in agreement with the results obtained by Buchholtz (3) and others. The greatest difference between averages for both bending and breaking lies between the fifth and tenth days after spraying. On this basis it would appear that the greatest recovery was made between these days. Strain averages are presented in Table 7.

One symptom not shown in any photograph is a yellowing or burning of the leaves shortly after being treated. This was most prevalent near the collar and extended along the blade to cover an area of several square inches. The plant on the left in Photo. 4 shows twisting of the stalk and shredding of the leaves which was characteristic of many treated plants. The plant on the right shows partial recovery from lodging and typical root proliferation. Another and more severe form of root proliferation is shown by the plant in Photo. 5. This plant also has a number of adventitous roots at the second node.

Photo. 1.--Control plots. No treatment applied.

Photo. 2.--Plots receiving 1.5 lbs. 2,4-D.

Photo. 3.--Typical bending and breaking within a week after treating with 1.5 lbs. of 2,4-D.

Photo. 4.--Proliferation of the roots and distorted leaves and stalks.

Table 5.—Analysis of variance of lodging at harvest of 16 corn varieties and hybrids treated with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Source	DF	Sum of Squares	Mean Square	F Values Calculated	F Values Required
Replications	3	2,042.53	680.8433		
Variety	15	11,485.51	765.7006	6.7407**	2.31
Error a	45	5,111.66	113.5924		
Plots of Variety	63	18,639.70			
Replications	3	2,042.53	680.8433		
Treatments	3	6,515.28	2,171.7600	10.7919**	6.99
Error b	9	1,811.31	201.2566		
Plots of Treatments	15	10,369.12			
Plots of Var.	63	18,639.70			
Dev. of Var. Plots From Replications	12	8,326.59			
Treat. x Var.	45	2,695.11	59.8913	1.0555	1.46
Error c	135	7,659.85	56.7396		
Total	255	37,321.25			

** Indicates significance at 1% level.

Photo. 5.—Recovery from lodging and extensive proliferation of the brace roots.

Table 6.--Comparison of the percentages of stalks broken and bent for 16 corn varieties and hybrids treated with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Lbs. of 2,4-D per acre	Form of Lodging	Average percent lodged after 5 Days	10 Days	15 Days	20 Days
0.0 lb.	Stalks Bent	0.12	0.12	0.33	0.00
	Stalks Broken	0.08	0.13	0.12	0.13
0.5 lb.	Stalks Bent	22.11	13.41	4.91	2.82
	Stalks Broken	2.09	2.76	3.28	3.07
1.0 lb.	Stalks Bent	43.09	37.79	23.24	15.02
	Stalks Broken	3.39	5.90	6.18	6.56
1.5 lbs.	Stalks Bent	43.13	42.18	31.42	21.83
	Stalks Broken	14.29	17.40	15.77	15.20
	Average	32.08	29.92	21.31	16.16

Table 7.--Average percent of lodging of 16 corn varieties and hybrids at four intervals after treatment with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Variety or Hybrid	Days from Spraying 5	10	15	20
	No Treatments			
Ohio C-38	00.00	00.00	00.00	00.00
Ohio C-12	1.37	1.37	1.38	00.78
U. S. 13	00.00	00.00	00.64	00.64
Illinois 200	00.00	00.78	00.78	00.78
Pioneer 332	00.00	00.00	00.00	00.00
Texas 18	00.64	00.00	00.64	00.00
Texas 12	00.00	00.00	00.00	00.00
Texas 20	00.00	00.00	00.00	00.00
Texas 9W	00.65	00.00	00.00	00.00
Kansas 2234	00.00	00.00	00.00	00.00
Kansas 1585	00.00	1.97	1.97	00.00
Kansas 1639	00.00	00.00	00.00	00.00
Funk G-711	00.00	00.00	00.00	00.00
Midland Yellow Dent	00.00	00.00	00.00	00.00
Reid Yellow Dent	00.69	00.00	00.00	00.00
Oklahoma Silvermine	00.00	00.00	00.00	00.00
Average	00.20	00.25	00.33	00.13
	0.5 lb. Treatments			
Ohio C-38	29.55	17.56	7.51	5.38
Ohio C-12	18.49	11.29	7.53	6.83
U. S. 13	14.67	7.60	7.69	5.10
Illinois 200	14.06	12.11	4.50	3.22
Pioneer 332	22.28	15.18	13.92	8.23
Texas 18	29.24	22.00	7.52	6.29
Texas 12	23.35	11.42	1.92	0.64
Texas 20	29.57	23.05	6.53	1.24
Texas 9W	22.80	17.28	5.09	1.88
Kansas 2234	12.08	14.00	4.52	5.20
Kansas 1585	12.62	10.11	7.03	7.57
Kansas 1639	25.78	11.32	7.48	5.03
Funk G-711	15.66	6.82	1.38	0.00
Midland Yellow Dent	29.73	19.20	11.55	10.89
Reid Yellow Dent	52.13	36.85	26.14	19.62
Oklahoma Silvermine	36.29	22.99	10.78	8.15
Average	24.20	16.16	8.19	5.95

Table 7.--Continued.

Variety or Hybrid	Days from Spraying 5	10	15	20
	1.0 lb. Treatments			
Ohio C-38	62.50	48.74	38.74	28.74
Ohio C-12	45.48	35.36	23.48	13.69
U. S. 13	41.67	34.71	29.03	23.72
Illinois 200	43.30	32.48	21.65	16.01
Pioneer 332	43.92	45.71	40.64	38.69
Texas 18	51.68	60.99	35.88	20.13
Texas 12	38.22	34.77	17.95	12.86
Texas 20	47.04	49.11	22.98	17.79
Texas 9W	35.72	39.45	26.02	14.56
Kansas 2234	23.77	31.58	24.52	20.98
Kansas 1585	29.68	46.98	29.10	17.61
Kansas 1639	60.10	45.55	31.66	13.28
Funk G-711	31.03	23.86	13.82	11.86
Midland Yellow Dent	55.86	47.95	29.19	25.95
Reid Yellow Dent	69.65	66.41	50.81	43.85
Oklahoma Silvermine	64.00	55.47	35.32	25.46
Average	46.47	43.69	29.42	21.57
	1.5 lbs. Treatments			
Ohio C-38	75.51	73.15	58.60	40.37
Ohio C-12	57.30	55.66	39.79	27.36
U. S. 13	59.90	54.25	48.20	30.36
Illinois 200	59.34	47.23	37.69	26.40
Pioneer 332	57.99	66.62	53.59	44.76
Texas 18	64.99	69.37	52.49	43.75
Texas 12	42.67	56.24	42.60	32.75
Texas 20	62.08	69.43	48.90	42.32
Texas 9W	42.56	47.67	37.22	21.03
Kansas 2234	24.39	42.83	39.71	34.64
Kansas 1585	45.25	42.08	41.40	38.28
Kansas 1639	72.99	73.77	53.15	40.49
Funk G-711	45.14	44.28	34.64	26.09
Midland Yellow Dent	54.99	61.00	46.69	44.77
Reid Yellow Dent	85.08	83.28	68.88	56.47
Oklahoma Silvermine	68.49	66.54	51.47	42.71
Average	57.41	59.58	47.19	37.03

Plants in the same hill did not always respond alike to the same treatment. This is evidenced by the plants in Photo. 6. The plant on the left shows heavy proliferation of the brace roots and a number of adventitous roots at the second node. The deformed leaf is also typical. The plant on the right is unique in that it has neither lodged nor suffered extensive root proliferation. The plant on the right in Photo. 7 has a normal tassel while the plant on the left has a tassel tightly enclosed by leaves. In order to show more detail the leaves about the encased tassel were pulled apart before being photographed. Many plants had the tassel so tightly rolled in the upper leaves that they were unable to emerge normally and caused the plants to grow in a hoop-shape. A few plants were observed with the tassel bursting through the enclosing leaves.

SUMMARY

An experiment designed to test the differential response of 16 strains of corn to 2,4-D treatments was conducted in 1948 near Stillwater, Oklahoma. The strains were sprayed with 0.5, 1.0 and 1.5 pounds (acid equivalent) of 2,4-D per acre when 22 to 26 inches high. The effects of the herbicide on lodging, silking, yields and quality were studied. Some of the external characteristics of corn treated with 2,4-D were recorded. The following results were outstanding:

1. Silking dates do not appear to be affected by treatments of 0.5 pounds of 2,4-D per acre but are slightly delayed by treatments of 1.0 and 1.5 pounds per acre.

Photo. 6.—Two plants in the same hill showing a wide difference in proliferation.

Photo. 7.—A normal tassel on the right and a tassel encased by the upper leaves on the left. The leaves of the plant on the left have been pulled apart to show more detail.

2. An analysis of variance for yields indicated a highly significant difference among varieties.
3. Differences in treatments were also highly significant. Yields of plots treated with 0.5 pound of 2,4-D were essentially the same as the control plots. Plots treated with 1.0 and 1.5 pounds, respectively, yielded 12.68% and 24.57% below the control plots.
4. Treatment x variety interaction in yield was not significant.
5. The quality of ear corn decreased with increased 2,4-D concentrations.
6. Variety and treatment differences were highly significant for lodging five days after spraying. Treatment x variety interaction was highly significant.
7. Variety and treatment differences were also highly significant for lodging at harvest. Treatment x variety interaction was not significant.
8. A differential response of varieties to different concentrations of 2,4-D is indicated in the lodging five days after spraying. This difference vanished as the strains recovered over a period of time.
9. Lodging took the forms of both bending and breaking. As breaking increased bending decreased. Lodging increased with the strength of treatments and decreased during a twenty-day interval. The greatest recovery from lodging was made between the fifth and tenth days.

10. Silking counts, lodging counts, yields and quality estimates indicate that generally not more than 0.5 pound (acid equivalent) of 2,4-D per acre should be applied to corn in this region.

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A P P E N D I X

Table 8.--Yields in bushels per acre of ear corn of 16 corn varieties and hybrids treated with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Variety or Hybrid	Replications I	II	III	IV	Average
No Treatments					
Ohio C-38	55.7	48.0	45.3	41.6	47.6
Ohio C-12	53.9	59.2	49.3	38.4	50.2
U. S. 13	64.3	56.8	51.7	50.9	55.9
Illinois 200	67.7	59.7	52.8	62.1	60.5
Pioneer 332	57.3	48.8	52.0	53.9	53.0
Texas 18	58.1	70.7	63.2	51.2	60.8
Texas 12	63.2	65.9	49.1	62.7	60.2
Texas 20	73.3	71.6	52.9	58.7	64.1
Texas 9W	71.4	61.3	58.4	55.7	64.7
Kansas 2234	46.4	53.6	47.7	62.1	52.4
Kansas 1585	49.9	38.9	62.9	57.2	52.2
Kansas 1639	48.8	48.8	51.5	46.4	48.8
Funk G-711	58.7	58.3	57.9	63.2	59.5
Midland Yellow Dent	47.2	34.7	39.3	32.8	38.5
Reid Yellow Dent	51.5	42.1	44.3	23.3	40.3
Oklahoma Silvermine	29.0	37.3	49.3	34.1	37.4
Average	56.0	53.4	51.7	49.6	52.7
0.5 lb. Treatments					
Ohio C-38	52.3	41.0	51.5	48.8	48.4
Ohio C-12	58.4	54.1	60.8	21.3	48.6
U. S. 13	62.4	60.8	62.9	43.4	57.4
Illinois 200	59.5	73.6	38.9	53.6	56.4
Pioneer 332	55.7	54.7	49.1	53.3	53.2
Texas 18	70.4	34.9	56.5	68.3	57.5
Texas 12	69.1	64.0	57.1	86.7	69.2
Texas 20	80.5	73.9	65.9	35.7	64.0
Texas 9W	74.1	65.2	35.5	70.7	61.4
Kansas 2234	36.2	64.0	46.9	67.5	53.6
Kansas 1585	53.6	57.6	50.4	54.7	54.1
Kansas 1639	54.9	61.3	57.3	53.1	56.6
Funk G-711	75.5	68.5	61.6	69.5	68.8
Midland Yellow Dent	48.1	37.3	43.7	27.7	39.2
Reid Yellow Dent	40.5	18.1	46.1	23.2	31.9
Oklahoma Silvermine	26.4	24.6	39.2	50.6	35.2
Average	57.4	53.4	51.5	51.8	53.5

Table 8.--Continued.

Variety or Hybrid	Replications I	II	III	IV	Average
		1.0 lb. Treatments			
Ohio C-38	43.5	37.9	36.0	26.1	35.9
Ohio C-12	46.1	37.9	43.5	15.2	35.7
U. S. 13	57.8	50.1	45.3	27.7	45.2
Illinois 200	59.2	64.5	30.7	44.5	49.7
Pioneer 332	37.9	43.5	34.1	32.8	37.1
Texas 18	48.3	42.7	55.0	50.4	49.1
Texas 12	73.9	54.9	62.7	69.4	65.2
Texas 20	79.5	71.2	42.9	41.3	58.7
Texas 9	69.6	64.3	27.5	40.3	50.4
Kansas 2234	30.9	53.9	48.8	26.4	41.2
Kansas 1585	48.3	43.2	48.4	49.1	47.2
Kansas 1639	39.7	48.0	43.2	44.5	43.8
Funk G-711	68.8	57.9	71.5	40.8	59.7
Midland Yellow Dent	38.7	38.1	40.5	21.3	34.6
Reid Yellow Dent	26.8	22.7	37.3	21.1	27.5
Oklahoma Silvermine	19.7	32.8	32.3	36.3	30.3
Average	49.4	48.0	43.7	36.7	44.5
		1.5 lbs. Treatments			
Ohio C-38	26.1	21.6	35.5	37.6	30.2
Ohio C-12	39.7	35.9	34.9	39.7	37.5
U. S. 13	43.2	41.1	38.4	43.1	41.4
Illinois 200	42.1	55.2	45.3	44.2	46.7
Pioneer 332	41.6	22.9	22.1	33.1	29.9
Texas 18	48.0	21.6	44.5	51.7	41.4
Texas 12	66.1	58.4	38.4	55.5	54.6
Texas 20	59.8	51.5	34.7	34.7	45.2
Texas 9	70.9	67.2	44.0	62.4	61.1
Kansas 2234	26.1	43.7	44.8	63.2	44.4
Kansas 1585	34.1	36.0	38.1	54.1	40.6
Kansas 1639	30.9	35.7	25.6	45.6	34.4
Funk G-711	64.3	52.5	53.3	46.4	54.1
Midland Yellow Dent	26.7	27.2	19.2	32.3	26.3
Reid Yellow Dent	28.0	12.7	20.8	28.3	22.4
Oklahoma Silvermine	15.5	27.2	21.0	40.0	25.9
Average	41.4	38.2	35.0	44.5	39.6

Table 9.--Percentage of plants lodged of 16 corn varieties and hybrids 5 days after being treated with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Variety or Hybrid	Replications I	II	III	IV	Average
			No Treatments		
Ohio C-38	00.00	00.00	00.00	00.00	00.00
Ohio C-12	3.13	2.38	00.00	00.00	1.38
U. S. 13	00.00	00.00	00.00	00.00	00.00
Illinois 200	00.00	00.00	00.00	00.00	00.00
Pioneer 332	00.00	00.00	00.00	00.00	00.00
Texas 18	00.00	00.00	2.56	00.00	00.64
Texas 12	00.00	00.00	00.00	00.00	00.00
Texas 20	00.00	00.00	00.00	00.00	00.00
Texas 9W	00.00	00.00	00.00	2.63	00.66
Kansas 2234	00.00	00.00	00.00	00.00	00.00
Kansas 1585	00.00	00.00	00.00	00.00	00.00
Kansas 1639	00.00	00.00	00.00	00.00	00.00
Funk G-711	00.00	00.00	00.00	00.00	00.00
Midland Yellow Dent	00.00	00.00	00.00	00.00	00.00
Reid Yellow Dent	00.00	00.00	00.00	00.00	00.00
Oklahoma Silvermine	00.00	00.00	00.00	00.00	00.00
Average	00.19	00.15	00.16	00.16	00.04
			0.5 lb. Treatments		
Ohio C-38	28.21	22.50	15.00	52.50	29.55
Ohio C-12	21.95	17.50	10.00	24.32	18.44
U. S. 13	13.15	5.00	19.51	21.05	14.67
Illinois 200	20.51	15.00	12.82	7.89	14.05
Pioneer 332	23.08	12.50	12.50	41.03	22.28
Texas 18	41.46	27.50	20.51	27.50	29.24
Texas 12	10.00	38.46	22.50	18.42	22.34
Texas 20	20.00	20.51	33.33	44.44	29.57
Texas 9W	22.50	16.22	17.50	35.00	22.80
Kansas 2234	15.00	2.50	20.00	10.81	12.07
Kansas 1585	5.41	7.50	17.07	20.51	12.62
Kansas 1639	25.64	20.00	37.50	20.00	25.78
Funk G-711	9.09	7.50	22.50	23.53	15.65
Midland Yellow Dent	31.58	25.64	27.50	34.21	29.73
Reid Yellow Dent	46.34	60.52	35.00	66.66	52.13
Oklahoma Silvermine	58.97	26.31	44.47	18.42	37.04
Average	24.55	20.32	22.98	29.14	24.25

Table 9.--Continued.

Variety or Hybrid	Replications I	II	III	IV	Average
		1.0 lb. Treatments			
Ohio C-38	50.00	57.50	72.50	70.00	62.50
Ohio C-12	37.50	31.58	46.18	66.67	45.48
U. S. 13	34.12	41.46	42.50	48.65	41.68
Illinois 200	35.00	42.11	52.50	43.59	43.30
Pioneer 332	45.00	28.21	52.50	50.00	41.48
Texas 18	51.22	47.50	60.52	47.50	51.68
Texas 12	20.00	39.47	47.50	45.95	35.73
Texas 20	30.00	33.33	60.00	64.86	47.05
Texas 94	20.51	43.59	27.50	51.28	35.72
Kansas 2234	12.50	20.00	29.27	33.33	23.77
Kansas 1585	30.00	20.00	31.58	37.14	29.68
Kansas 1639	33.34	69.23	70.00	67.86	60.10
Funk G-711	13.16	15.00	35.00	60.98	31.03
Midland Yellow Dent	55.26	53.84	53.85	60.52	55.87
Reid Yellow Dent	60.00	71.06	80.00	67.57	69.65
Oklahoma Silvermine	60.97	72.50	55.88	66.67	64.00
Average	36.79	42.90	51.08	55.16	47.78
		1.5 lbs. Treatments			
Ohio C-38	64.86	82.50	82.93	71.79	75.72
Ohio C-12	47.50	45.71	77.50	58.54	57.31
U. S. 13	36.59	43.59	100.00	59.46	59.91
Illinois 200	65.00	42.50	82.50	47.37	59.34
Pioneer 332	30.77	43.59	70.46	87.18	58.00
Texas 18	62.50	40.00	85.00	72.50	65.00
Texas 12	29.27	35.00	65.00	41.46	42.68
Texas 20	56.76	38.46	77.50	75.61	62.08
Texas 94	33.33	25.64	48.79	62.50	42.56
Kansas 2234	17.94	27.50	14.64	37.50	24.39
Kansas 1585	40.00	47.50	41.02	52.50	45.25
Kansas 1639	52.62	82.50	99.00	57.90	73.00
Funk G-711	37.50	21.95	63.64	57.50	45.14
Midland Yellow Dent	56.41	41.46	68.29	53.85	55.00
Reid Yellow Dent	86.41	81.08	90.00	82.85	85.08
Oklahoma Silvermine	80.00	65.00	70.00	58.98	68.74
Average	49.84	47.57	71.02	61.09	57.43

Table 10.--Percentage of plants lodged at harvest of 16 corn varieties and hybrids treated with various rates of 2,4-D at Stillwater, Oklahoma, in 1948.

Variety or Hybrid	Replications I	II	III	IV	Average
			No Treatments		
Ohio C-38	22.5	17.1	28.2	51.2	29.7
Ohio C-12	28.1	7.1	25.0	59.0	29.8
U. S. 13	9.1	7.7	42.5	22.5	20.4
Illinois 200	9.4	18.0	25.0	30.0	20.6
Pioneer 332	15.0	15.0	36.9	27.5	23.6
Texas 18	75.6	47.5	37.5	46.2	51.7
Texas 12	35.9	17.5	30.0	50.0	33.3
Texas 20	40.0	33.3	25.8	47.4	36.6
Texas 9W	37.5	42.5	35.0	68.4	45.8
Kansas 2234	59.0	13.1	34.2	30.0	34.0
Kansas 1585	13.2	15.8	27.5	28.9	21.3
Kansas 1639	30.8	5.0	25.0	37.5	24.6
Funk G-711	30.9	23.7	25.7	47.5	31.9
Midland Yellow Dent	39.5	37.5	55.6	55.0	46.9
Reid Yellow Dent	65.0	33.3	41.5	72.3	53.0
Oklahoma Silvermine	60.5	55.3	25.6	48.7	47.3
Average	35.8	24.3	32.6	45.1	34.4
			0.5 lb. Treatments		
Ohio C-38	41.0	50.0	22.5	30.0	35.9
Ohio C-12	21.9	15.0	22.5	81.0	35.1
U. S. 13	29.0	17.5	19.5	52.6	29.4
Illinois 200	15.4	27.5	17.9	42.2	27.2
Pioneer 332	20.5	42.5	42.5	48.7	38.5
Texas 18	61.0	42.5	30.7	40.0	43.5
Texas 12	45.0	56.4	37.5	65.8	51.1
Texas 20	55.0	20.5	42.8	55.5	43.4
Texas 9W	62.5	62.1	75.0	40.0	59.9
Kansas 2234	47.5	27.5	45.0	27.0	36.5
Kansas 1585	29.7	17.5	34.1	33.3	28.6
Kansas 1639	15.4	12.5	22.5	27.5	19.4
Funk G-711	45.5	45.0	32.5	79.5	50.6
Midland Yellow Dent	50.0	53.8	37.5	60.6	50.5
Reid Yellow Dent	70.7	68.4	55.0	84.6	69.6
Oklahoma Silvermine	69.3	68.4	43.9	31.6	53.3
Average	42.5	39.2	36.3	50.0	42.0

Table 10.--Continued.

Variety or Hybrid	Replications I	II	III	IV	Average
		1.0 lb. Treatments			
Ohio C-38	45.0	45.0	30.0	92.5	53.1
Ohio C-12	42.5	21.1	38.2	91.7	48.4
U. S. 13	47.4	36.6	40.0	67.5	47.9
Illinois 200	45.0	15.8	45.0	30.7	34.1
Pioneer 332	40.0	25.6	42.5	47.4	38.9
Texas 18	31.7	55.0	55.3	67.5	52.4
Texas 12	57.5	47.4	40.0	45.9	47.7
Texas 20	32.5	48.7	60.0	40.5	45.4
Texas 9W	87.2	76.9	72.5	89.7	81.7
Kansas 2234	67.5	30.0	56.1	75.0	57.1
Kansas 1585	22.5	27.5	23.7	40.0	28.4
Kansas 1639	33.4	25.6	30.0	60.0	34.7
Funk G-711	55.3	50.0	42.5	31.8	44.9
Midland Yellow Dent	55.3	43.6	43.6	63.2	41.4
Reid Yellow Dent	65.0	90.5	52.5	62.2	67.5
Oklahoma Silvermine	70.7	67.5	47.1	59.0	61.0
Average	49.9	44.2	44.9	60.3	49.8
		1.5 lbs. Treatments			
Ohio C-38	45.9	67.5	24.4	43.6	45.3
Ohio C-12	45.0	54.3	45.0	41.5	46.4
U. S. 13	73.2	76.9	57.5	45.9	63.4
Illinois 200	40.0	32.5	45.0	63.1	45.1
Pioneer 332	53.8	74.3	40.9	56.4	56.3
Texas 18	50.0	90.0	50.0	37.5	56.9
Texas 12	53.7	77.5	32.5	65.8	57.4
Texas 20	70.3	47.1	47.5	56.1	55.2
Texas 9W	71.4	74.4	82.9	77.5	76.5
Kansas 2234	89.8	47.5	58.5	37.5	58.3
Kansas 1585	42.5	42.5	46.1	30.0	40.2
Kansas 1639	51.3	40.0	28.9	26.4	36.6
Funk G-711	60.0	41.5	56.8	65.0	55.8
Midland Yellow Dent	66.6	73.2	63.4	64.1	41.8
Reid Yellow Dent	75.6	89.2	42.5	82.9	72.5
Oklahoma Silvermine	90.0	82.5	57.5	51.3	70.2
Average	61.2	63.2	48.7	52.8	56.5

Typist: Mary Wallace Spohn