

26/828 0335

II deer, white-tailed
3 " , male

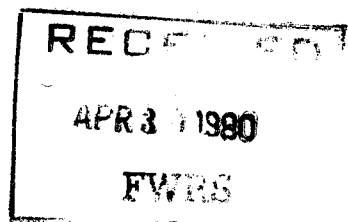
pronghorn
alfalfa
cropland, not tilled for corn land
damage by wildlife

Deer and Pronghorn Depredation in
Alfalfa and Corn

bibkey: 549353

By

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Introduction

With increased corn and alfalfa production in the Sandhills area, concern was expressed by personnel of the Nebraska Game and Parks Commission and University of Nebraska Agriculture Extension agents about potential crop depredation by wildlife. Their primary concern was the large herbivores, white-tailed deer (Odocoileus virginianus), mule deer (Odocoileus hemionus), and pronghorn (Antilocapra americana).

Nebraska data were not available on estimates of losses on growing crops. Complaints in the Sandhills about deer feeding on growing alfalfa and corn have been few. This study was for the purpose of developing base line data on deer use.

The first objective of the study was to determine if there was damage to growing corn and alfalfa, and if so, determine the extent of this damage. If significant damage was occurring in the area, it would leave time to consider the alternative solutions before damage became more severe.

The second objective was to determine the portion of the growing season in which deer and pronghorn damage is the most severe. This would allow better application and timing of control methods.

The third objective of the study was to develop recommendations to control the depredation. We did not hope to develop new methods of control, but if during the study something was observed that would allow better application of existing methods, this would be our recommendations.

A study conducted by McDowell and Pillsbury (1959) reported that deer were the most destructive species on agricultural lands in the United States. In Colorado during the years 1951-1955, the Colorado Game and

Fish Department paid over \$33,000 for damage to hay, alfalfa and grain (Boyd 1967). During the winter of 1973-1974, \$58,000 was paid for damages in Colorado (Lashnits, 1976).

Boyd (1960) conducted studies in Colorado to determine the extent of mule deer depredation on early growing alfalfa. He found no significant damage occurred on spring alfalfa when grazed by deer.

Study Area

The Niobrara River in the Sandhills region of Nebraska was selected as the study area because of increased agricultural development there.

The Sandhills cover approximately 49,987 km² in the northcentral portion of the state. The Sandhills are roughly bordered on the north by the Niobrara River and except in the eastern half, the Platte River is the southern boundary (Figure 1).

The region is characterized by rolling sand dunes, flat sand plains, wet meadows and creek bottoms. Little humus occurs in the dunes and plains, but 7.6 to 12.7 cm of humus occurs in the wet meadows and creek bottoms. The region has large quantities of underground water and in wet meadows and creek bottoms, the water table is 0.9 to 1.5 m underground (Weaver, 1965).

Precipitation ranges from 6.3 cm in the western Sandhills to 96 cm in the east, with 80 percent of this falling from April through September. Average date of first snowfall greater than .39 cm is 14 November. The average date of the last snowfall greater than .39 cm is 25 March. There is an average of 13 days per year that snow cover exceeds 2.4 cm in this area.

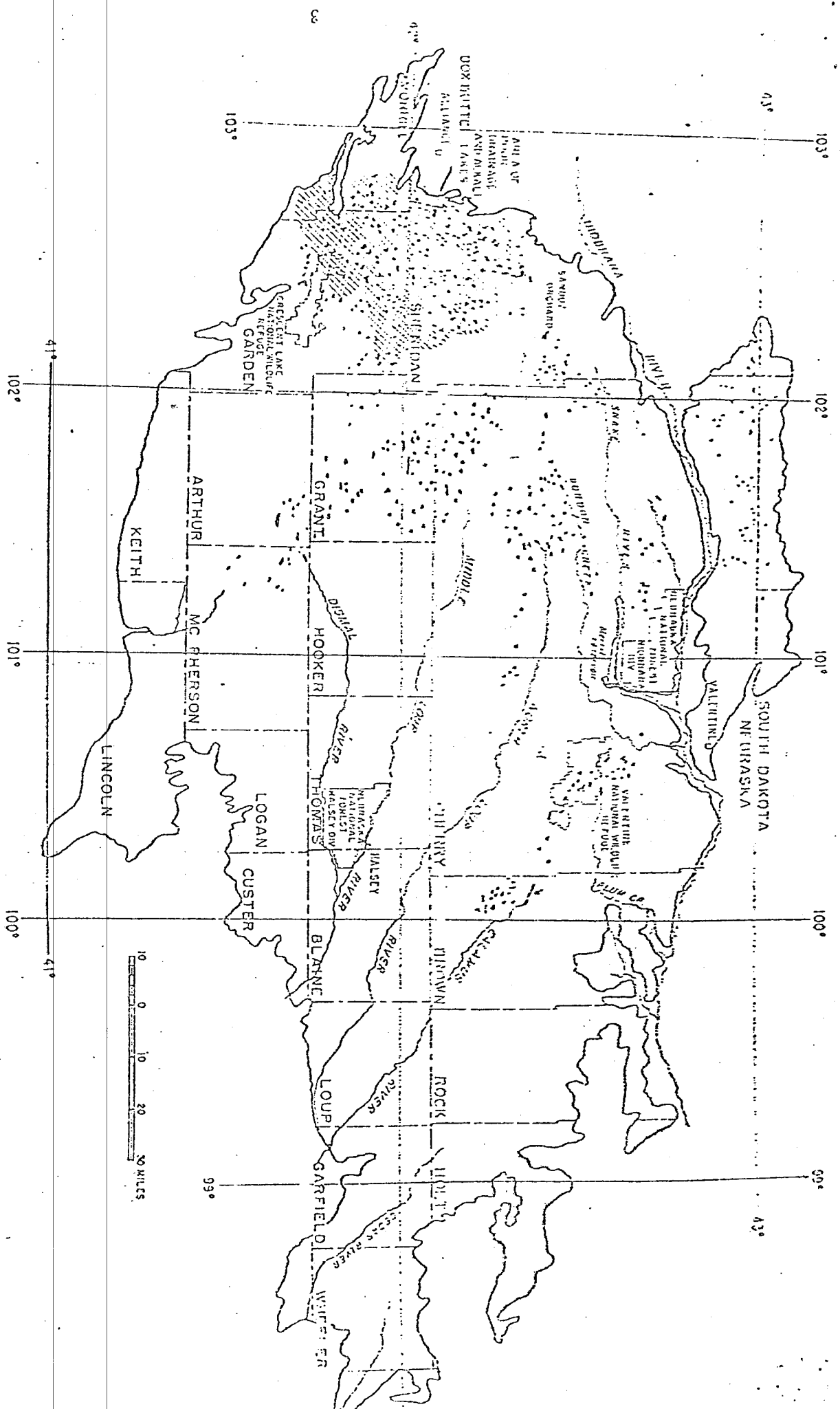


Figure 1. - The Sandhills region of northcentral Nebraska. Most of the region is drained by the Loup and Niobrara Rivers. An area of closed basins in the western part ordinarily is noncontributing to streams. (Keech and Bentall, 1971)

Temperatures average about 8.9°C but range from -40°C to 43.7°C (Keech and Bental, 1971).

Two alfalfa fields were used during the 1976 growing season. One field was located 17.2 km north-northeast of Bassett, Nebraska in Rock County. The second was located 22.4 km north of Ainsworth, Nebraska in Brown County. Both fields are located within 90 m of the Niobrara River. Three alfalfa fields were used during the 1977 growing season. A new field, 200 m west of the field north of Bassett, was added in 1977.

Materials and Methods

Exclosures were used to determine extent of depredation on alfalfa. The methods used by Boyd and in this study have been used by agronomists for many years. Klingman (1943) and Linehan (1952) used the cage or exclosure technique to determine forage yield and consumption on pasture herbage. Exclosures were designed with large wire to avoid creating a more favorable environment for growth inside the exclosure (Cowlshaw, 1951). The exclosure method has also been used in forested areas to determine damage done to browse species by deer (Graham, 1958).

The fields were measured and drawn to scale. Fields were then subdivided into 60 x 60 m blocks. Numbers were assigned each block and six were selected at random to receive an exclosure.

The four corners of the blocks were numbered and one corner was randomly drawn to determine placement of exclosures.

Exclosures were 2.7 x 3 x .9 m in size. They were constructed of 5 x 10 cm welded wire and topped with 5 cm chicken wire.

Data from the fields were taken 3 to 5 days prior to harvest.

Data outside of the exclosures were taken by randomly cutting ten 91.44 cm² subplots. The ten combined subplots equaled the same area as the exclosure. Subplots were cut at the same time as the exclosures.

All exclosures were cut using a Jari mower with a 91.44 cm bar. The alfalfa was raked onto a 121.92 cm² tarpaulin. In 1976, weights were taken using a 25-pound Viking scale. Because of problems with sand getting into the Viking scale, a 25-pound Chattleon scale was used in 1977.

All subplots were cut using a Disston heavy duty grass shear. Shears were equipped with a rechargeable battery pack (Daigger, 1972). Subplots were cut and handled the same as exclosures.

Figure 1.

Moisture content was determined so that exclosure and subsample weights could be compared on a dry weight basis. To determine moisture, a sample was taken from each plot that received an exclosure. Samples were weighed on a Detecto scale and dried in an Acme drying oven for 72 hours. Dry weights were then taken on the same scale.

Corn data were collected in two ways. One technique was used when deer approached the fields perpendicular to the rows. The second technique was used when deer approached the fields parallel to the rows.

When deer approached fields perpendicular to rows, the technique was to sample the first and second row of the field. It was determined from preliminary observations that no significant damage occurred deeper

than two rows into the fields. Data were collected by counting ears eaten by deer in each of four sample areas 25 m in length.

The second technique was used when deer approached fields parrallel to the rows. Damage to ears were counted every ten rows. Damaged ears were counted as far into the field as they extended. The distance the damage extended was measured and recorded.

In order to get a representative sample of deer populations in the immediate area of the study fields, early spring counts were made on one alfalfa field using an aircraft landing light during early morning hours. Track counts were attempted using a modification of Daniel and Frels (1971) methods. They used a 36-inch daag to condition the soil so tracks could be counted. A six-mile transect was counted every morning. In our study, 36-inch wide counting areas were raked across known entrance route leading into the fields.

Results and Discussion

Alfalfa

Deer fed on alfalfa from late March to late April or early May. Heaviest use occurred during early and middle April (Figure 2). Use patterns were the same in 1977 except total numbers of deer were less. This is the same type of spring number fluctuation seen by Bartman (1974) on the Rifle Gap Study area. He explained the fluctuation in numbers seen on alfalfa as vertical migration of deer. He noted deer congregated on alfalfa meadows prior to migration. In the Sandhills region, it appeared deer congregate on alfalfa fields to feed. Speculation is that deer feed on alfalfa because of the early greening.

During the 1976 growing season, two fields were sampled. One field was sampled over three cuttings and one field was sampled at the time of the third cutting. The reason for the variation in the sampling of the two fields arose from communication problems with landowners. Because of the distance to be traveled and the time it took to sample, cutting date had to be known at least 2 days prior to harvest. This time schedule was not met.

During the 1977 growing season, three fields were sampled over the first and second cuttings. Third cutting samples were not taken because observations during 1976 showed an insignificant number of deer feeding on alfalfa during this period. Analysis of variance for 1976 and 1977 data are presented in Table 1.

Figure 2. Trend in deer numbers during spring 1976 on a 15 acre alfalfa field.

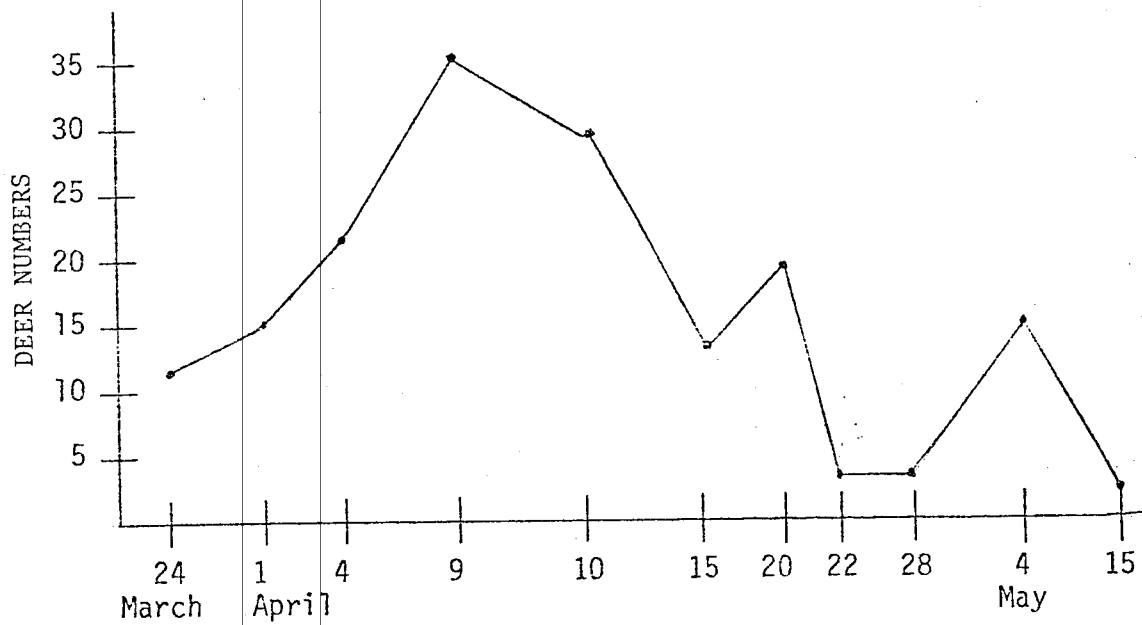


TABLE 1. Analysis of Variance for Alfalfa Data, 1976 and 1977.

(This analysis was figured with data in pound measurements.)

	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F calc.</u>
Among treatments	1	2.0	2.0	.32
Within treatments (error)	<u>108</u>	<u>663.8</u>	6.2	
TOTAL	109	665.8		

The Points for the Distribution of F table was used to determine significant difference between exclosure and control plots in the study. The table value of F for 1 and 120 degrees of freedom and 90% accuracy is 2.75. The effect of use is not significant at this level.

Data from 1977 were analyzed separately at the suggestion of Dr. Robert Mumm. This was done because the data were complete over the second year. Data were analyzed to remove field, as well as cutting, differences (Table 2).

TABLE 2. Analysis of Variance for Alfalfa Data, 1977.

(This analysis was figured with data in kilograms.)

<u>Source</u>	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Square</u>	<u>F value</u>
Model	4	37.554	9.389	43.03
Error	67	14.618	0.218	
Corrected Total	71	52.173		

<u>Source</u>	<u>D.F.</u>	<u>ANOVA S.S.</u>	<u>F value</u>	<u>PR > F</u>
Exclosures	1	0.087	0.40	0.530
Field	2	37.048	84.90	0.000
Cutting	1	0.420	1.93	0.170

Deer use, represented by exclosures in the model, was not significant ($P > 0.25$). Most of the variance in the data is accounted for by field differences. Soil types and rainfall differences account for the field differences.

Damage was not significant when populations of 6-8 deer per 1.6 km^2 existed in this area. In certain years under extreme weather conditions, significant damage could be experienced in isolated areas of the Sandhills. Damage on irrigated alfalfa could also be experienced when high deer populations combine with severe drought.

Corn

All corn data were taken when the corn was in the early dent to mature stage of growth. Checks were made on fields throughout the season. Damage did not start until corn reached the milk stage.

During checks run earlier in the season, deer tracks were observed and followed. Deer generally sampled 1 to 4 ears and then left the field. Deer did not bed down in any of the study fields. This was contrary to the opinion of the general population in the area. This could be due to temperatures of 21.1°C to 48.9°C during daylight hours at ground level during July and August. Following fresh tracks showed the deer feeding and then moving out of the fields to the ridges to bed down.

ANOVA for corn data when deer entered perpendicular to the rows is shown in Table 3.

Table 3. Analysis of Variance for Corn Data, 1976 and 1977 Study Years.

	D.F.	Sum of Squares	Mean Squares	F calc.
Among treatments	1	1456.3	1456.3	5.28
Within treatments (error)	86	7427.1	86.4	
Total	87			

Treatments in the above analysis are the first and second rows. The table values of F for 1 and 120 degrees of freedom and 95% accuracy are 3.92. The difference in use between rows is significant. This supports visual observation that the deer in this area do not feed far into the field if they have to walk cross row. Visual observation showed no significant damage to ears three rows or farther into the fields.

Calculations used in the Analysis of Variance appear in Appendix i.

Because individual ears were not totally consumed when fed upon by deer, ten damaged ears from each field were used to determine an average damage of ears fed upon. Corn ears fed upon by deer showed sharp cutting of both the cob and the corn husks (Fig. 3). Secondary damage caused by disease and insects was apparent on many ears that had been nipped by deer (Fig. 4).

(picture)

Corn damage caused by deer feeding parallel to rows was checked on two fields in 1976 and four fields in 1977. Because of the location of game trails some study fields did not have damage of this nature. Data from deer feeding parallel to the rows is shown in Appendix 2.

When damage from deer feeding perpendicular to the rows is compared to damage from deer feeding parallel to rows, there is a difference in the distance they feed into the field. Average distance deer fed parallel with the rows into the fields was 9.3 m. Total distance deer fed perpendicular to the rows was 1.5 m. Deer did not feed farther than the second row into the field when they had to walk perpendicular to the rows. The greatest amount of damage occurred by deer feeding perpendicular to the rows. Tracks showed that deer walked along the outside of the field and fed on the outside row.

Track counts were taken at three fields during 1976. Data collected were used as a relative number of deer using each field. The method used did not allow for accurate counts because the deer did not always use well defined game trails to enter the study fields.

Antelope were never seen or tracked on the study fields. It is believed that as spring begins, they move back to the south. The only time they are in the vicinity of the study area is during the winter (Menzel 1976). During the winter of 1974-75, a herd approximately 20 antelope spent January 2 miles south of field #1.

Raccoon damage to corn ears was distinguishable from deer damage by the method of feeding. Raccoons broke stalks as they climbed to the ears. When the ears were reached, the husks were peeled back to expose the kernels. Also, many ears were stacked in one area.

RECOMMENDATIONS

At the time of the study, none of the alfalfa study fields were experiencing significant damage. From counts of deer on the area it would seem that if damage became a problem on growing alfalfa it would be in the early spring. Control of damage in this situation would have to be through the conventional means of repellents, fencing and exploders (Cowan 1960). These techniques have been used with varying degrees of success.

Corn damage caused by deer was low on the study fields. To stop damage that is already taking place in a field, the techniques mentioned above could be employed.

As shown by the data, deer did not feed far into a field if they had to move cross row. As a long range deterrent to high yield loss from deer damage, I would suggest determining major trails leading to fields, then planting corn rows perpendicular to this trail. If deer begin to feed on corn in this field damage will be confined to the outside few rows. Characteristically, these outside rows are the poorest in terms of yield; therefore, if damage is experienced in these rows yield reduction will be held to a minimum.

The ultimate deterrent to deer depredation would be for County Extension agents and Game and Parks Commission personnel to work with farmers and ranchers in determining site selection of new fields. If possible, fields could be located in areas where travel lanes do not lead into the fields.

APPENDIX 1.

Number of Corn Ears Damaged by Deer Feeding Perpendicular to Rows 1976 and 1977

Field	Date	First Sample			Second Sample			Third Sample			Fourth Sample			Average Damage to Ears Fed Upon by Deer				
		Outside Row	Total	Inside Row	Outside Row	Total	Inside Row	Outside Row	Total	Inside Row	Outside Row	Total						
#1	9-15-76	35	73	21	61	26	54	14	62	17	60	12	56	10	68	6	67	64%
#2	9-15-76	25	67	15	59	29	64	14	71	36	60	19	59	28	59	15	62	67%
#3	9-15-76	27	61	17	53	41	70	23	60	21	55	12	63	15	59	12	67	63%
#4	8-26-76	22	70	12	42	30	40	18	69	29	67	16	66	17	37	8	86	74%
#5	9-13-76	3	47	0	62	2	43	1	57	0	50	0	43	3	49	2	51	68%
#6	8-26-76	Trace			Trace			Trace			Trace			Trace				
#1	9-17-77	30	80	24	79	21	59	7	58	10	59	9	63	5	74	0	71	53%
#2	9-17-77	20	63	8	59	19	73	6	54	22	65	15	55	23	68	9	64	61%
#3	9-14-77	21	58	10	63	29	76	12	65	18	63	5	68	16	55	9	72	58%
#4	9-13-77	18	69	10	52	25	48	9	70	25	62	15	66	15	49	12	75	63%
#5	9-12-77	10	53	3	73	0	57	0	68	1	49	0	53	0	60	0	61	56%
#6	9-12-77	6	50	2	49	5	44	0	53	4	41	1	53	2	49	0	57	54%

Outside and Inside row numbers represent ears damaged by deer.
Totals represent total ears in sample area.

APPENDIX 2.

Corn Damage Caused by Deer Feeding Parallel to Rows

1976 and 1977

Field	Date	Distance damage extended into field and ears damaged						Average damage to ears caused by deer
		Row 10		Row 20		Row 30		
#4	3-26-76	4 meters	10 damaged	3 meters	4 damaged	3 meters	3 damaged	39%
#5	9-13-76	6 meters	15 damaged	4 meters	8 damaged	2 meters	1 damaged	46%
#1	9-17-77	4 meters	10 damaged	5 meters	12 damaged	4 meters	8 damaged	49%
#2	9-17-77	6 meters	14 damaged	0 meters	0 damaged	0 meters	0 damaged	56%
#4	9-13-77	7 meters	18 damaged	4 meters	6 damaged	2 meters	3 damaged	51%
#5	9-12-77	4 meters	4 damaged	2 meters	3 damaged	3 meters	4 damaged	53%

TABLE 1. First Cutting Data from Field #1. Bottom Land Alfalfa Field. 5-24-76.

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
4	5.4 lbs.	4.5 lbs.	63.1	2.0	1.7 lbs.
9	8.2	7.3	63.3	3.0	2.6
1	8.6	10.0	66.3	2.9	3.4
11	10.4	6.1	56.8	4.5	2.6
10	16.3	9.1	65.7	5.6	3.1
Means	9.8 lbs.	7.4 lbs.	63.0%	3.6 lbs.	2.7 lbs.

*Exclosure and subsample wt. corrected for moisture

TABLE 2. Second cutting data from field #1. Bottom land alfalfa. 7-23-76

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
4	6.0 lbs.	3.7 lbs.	54.9	2.7 lbs.	1.7 lbs.
9	5.1	6.0	61.3	2.0	2.3
1	7.7	7.0	52.2	3.7	3.4
11	7.8	6.3	52.4	3.7	3.0
10	5.9	8.6	55.3	2.6	3.9
7	8.2	5.7	45.3	4.5	3.1
Means	6.8 lbs.	5.6 lbs.	56.3%	3.2 lbs.	2.9 lbs.

*Exclosure and subsample wt. corrected for moisture.

TABLE 3. Third cutting from Field #1. Bottom land alfalfa field. 9-14-76

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
4	2.9 lbs.	2.8 lbs.	67.5	1.0 lbs.	.9 lbs.
7	9.1	8.3	67.3	2.9	2.7

*Exclosure and subsample wt. corrected for moisture

TABLE 4. Third cutting data from Field #3. 9-12-76

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
3	10.2 lbs.	8.4 lbs.	77.4	2.3 lbs.	1.9 lbs.
2	7.7	9.8	75.3	1.9	2.4
10	3.8	8.6	70.4	1.1	2.5
9	7.3	8.8	68.7	2.3	2.7
7	8.2	8.1	70.6	2.4	2.4
13	5.5	6.3	68.2	1.5	2.0
Means	7.1 lbs.	7.6 lbs.	71.8%	2.0 lbs.	2.0 lbs.

*Exclosure and subsample wt. corrected for moisture

TABLE 5. First cutting data field #1. Bottom land alfalfa. 5-29-77

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
4	10.7 lbs.	10.3 lbs.	65.6	3.7 lbs.	3.5 lbs.
9	12.7	12.4	66.0	4.3	4.2
1	12.0	12.2	68.3	3.8	3.9
11	12.4	11.4	60.0	4.9	4.6
10	12.8	12.5	62.2	4.9	4.7
7	14.1	13.3	68.0	4.5	4.3
Means	12.4	12.1	65.0	4.4	4.2

TABLE 6. Second cutting data field #1. 7-6-77

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
4	10.2 lbs.	10.6 lbs.	58.3	4.2 lbs.	4.4 lbs.
9	12.5	12.4	60.1	5.0	4.9
1	12.2	11.7	63.3	4.4	4.3
11	11.7	11.3	59.6	4.7	4.6
10	12.7	12.6	60.1	5.0	5.0
7	13.4	13.6	58.9	5.5	5.6
Means	12.1 lbs.	12.0 lbs.	60.1%	4.8 lbs.	4.8 lbs.

*Exclosure and subsample wt. corrected for moisture.

TABLE 7. First cutting data field #2. Dry land field. 5-28-77

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
8	9.8 lbs.	10.3 lbs.	56.3%	4.3 lbs.	4.5 lbs.
5	10.6	10.4	51.0	5.2	5.1
12	9.5	8.9	57.4	4.0	3.8
17	11.6	11.2	53.6	5.4	5.2
3	10.8	10.7	55.2	4.9	4.8
14	10.2	9.9	55.6	4.5	4.4
Means	10.4 lbs.	10.3 lbs.	54.9%	4.7 lbs.	4.6 lbs.

TABLE 8. Second cutting data field #2. Dry land field. 7-8-77

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
8	9.1 lbs.	9.2 lbs.	53.3	4.3 lbs.	4.3 lbs.
5	10.3	9.5	50.8	5.0	4.7
12	8.5	8.3	55.6	3.8	3.7
17	11.3	10.7	53.0	5.3	5.0
3	10.7	10.9	56.0	4.7	4.8
14	9.8	9.5	55.4	4.4	4.2
Means	9.9 lbs.	8.2 lbs.	54.0%	4.6 lbs.	4.4 lbs.

*Exclosure and subsample wt. corrected for moisture.

TABLE 9. First cutting data field #3. Center pivot irrigated. 5-30-77

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
3	10.3 lbs.	9.6 lbs.	63.6	3.8 lbs.	3.5 lbs.
2	8.1	8.2	59.8	3.3	3.3
10	6.9	7.0	62.1	2.6	2.6
9	7.3	7.8	64.0	2.6	2.8
7	8.1	7.7	61.7	3.1	2.9
13	7.1	6.7	60.4	2.8	2.7
Means	8.0 lbs.	7.8 lbs.	6.9%	3.0 lbs.	3.0 lbs.

TABLE 10. Second cutting data field #3. Center pivot irrigated. 7-4-77

Plot No.	Exclosure Wt.	Subsample Wt.	% Moisture	Exclosure Wt.*	Subsample Wt.*
3	9.9 lbs.	9.9 lbs.	61.6	3.8 lbs.	3.8 lbs.
2	7.5	7.7	58.5	3.1	3.2
10	7.2	7.4	62.7	2.7	2.8
9	7.7	7.8	60.8	3.0	3.1
7	7.8	7.6	61.4	3.0	2.9
13	7.2	7.0	59.6	2.9	2.8
Means	7.9 lbs.	7.9 lbs.	60.7%	3.1 lbs.	3.1 lbs.

*Exclosure and subsample wt. corrected for moisture.