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THE MONETARY EFFECTS OF DEER DAMAGE ON THE ENVIRONMENT

By

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The Monetary Effects of Deer Damage on the Environment

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University of Nebraska-Lincoln 2011

Advisor: Dr. Scott Hygnstrom

The focus of my study was deer damage that occurred to crops and trees in Northeast Nebraska, around Wisner in Cuming County. I collected data from corn fields and harvest yields to determine the monetary losses landowners receive to deer damage. The damage can be anywhere from minimal to significant and affects each person differently. I study used test plots to collect data for an average damage per acre, and variable-sized plots to accurately estimate the level of damage occurred. I also incorporated data from tree nurseries to estimate the damage tree farmers and landowners would have when planting new trees. The results were varied in the corn fields, but the closer to the rivers and wooded habitat, the greater amount of damage occurred to the fields. The fields closest to the river and wooded habitat had the most damage with nearly 8% loss and 100% loss in total yield. The fields further away from the river and wooded habitat received far less damage, 0% loss and 3.5% loss in the total yield.

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The Monetary Effects of Deer Damage on the Environment

Abstract

The focus of my study was deer damage that occurred to crops and trees in Northeast Nebraska, around Wisner in Cuming County. I collected data from corn fields and harvest yields to determine the monetary losses landowners receive to deer damage. The damage can be anywhere from minimal to significant and affects each person differently. I study used test plots to collect data for an average damage per acre, and variable-sized plots to accurately estimate the level of damage occurred. I also incorporated data from tree nurseries to estimate the damage tree farmers and landowners would have when planting new trees. The results were varied in the corn fields, but the closer to the rivers and wooded habitat, the greater amount of damage occurred to the fields. The fields closest to the river and wooded habitat had the most damage with nearly 8% loss and 100% loss in total yield. The fields further away from the river and wooded habitat received far less damage, 0% loss and 3.5% loss in the total yield.

Acknowledgements

This research topic was inspired by Dr. Scott Hygnstrom during my enrollment in his wildlife damage management class in the spring of 2011. I would like to thank Dr. Hygnstrom for his guidance throughout my research. I would like to thank Mike Heller and Bill Holland for allowing me the opportunity to use their fields for my study. Great thanks go out to Mike Heller, Dave Fullner, and Bill Johnson for providing me with information regarding yield data and tree damage. I would like to thank Dr. Larkin Powell for being a reader during my theses presentation.

Introduction

The white-tailed deer, *Odocoileus virginianus* can be regarded as many different things: a trophy, a beautiful creature, or just fun to watch, but to farmers or anyone else that has had problems with deer, they are just considered an economic menace (White-tailed Deer - Odocoileus virginianus). I will address the effects that deer can have on an environment, focusing on the impacts in corn fields and on trees. With an estimated 375,000 deer in Nebraska, this can be used to determine how much damage is occurring, where it is occurring, and ways to try minimizing damage (Duggan, J 2011). Most people only think about deer damage when a deer runs out in front of their car, but they can cause problems in other ways (Hygnstrom, et al 2008). If nothing is done about the abundance of deer, they can become major problems that most people would never think about. Controlling deer and deer damage can lessen the economic impact and save people the headache of deer damage. In agricultural areas, deer feast on the abundant supply of corn, soybeans, alfalfa, and other crops. Here farmers know that they are going to have to deal with the loss of crops due to deer, but when the population gets out of control, deer can decimate entire fields causing hundreds of thousands of dollars in losses to farmers (Identification of Deer Damage)(Hygnstrom, et al 2008). The question I wanted to answer is how much damage can deer cause on corn and trees in areas along the Elkhorn River with adequate habitat. My hypothesis is that deer damage will decrease significantly the farther away from the river and wooded habitat the fields are. If deer cause substantial amounts of damage all over the area, this could cause large financial losses for all involved. The limitations of this study are the time that I had to conduct my research as well as permission for fields for my research. It was not practical to estimate how many deer were in the study area because the simplest way to count them is flying over them in a helicopter during winter. The Nebraska

Game and Parks Commission was able to give me an estimate of the deer population (Hygnstrom and VerCauteren 2000)(Nebraska Game and Parks). I will be presenting a great deal of information about yield, which is the amount of grain harvested from the fields. Yield will be represented in bushels, which are the unit of measurement used in harvesting. My area of study was around Wisner, Nebraska, located in the northeastern part of the state. This area has the Elkhorn River running through it which provides adequate cover and water year round for deer. The area around Wisner is mostly agricultural fields, but there are a few pastures. The river bottom has a bunch of trees to provide cover and recent floods have turned former fields into CRP with volunteer trees coming up. I used four different cornfields during my study, two were irrigated and two were not, this way if there was a drier than normal year there would at least be two fields that weren't affected by the lack of moisture. Field A was one mile south and four miles west of Wisner, roughly 1/4 mile off the river. Field B was two miles south and four miles west of Wisner, roughly 3 miles off the river. Field C was 1 mile south and 2 miles east of Wisner, directly next to the Elkhorn River. Field D was seven miles south and one mile east of Wisner, roughly 7 1/2 miles off the river. Fields A and C were irrigated while fields B and D were dry land, this was done to incorporate wet and dry years. Now that I have explained what my study covered, I will present some other research related to this project. Figures 2 and 3

Literature Review

The white-tailed deer population in our state has been growing rapidly and there have been increased damage due to this (Christensen M. Senator 2010). With an estimated population of 375,000 deer, the Nebraska Game and Parks Commission (NGPC) added bonus antlerless permits to all permits. More recently, they have implemented the Earn-a-Buck program in select units where hunters have to check in an antlerless deer before or at the same time as a buck (Nebraska Game and Parks). One of the units where this program is in effect is the Elkhorn Unit, the heart of where my study took place. (Fig. 1) With so many deer in the state, damage caused by these animals is inevitable. Dr. Scott Hygnstrom, wildlife damage specialist at the University of Nebraska Lincoln, has done extensive work with deer damage for over 20 years. His research on white-tailed deer is unprecedented and he is regarded as one of the best in his field. One of his many research projects deals with the home range characteristics and relative damage to cornfields. Here he has studied the habitat deer live in and the fields, specifically corn, they affect.

"to examine the relationships between the physiological growth stages of field corn; timing and impacts of deer damage on corn yields; and female deer home range characteristics relative to corn growth, harvest, and hunting season" (Hygnstrom, VerCauteren, 1993).

Dr. Hygnstrom has also done work in Fontenelle Forest where he studied the over-abundance of deer and the effects they had on their environment and the surrounding homes in the urban environment. I come from an agricultural community where farmers lose crops to deer so I found how Dr. Hygnstrom had gone about some of this research and tried to take parts of his research and incorporate them into mine, focusing on the property people are losing.

"randomly located *22* treatment plots and 6 control plots (1 m x 50 m) across corn rows and along the northern edge of the cornfield, which was immediately adjacent to a 50-ha woodlot."

"Cornfields and subsequent yields were found to be impacted most by deer damage during the tasseling-silking stage. At this stage deer use is highest, more plants are required to satiate deer, and the plants are physiologically more susceptible to physical damage. Landowners may be able to reduce deer damage to tolerable levels by delaying implementation of control, measures until shortly before the tasseling-milking stage and employing such short-term and cost-effective techniques as frightening devices, repellents, or single-strand electric fences" (Hygnstrom, VerCauteren, 1993).

This type of research is very valuable in the area where my research was conducted. Dr.

Hygnstrom's work was of great value to my research.

Methods and Materials

I used several methods to measure and record damage. One method was to gather yield data from farmers on fields that are directly adjacent to the river and on fields that are several miles off the river. This is similar to work that Dr. Hygnstrom conducted in regards to home-range for deer (Hygnstrom, VerCauteren 1993). I acquired yields from the past years on corn and from different farmers, if available. Another method I used for crop damage was to take a section of the field, rope off, and weekly record the damage caused by the deer (Identification of Deer Damage). To do this, I randomly picked a row of corn to start at and measured out 17.5 feet down a row of corn and counted how many plants were in the 17.5 feet. I did this on 10 rows of corn and then found the average for number of plants in the 10 rows. The 17.5 feet is 1/1000 of an acre in a corn field with 30 inch per row spacing, so once I had the average, I multiplied it by a thousand to determine the plant population per acre on average. Once I found out the average damaged plants in an acre, I multiplied that by 0.5lbs. per ear per plant to find the bushels lost to deer. I then converted it to bushels by dividing by 56 lbs., which is roughly how much a bushel of corn weighs. I went out to these plots and counted the damaged plants each week, recounting the damaged plants from the previous week. I added them up, and then multiplied it by one thousand to get the number of damaged plants in an acre. I used this method to get information on deer damage in 4 separate cornfields. Once the data were collected, I analyzed them to find out how many bushels of corn were lost to deer; I then took the price of corn from the Wisner Farmers Elevator and multiplied it against the lost corn to get the value of that lost corn. This part of the study ran from June 5th to August 14th when I pulled my equipment, steel poles and rope, from the field.

Since the deer damage was random, I used the variable-sized plot method to rank the damage risk for certain parts of the field. To do this, I started from a point in the field and counted ears until I got to five damaged ears. I measured out 100 meters and counted all the crops until I got to five damaged crops. Once I got to five damaged ears, I recorded five over the total amount of ears I counted and got a percent from it. I recorded data at 10 and 20 rows in from the edge of the field closest to where deer would be found to get an estimate on the percent damage in the field. If I did not reach five damaged ears before the 100 meters were up, I took the damaged over the total in 100 meters and crossed multiplied to find out how many plants it would take to have five damaged ears. I calculated the average percent of ears damaged per row for each field. I divided the fields into sections, classified the percent damage as minimal (less than 10%), moderate (between 10%-20%), and high (greater than 20%), so that I could accurately estimate damage. I used this method in areas that were closest to cover and worked my way away from it until there was no damage. All data on damage were collected after August 14th, 2011.

I also consulted with a local tree farm to see if they had data on deer damage (Genger, L. E 2011). I found out if they were able to sell trees that had been damaged by deer and the prices on different sized trees. The last aspect of my research was reading case studies from deer damage on crops and trees.

Results

For plot A, the field was 50.85 acres and produced a yield of 195.51 bushels per acre. The yield for the field two years previous when it was last in corn was 168.20 bushels per acre (Fullner, 2011). I estimated 28,400 corn plants in each acre in which 2,800, or 9.859% were damaged, so 2,800 damaged plants comes out to a loss of 25 bushels per acre, or 7.820% loss per acre. As of October 31st the sale price of corn at Wisner Farmers Elevator was $6.35, which calculates to a loss of $4,936.74 for the field. (Table 1)

In plot B, the field was 143.66 acres and produced 149.87 bushels per acre. The previous yield for this field was 138.53 bushels per acre (Fullner, 2011). The plant population estimate for the field was 25,300 plants per acre. There were no recorded damaged plants in the field so there were no losses on the field and the $136,717.56 was profit, minus the costs of planting and running equipment. (Table 2)

For plot C, the field was 61 acres and produced 189 bushels per acre. The harvest data for 2009 in this field was 225 bushels per acre (Heller, 2011). The population estimate for the field was 22,300 and of those 22,300 plants, every plant in the plot was damaged to the point where no ears were produced, resulting in a 100% loss. The loss of 22,300 plants comes out to 199.107 bushels per acre; this would come out to a loss of $77,124.10 on the field, however this plot is not representative of the entire field. (Table 3)

In plot D, the field was 64 acres and produced 178 bushels per acre. The previous corn harvest for this field was 185 bushels per acre (Heller, 2011). The plant population estimate for the field was 23,300 plants per acre. Of those plants, there were only 700 recorded as damaged or

3.004%. This loss of plants comes out to 6.25 bushels per acre or 3.511%. This calculates out to a $2,173.07 loss of the $72,339.20 profit for the field. (Table 4) (Graph 1)

The results for the variable-sized plots are as follows. In variable plot A, the damage closest to the river was 11.78%, or moderate. Moving farther into the field, the damage was 0.72%, or minimal. For variable plot B, the data nearest the grove of trees was 0.13%, or minimal. Since this was the case, it was assumed that the rest of the field was similar and no further measurements were taken. In variable plot C, recordings next to the road yielded 45.96%, or high damage. Data from the end of the field next to the trees was recorded as 77.78%, or high damage, and for the edge of the field next to the river, it resulted in 12.57%, or moderate damage. For the inner part of the field, I recorded 0% damage. For variable plot D, the edge closest to the trees yielded only 1.99%, or minimal, and the inner part of the field had 0% damage.

Deer damage on trees can be very selective, based on variety. Preferred species include: aspen, maple, locust, flowering pear, red oak, linden, white pine, and fir. At Oak Prairie Nurseries, about 300 trees received deer damage this year. Of that, roughly half had enough damage that they could not be sold. The trees listed above are valued from $125 to $175 when they are 3 inches in diameter (Johnson, 2011). At this rate, Oak Prairie Nursery lost $18,750 to $26,250 to deer damage this year.

Discussion

All of the fields in my study had fairly good yields for the two years of corn data collected. Many factors play a role in the yields of a field, such as: soil quality, nutrients, moisture, variety, and fertilizer many of which cannot be controlled, but some can. During my research, I assumed that the fields closest to the river would have the most damage because there is adequate cover, water, and food source. This was exactly the case. Field C was the closest field to the river in my research and it clearly had the most damage. The other field that I chose for my "river" field was field A, which was about 1/4 mile off the river. This field was the next leader in deer damage, but there was significantly less than field C. There were two fields of corn that were closer to the river that I could not gain access to for my research. I feel that the damage in those fields would be similar to field C. For the other two fields that I used, B and D, there was little to no damage. Field B was 3 miles off the river and field D was about 7 miles off the river. These results also support my hypothesis of there being more deer damage to corn fields closer to the river. I believe this is due to the distance from the river and the surrounding fields. Distance from the river plays a factor in the amount of damage each field received. The reason there are so many deer around the river is not because of the river itself, but because of the wooded area that is associated with it. This creates habitat for the deer and having water and a food source close makes it an ideal place for deer. Thus, as a person gets farther off the river and this wooded habitat, they will likely see fewer and fewer deer, resulting in less damage to fields.

Field D received more damage than field B, and I believe that is due to a stream and trees running along one side of the field.

During my research, I realized that the deer damage could not be predicted. There were spots where a person would not think deer would cause damage, but ended up causing significant damage. Also, there will be more damage to the field of the edges because of the easy access. This led me to talk with Dr. Hygnstrom, and he suggested I use the variable-sized plot method. In doing so, I was able to rank the areas of the fields with different levels of damage. Using this method and the plot data analysis, one could rank sections of the field with varying levels of damage. This could help farmers save money by knowing where the most severe damage occurs and allowing them to plant crops that are less palatable to deer in hopes that deer choose to find a different field in which to feed.

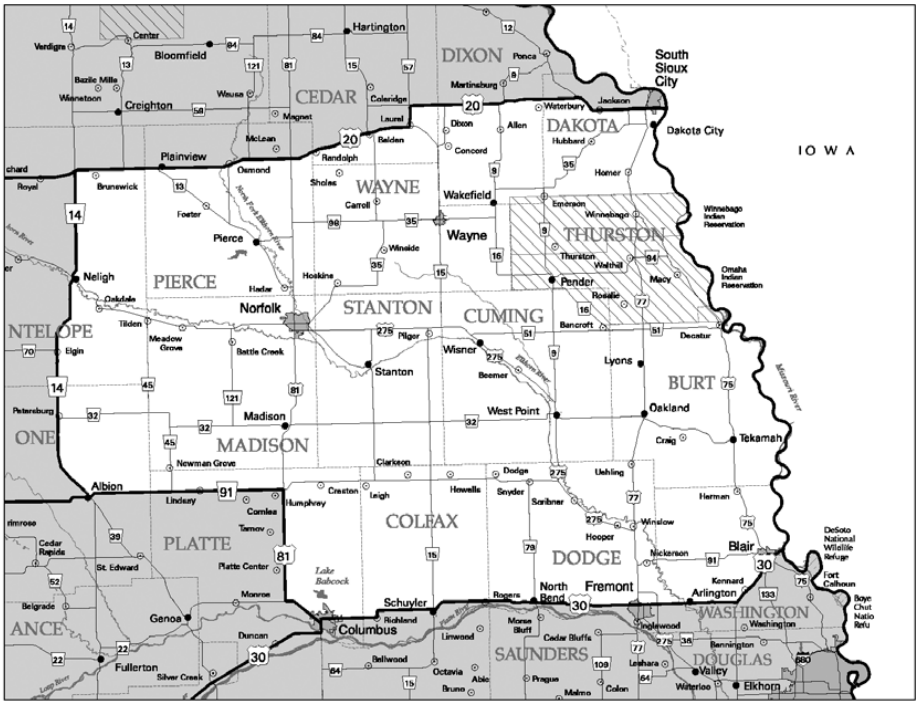
Deer do the most damage to crops during the spring and summer when they are growing soft palatable tissue, but this continues until the crops are harvested. The data collected also points to specific stages of the corn where deer seemed to cause more damage than others. The most damage occurred during the silking stage, except for field C. The largest jumps in the amount of plants damaged occurred during this time, there was still damage during other stages. Field C was the exception since the biggest jump in damage occurred between June 19th and 26th. There was still damage during the silking process, but by that time most of the plot had been damaged and few plants were left. My research was dictated by when the crops came up. I wasn't able to monitor the harvest of the crops because I was not in the area and needed to get my equipment out of the field, but I did get the yield data from each field.

In the case of Oak Prairie Nursery, no rivers are in the area but there are a couple lakes and a stream within 2 to 3 miles, which coupled with the trees associated with these water systems, makes Oak Prairie Nursery a good candidate for damage. (Figure 4) Bill Johnson said that the damage at this facility did not come from the deer eating the trees, but from the bucks rubbing on

the trees to shed their velvet and mark territories during the mating season. For this aspect of my research, I was more focused on the personal losses that would occur if an individual would purchase the trees to plant on his or her property where deer regularly visit. In both cases, there are the possibilities for significant property damage.

A variety of methods, lethal and nonlethal, can be implemented to reduce the amount of damage sustained. One way to prevent deer from rubbing on trees would be to use cylinders that are placed around the stems of the trees. This will protect the trees from any animals damaging the stem. Another method that could be used for trees or gardens would be high-tensile electric fencing. Electric fences will keep most of the deer in the area out of whatever it surrounds. A number of repellents can be sprayed on plants that keep deer away as well as frightening devices that flash and make noise to scare deer. The most effective means of controlling deer populations, however, is hunting. Hunting is useful for farmers in rural settings, but it is not practical for many urban areas (Hygnstrom, Wildlife Damage lecture 2011). Using some of these methods, combined with the data collected during my research, a person can take measures to reduce the probability of deer damage to one's property.

Figure 1



(2010 Elkhorn Management Unit and Cuming County)

Figure 2



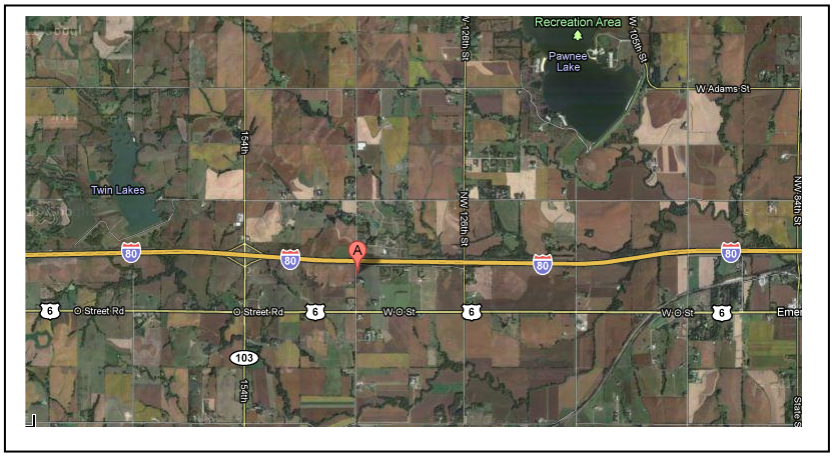
Fields A and B

Figure 3



Fields C and D

Figure 4



Oak Prairie Nursery

Table 1

Plot A

Ears Damaged	Total Ears	Percent Damaged	Week
0	284	0	1
6	284	0.021126761	2
6	284	0.021126761	3
6	284	0.021126761	4
8	284	0.028169014	5
17	284	0.059859155	6
17	284	0.059859155	7
19	284	0.066901408	8
21	284	0.073943662	9
25	284	0.088028169	10
28	284	0.098591549	11
		Total 9.859%	

Plot A	Ears Damaged	
5-Jun	0	
12-Jun	6	
19-Jun	8	
26-Jun	8	
3-Jul	8	
10-Jul	17	starting to tassel
17-Jul	17	tasseling
24-Jul	19	tasseling
31-Jul	21	
7-Aug	24	
14-Aug	28	

Table 2

Plot B

Ears Damaged	Total Ears	Percent Damage	Week
0	253	0	1
0	253	0	2
0	253	0	3
0	253	0	4
0	253	0	5
0	253	0	6
0	253	0	7
0	253	0	8
0	253	0	9
0	253	0	10
0	253	0	11
		Total 0%	

Plot B	Ears Damaged	
5-Jun	0	
12-Jun	0	
19-Jun	0	
26-Jun	0	
3-Jul	0	
10-Jul	0	starting to tassel
17-Jul	0	tasseling
24-Jul	0	tasseling
31-Jul	0	
7-Aug	0	
14-Aug	0	

Table 3

Plot C

Ears Damaged	Total Ears	Percent Damage	Week
0	223	0	1
0	223	0	2
37	223	0.165919283	3
114	223	0.511210762	4
140	223	0.627802691	5
184	223	0.825112108	6
190	223	0.852017937	7
196	223	0.878923767	8
208	223	0.932735426	9
215	223	0.964125561	10
223	223	1	11
		Total 100%	

Plot C	Ears Damaged	
5-Jun	0	
12-Jun	4	
19-Jun	37	
26-Jun	114	
3-Jul	140	starting to tassel
10-Jul	184	tasseling
17-Jul	190	tasseling
24-Jul	196	
31-Jul	208	
7-Aug	215	
14-Aug	223	

Table 4

Plot D

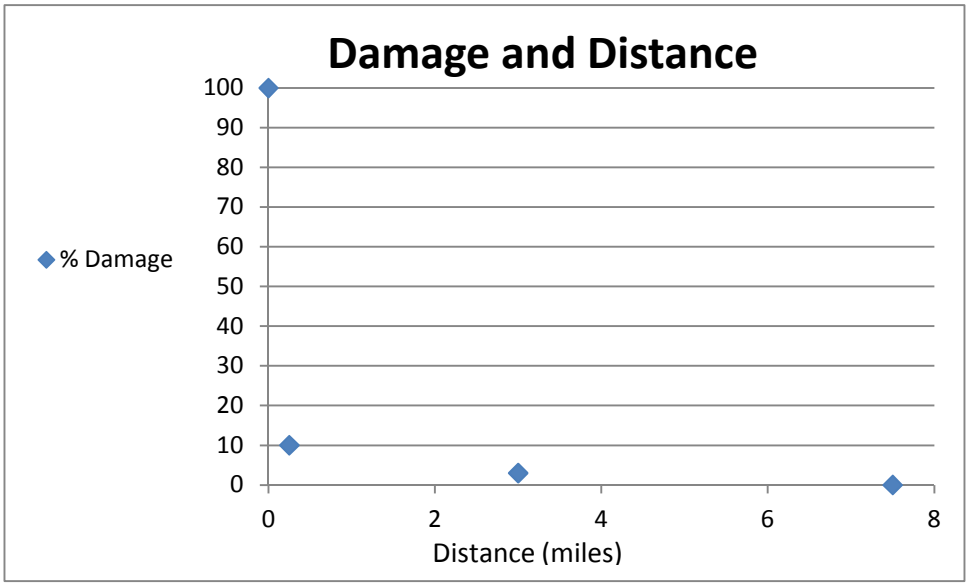
Ears Damaged	Total Ears	Percent Damage	Week
0	233	0	1
4	233	0.017167382	2
4	233	0.017167382	3
4	233	0.017167382	4
4	233	0.017167382	5
6	233	0.025751073	6
6	233	0.025751073	7
6	233	0.025751073	8
7	233	0.030042918	9
7	233	0.030042918	10
7	233	0.030042918	11
		Total 3.004%	

Plot D	Ears Damaged	
5-Jun	0	
12-Jun	4	
19-Jun	4	
26-Jun	4	
3-Jul	4	starting to tassel
10-Jul	6	tasseling
17-Jul	6	tasseling
24-Jul	6	
31-Jul	7	
7-Aug	7	
14-Aug	7	

Table 5

Plot	Plant Population	% Damage
A	28,400	
B	25,300	
C	22,300	
D	23,300	

Graph 1


Damage and Distance
100
90
80
70
60
50
40
30
20
10
0
% Damage
0
2
4
6
8
Distance (miles)

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