CAMERA DRONES IN AGRICULTURE
USING THE REQUIRED ENGINEERING PRINCIPLES
AGRICULTURE DRONE OVERVIEW

- At an average of $2 per acre for a walking visual inspection or an aerial survey to take an image of crop fields, the return on investment on the purchase of an aerial camera drone can be met quickly for farmers in Redwood Minnesota.

- Drones can reduce farmers operating costs and improve their crop yields by giving farmers timely information they need for quick management intervention.
I. ASKING QUESTIONS AND DEFINING PROBLEMS.

- How could an aerial drone with a camera be used to enhance or improve corn crop production in Redwood County, MN?
- What are common corn pest that affect corn production in Redwood County, MN?
- In Southeast Minnesota, farmers reported more than $2.5 million in value was lost to the 187,134 acres of corn grown in 2011 by whitetail deer.
- Whitetail deer are a common pest to corn production in Minnesota and have a negative effect on farming.
- How can drones be utilized to minimize the damage caused by whitetail deer?
I. PLANNING AND CARRYING OUT INVESTIGATIONS.

- 3 one square acre test plots of field corn were identified and monitored via agriculture drones to establish a survey of whitetail deer activity for the month of October, 2014.
- The plots were all in different areas of the same farm.
- Data was collected and analyzed and presented in the form of charts and graphs.
Deer were observed every evening using an agriculture camera drone during October 1\textsuperscript{st} – 31\textsuperscript{st}, 2014.

Data collection always occurred from 7:30pm-8pm within the boundaries of the 3, 1 square acre corn plots in Redwood, MN.

### III. ANALYZING AND INTERPRETING DATA.

<table>
<thead>
<tr>
<th>Field</th>
<th>Avg. Deer Count per day</th>
<th>Total Deer Count for Oct.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9</td>
<td>279</td>
</tr>
<tr>
<td>B</td>
<td>4.5</td>
<td>141</td>
</tr>
<tr>
<td>C</td>
<td>.61</td>
<td>19</td>
</tr>
</tbody>
</table>

![Deer Observed Graph](image)
Using Mathematics and Computational Thinking.

- In corn production, 1 square acre of corn will have approximately 30,000 corn plants. Damage to all 30,000 plants would equal approximately $500 in damages. ($0.016 per plant)
- One whitetail deer can damage approximately 8-12 plants per feeding/day.

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USING MATHEMATICS AND COMPUTATIONAL THINKING.

- Using the averages and data collected, the chart below represents the potential financial damages caused by whitetail deer in the 3 fields in a one month time span.

<table>
<thead>
<tr>
<th></th>
<th>Total number of Deer</th>
<th>Total stalks destroyed</th>
<th>$ Loss of stalks damaged</th>
<th>% of $ loss for each field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field A</td>
<td>279</td>
<td>2,790</td>
<td>$-44.64</td>
<td>8.9%</td>
</tr>
<tr>
<td>Field B</td>
<td>141</td>
<td>1410</td>
<td>$-22.56</td>
<td>4.5%</td>
</tr>
<tr>
<td>Field C</td>
<td>19</td>
<td>190</td>
<td>$-3.04</td>
<td>0.6%</td>
</tr>
<tr>
<td>Total Financial Loss to Farmer:</td>
<td></td>
<td></td>
<td>$-70.24</td>
<td></td>
</tr>
</tbody>
</table>
CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS.

Questions

1. What caused whitetail deer to be more prevalent in fields A & B when compared to field C?
2. What steps can be taken in the future to reduce whitetail deer damage to the corn fields?
3. What role did the drone play in identifying and correcting the deer damage problem?
4. What was the cost of the drone?
5. Was the cost of the drone worth it to solve the problem?

Solutions

1) Biological factors, habitat and food availability.
2) Providing food plots in key locations away from corn fields to encourage deer to move to more desirable areas of the farm.
3) The drones scouted the area and provided a real time count of the deer and identified their movement patterns and desired feeding zones.
4) The Axis Gyro RC Quadcopter with Camera retails for $70.00.
5) On a larger operation with a large land area the drones could potentially save time and money.
ENGAGING IN ARGUMENT FROM EVIDENCE.

✓ Food plots are valuable for attracting deer, turkeys, rabbits, and other wildlife to specific areas for hunting or viewing, but they do not substitute for management activities that improve habitat over large areas. Food plots will attract deer most where the surrounding habitat is poor.

  -Virginia Dept. of Game and Inland Fisheries

✓ Land managers could use camera drones to monitor food plots, analyze mast yields, or simply get a better overall sense of their property’s natural deer forage.

  -Field & Stream Magazine

✓ “Some guys want to track their deer population using drones,” Sheller said. “I don’t know anyone who’s done it, but it's definitely being talked about. It’s not necessarily for hunting, but so they can prove their numbers to DNR to better manage against deer damage.

  -Adam Sheller, Precision Drone Sales Director
SOURCES


