How Much is the Aerial Application Industry in the United States Worth?

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Motivation

- U.S. aerial application industry
  - Over 100 years
  - Safe, affordable, abundant supply of food, fiber, biofuel
  - Protecting forestry, controlling pests
- U.S. aerial application
  - Contributor for high yielding and highly efficient agriculture
  - Highly efficient compared to ground rigs
  - Treat about 71 million acres (~25% of commercially treated cropland)

Question?

How much is the United States aerial application industry worth in terms of total economic value?

Approaches to Estimating Economic Value

- Revenue side and cost side
- Revenue foregone by U.S. farmers of not having aerial applications
- Loss of revenue and acreage of crop land
- Cost side: cost incurred by the aerial application industry to maintain the business
- In the absence of cost information, we used the loss in revenue due to reduced crop land

Assumptions

- Acreage planted = acreage harvested
- Aerial application acreage ~25% of total
- Expected price of crops with no aerial application is 10% higher than average price received
- Crops grown limited to corn for grain, wheat, cotton, soybeans, rice
- Ground application does not replace the loss due to aerial application
- Prices are distributed truncated normal
Data

- USDA-National Agricultural Statistical Service Crop Production 2018 Summary (published in February, 2019)
- Price from various government and industry sources
- Acreage and yield data
  - Corn for grain (bu./ac), ($/bu.)
  - Wheat (bu./ac), ($/bu.)
  - Cotton (lbs./ac), ($/lb.)
  - Soybeans (bu./ac), ($/bu.)
  - Rice (lbs./ac), ($/lb.)

Model for Texas

<table>
<thead>
<tr>
<th></th>
<th>Corn for grain</th>
<th>Wheat</th>
<th>Cotton</th>
<th>Soybeans</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acreage planned</td>
<td>2,200,000</td>
<td>4,500,000</td>
<td>7,748,000</td>
<td>175,000</td>
<td>195,000</td>
</tr>
<tr>
<td>Aerial application</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acreage</td>
<td>550,000</td>
<td>1,125,000</td>
<td>1,942,000</td>
<td>43,750</td>
<td>48,750</td>
</tr>
<tr>
<td>Yield</td>
<td>108</td>
<td>32</td>
<td>721</td>
<td>32</td>
<td>7,970</td>
</tr>
<tr>
<td>Price</td>
<td>$3.35</td>
<td>$5.14</td>
<td>$0.70</td>
<td>$9.35</td>
<td>$0.71</td>
</tr>
<tr>
<td>Revenue</td>
<td>$795,960,000</td>
<td>$740,160,000</td>
<td>$3,916,029,018</td>
<td>$52,360,000</td>
<td>$1,103,446,500</td>
</tr>
<tr>
<td>Acreage with no aerial application</td>
<td>1,650,000</td>
<td>3,375,000</td>
<td>5,826,000</td>
<td>131,250</td>
<td>146,250</td>
</tr>
<tr>
<td>Expected price with no aerial application</td>
<td>$3.69</td>
<td>$5.65</td>
<td>$0.77</td>
<td>$10.29</td>
<td>$0.78</td>
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<tr>
<td>Revenue with no aerial application</td>
<td>$656,667,000</td>
<td>$610,632,000</td>
<td>$3,230,723,940</td>
<td>$43,197,000</td>
<td>$910,343,363</td>
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<tr>
<td>Revenue loss</td>
<td>$139,293,000</td>
<td>$129,528,000</td>
<td>$685,305,078</td>
<td>$9,163,000</td>
<td>$193,103,138</td>
</tr>
</tbody>
</table>

Total Revenue Loss is $1,156,392,216 (about $1.2 Billion)

Model for United States

<table>
<thead>
<tr>
<th></th>
<th>Corn for grain</th>
<th>Wheat</th>
<th>Cotton</th>
<th>Soybeans</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acreage planned</td>
<td>89,129,000</td>
<td>47,800,000</td>
<td>14,099,000</td>
<td>89,196,000</td>
<td>2,946,000</td>
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<tr>
<td>Aerial application</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acreage</td>
<td>22,282,250</td>
<td>11,950,000</td>
<td>3,524,750</td>
<td>22,299,000</td>
<td>736,500</td>
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<tr>
<td>Yield</td>
<td>176</td>
<td>48</td>
<td>838</td>
<td>52</td>
<td>7,692</td>
</tr>
<tr>
<td>Price</td>
<td>$3.35</td>
<td>$5.14</td>
<td>$0.70</td>
<td>$9.35</td>
<td>$0.71</td>
</tr>
<tr>
<td>Revenue</td>
<td>$52,550,458,400</td>
<td>$11,793,216,000</td>
<td>$8,361,021,430</td>
<td>$43,347,095,200</td>
<td>$16,089,048,720</td>
</tr>
<tr>
<td>Acreage with no aerial application</td>
<td>66,846,750</td>
<td>35,850,000</td>
<td>10,574,250</td>
<td>66,897,000</td>
<td>2,209,000</td>
</tr>
<tr>
<td>Expected price with no aerial application</td>
<td>$3.69</td>
<td>$5.65</td>
<td>$0.77</td>
<td>$10.29</td>
<td>$0.78</td>
</tr>
<tr>
<td>Revenue with no aerial application</td>
<td>$43,314,128,180</td>
<td>$9,729,043,200</td>
<td>$6,813,342,680</td>
<td>$35,773,813,540</td>
<td>$13,273,461,194</td>
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<tr>
<td>Revenue loss</td>
<td>$9,196,330,220</td>
<td>$2,063,812,800</td>
<td>$1,445,678,750</td>
<td>$7,589,241,660</td>
<td>$2,815,583,526</td>
</tr>
</tbody>
</table>

Total Revenue Loss is $23,110,646,956 (about $23 Billion)
About 80% of time US crop industry will incur a loss of $23B or more.

What next?
- Relax assumptions
  - Ground applications substitution
  - Expand the crops and forest operations
  - Planted vs harvested acreage adjustment
  - Categorize by application type
  - Price increase percentage and price distribution

Questions, Comments…

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Preliminary analysis only. Do not cite or use the numbers for your work as they may change based on the assumptions.