Alfalfa is a critical cash crop in the western states and is susceptible to a pest known as the alfalfa stem nematode (ASN), (Ditylenchus dipsaci). Managing the ASN is vital so farmers can avoid economic losses due to decreased yield caused by the ASN.

One method to lessen economic losses incurred by ASN infestation is to use resistant varieties of alfalfa. Knowing how different resistant ratings affect harvest yield will be beneficial to alfalfa growers.

Resistance Class

- Resistance
- Susceptible
- Low Resistance
- Highly Resistant

<table>
<thead>
<tr>
<th>Resistance Class</th>
<th>Percentage of resistant seed used in field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly Resistant</td>
<td>15-30%</td>
</tr>
<tr>
<td>Moderate Resistance</td>
<td>31-50%</td>
</tr>
<tr>
<td>Low Resistance</td>
<td>6-14%</td>
</tr>
<tr>
<td>Susceptible</td>
<td>0%</td>
</tr>
</tbody>
</table>

**The Model (Difference Equations)**

- $S_t$: Density of non-resistant nematode-free plants
- $I_t$: Density of non-resistant nematode-infested plants
- $S_r$: Density of resistant nematode-free plants
- $I_r$: Density of resistant nematode-infested plants
- $W_t$: Average density of nematodes in one plant’s rhizosphere

$S_t = S_{t-1} - e^{-SW_{t-1}}$  

$\hat{S}_t = S_{t-1}e^{-SW_{t-1}}$  

$\hat{I}_t = I_{t-1} + (1 - e^{-SW_{t-1}}) S_{t-1}$  

$\hat{W}_t = (1 - \mu W)W_{t-1} + C(1 + e^{-3/3})$  

- $\mu$: nematode survival
- $W$: nematode immigration

**Parameter Fitting**

Data obtained in Weber County, UT

**Resistant Varieties and Harvest Yield**

Alfalfa growers can benefit from knowing how each resistance class can affect the harvest yield of their field. Figure 1 shows model computations for growing alfalfa for 3, 4, 5, and 6 continuous years. It demonstrates how each resistant class will affect the yield based on how many years alfalfa is grown, which is, moving to a higher resistance class results in an increased harvest yield.

For each resistance class the relationship between time grown and total harvest yield is linear, suggesting that the total yield does not change from year to year. Thus, the average harvest yield per year for each resistance class is the same regardless of the length of time alfalfa is grown.

**Conclusion**

<table>
<thead>
<tr>
<th>Year</th>
<th>Susceptible</th>
<th>Low</th>
<th>Moderate</th>
<th>Resistant</th>
<th>Highly</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0%</td>
<td>10%</td>
<td>3%</td>
<td>51%</td>
<td>83%</td>
</tr>
<tr>
<td>4</td>
<td>-4%</td>
<td>3%</td>
<td>13%</td>
<td>29%</td>
<td>62%</td>
</tr>
<tr>
<td>5</td>
<td>-21%</td>
<td>13%</td>
<td>1%</td>
<td>19%</td>
<td>45%</td>
</tr>
<tr>
<td>6</td>
<td>-33%</td>
<td>-2%</td>
<td>-16%</td>
<td>0%</td>
<td>22%</td>
</tr>
</tbody>
</table>

Table 1: Percentage change in yield (tons/acre) between different resistant classes of alfalfa. Table shows changes by going from the resistant class in left column to the resistance class along top row.

Crop management strategies can be improved by observing the impact of different resistant classes on harvest yield. Table 1 shows the average percentage change in yield (tons/acre) per year when changing from one resistant class to another. Changing from the susceptible class to the resistant class can approximately double the harvest yield during the growing season.

The model can be adapted to include other important characteristics that have an impact on ASN management. Such as including spatial spread to predict how the nematode infestation will propagate throughout a field.

**References**


