Severity of strawberry powdery mildew in open field vs under plastics that either block or transmit UV light.

Introduction

- Strawberry powdery mildew, *Podosphaera aphanis*, is particularly destructive in glasshouse and plastic tunnel production systems, which are constructed of materials that reduce UV rays.
- *P. aphanis* can infect all aerial parts of strawberry. Characteristic signs are white patches of mycelia (Fig 1. B - D) with conidiophores and conidia on the surface of the organ (Fig 1. A). In late infections, leaf curling (Fig 1. E) and purple discoloration on leaves occur.
- Ultraviolet (UV) radiation may be used as a non-chemical method for management of foliar and fruit powdery mildew on a broad range of pathogens and crops, including in strawberry (Janisiewicz et al 2016; Suthaparan et al 2012, 2016a, 2016b).
- However, current disease management relies heavily on fungicide application since resistant strawberry cultivars are limited and fungicide sensitivity has decreased (Kanto, 2004).
- Our objective was to compare disease progress of strawberry powdery mildew progress in the open field and under tunnels constructed with different UV transmissibility properties.

![Figure 1. Podosphaera aphanis conidiophores and conidia in chains (A), strawberry powdery mildew signs on flower (B), fruit (C) and upper leaves (D). Leaf curling symptom (E).](image)

Material and Methods

- Strawberry transplants of the cultivar Florida 127 'Sensation' were planted in late September 2016 into plastic-mulch raised beds.
- Disease progress was compared between open field and low tunnel production systems.
- Three different plastic materials were used to construct the low tunnels: i) polyethylene, which blocks nearly all solar UV (standard), ii) ethylene tetrafluoroethylene (ETFE) with an UV blocker (F-Clean GRUV), and iii) ETFE that transmits UV-B radiation (to 320 nm; F-Clean CLEAR).
- All low tunnels were placed in the field after plants were established by overhead irrigation 10 days after planting (Fig 2).

![Figure 2. Experiment set up.](image)

Results

<table>
<thead>
<tr>
<th>Treatments</th>
<th>10-Nov</th>
<th>16-Nov</th>
<th>26-Nov</th>
<th>30-Nov</th>
<th>6-Dec</th>
<th>12-Dec</th>
<th>20-Dec</th>
<th>26-Dec</th>
<th>AUDPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.3 a</td>
<td>2.2 a</td>
<td>25.0 a</td>
<td>35.1 a</td>
<td>57.7 a</td>
<td>75.8 a</td>
<td>87.3 a</td>
<td>97.3 a</td>
<td>2150.4 a</td>
</tr>
<tr>
<td>F-CLEAN GRUV</td>
<td>0.0 a</td>
<td>1.0 ab</td>
<td>11.9 ab</td>
<td>23.8 b</td>
<td>41.4 b</td>
<td>58.2 ab</td>
<td>75.2 ab</td>
<td>92.7 ab</td>
<td>1680.9 b</td>
</tr>
<tr>
<td>F-CLEAN Clear</td>
<td>0.0 a</td>
<td>0.4 b</td>
<td>5.6 b</td>
<td>14.6 b</td>
<td>37.4 b</td>
<td>48.6 b</td>
<td>67.1 b</td>
<td>81.8 bc</td>
<td>1390.0 c</td>
</tr>
<tr>
<td>Control-Open Field</td>
<td>0.1 a</td>
<td>0.6 b</td>
<td>4.8 b</td>
<td>18.8 b</td>
<td>35.6 b</td>
<td>24.7 c</td>
<td>55.9 c</td>
<td>84.8 c</td>
<td>1173.2 c</td>
</tr>
</tbody>
</table>

P-value: 0.5819 0.0553 0.1047 0.0113 0.0097 0.0009 0.0118 0.0035 0.0002

Table 1. Treatment effect on the strawberry powdery mildew foliar disease and Area Under Disease Progress Curve (AUDPC).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Yield (lb/A)</th>
<th>Fruit Disease Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>2777.8 b</td>
<td>57.6 a</td>
</tr>
<tr>
<td>F-CLEAN GRUV</td>
<td>4702.8 a</td>
<td>34.9 b</td>
</tr>
<tr>
<td>F-CLEAN Clear</td>
<td>4412.3 a</td>
<td>23.2 bc</td>
</tr>
<tr>
<td>Control-Open Field</td>
<td>5131.3 a</td>
<td>13.0 c</td>
</tr>
</tbody>
</table>

P-value: 0.0052 <.0001

Table 2. Fruit yield and strawberry powdery mildew fruit disease incidence.

Conclusions

- The foliar severity of powdery mildew within tunnels was directly proportional to their UV transmissibility (Table 1).
- Within tunnels, fruit infection was higher under polyethylene and lower under UV-transmitting ETFE (Table 2).
- There was no difference in fruit infection between the open field and F-Clean Clear plastic which transmits most UV radiation.
- These effects likely transcend crop, and the blocking of UV transmission by glass and certain plastics may markedly contribute to the environmental favorability of greenhouse and high-tunnel growing systems for powdery mildew.

References