# Using Ultraviolet Light to Control Various Diseases in Vine Crops: Update from 2020 & 2021 Trials

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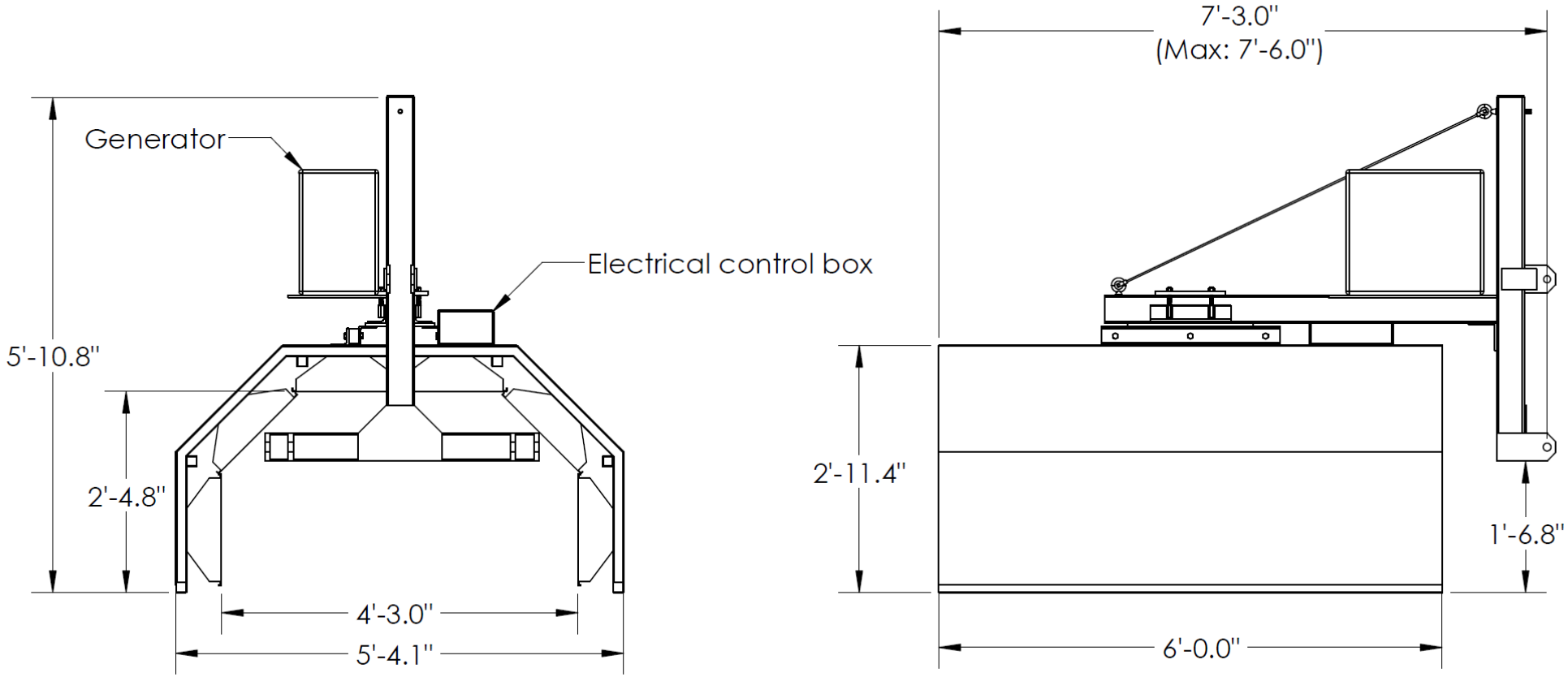
# Introduction

- UV treatment has shown promise in various crops
  - Strawberries (PM)
  - Grapes (PM)
  - Squash (PM)
  - Zinnias (PM)
  - Beets (CLS) – Ongoing Trials
  - Cucumbers (PM) – Lab
  - Basil (DM) – Lab
- Night-time UV treatments
  - Treatments followed by a period of darkness seem to be most effective
  - UV damages DNA
  - DNA repair mechanism triggered by short wavelength visible light

# Study 1 – Treating Cucurbit Downy Mildew

- Downy mildew can infect various cucurbits: melon, squash, pumpkin, and cucumber
- Cucumber is very susceptible

# UV-C Treatment Attachment



# UV-C Treatment Attachment (cont'd.)

## View of unit underside

## Calibrating travel speed/dose given

# 2020 Field Trial:
# Dose ranging and frequency exploration

- UV Dose Levels
  - 120 $J \cdot m^{-2}$, 240 $J \cdot m^{-2}$, 480 $J \cdot m^{-2}$
- Dose Frequency
  - 1 & 2 days per week
  - administered after sunset
- Mulch
  - Black (standard)
  - UV Reflective
- Conventional Fungicide Control
  - Black mulch only
- Untreated Control
- Outcome Measure
  - Percent DM foliar severity

- Cucumber variety: Raider
  - Not resistant to DM or PM
  - Intermediate ALS and CMV resistance
  - Scab resistance
- Field trial location
  - Ward's Berry Farm: Sharon, Mass.

# Disease Assessments

- Sample percent foliar disease severity shown below
- Assessments were made on plots as a whole

10%

25%

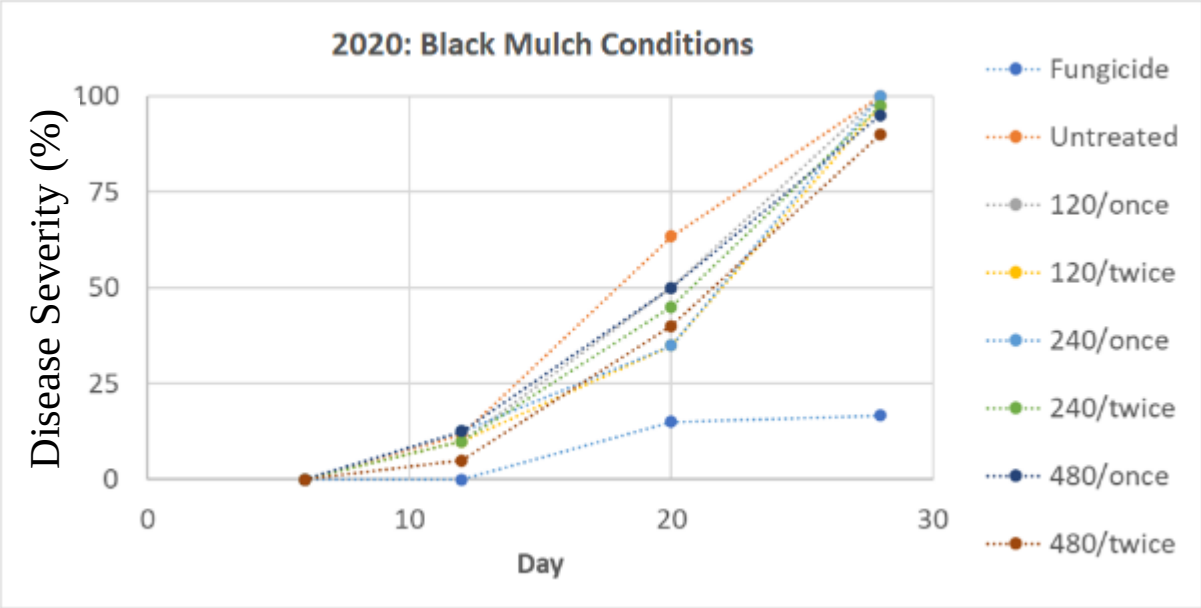
50%

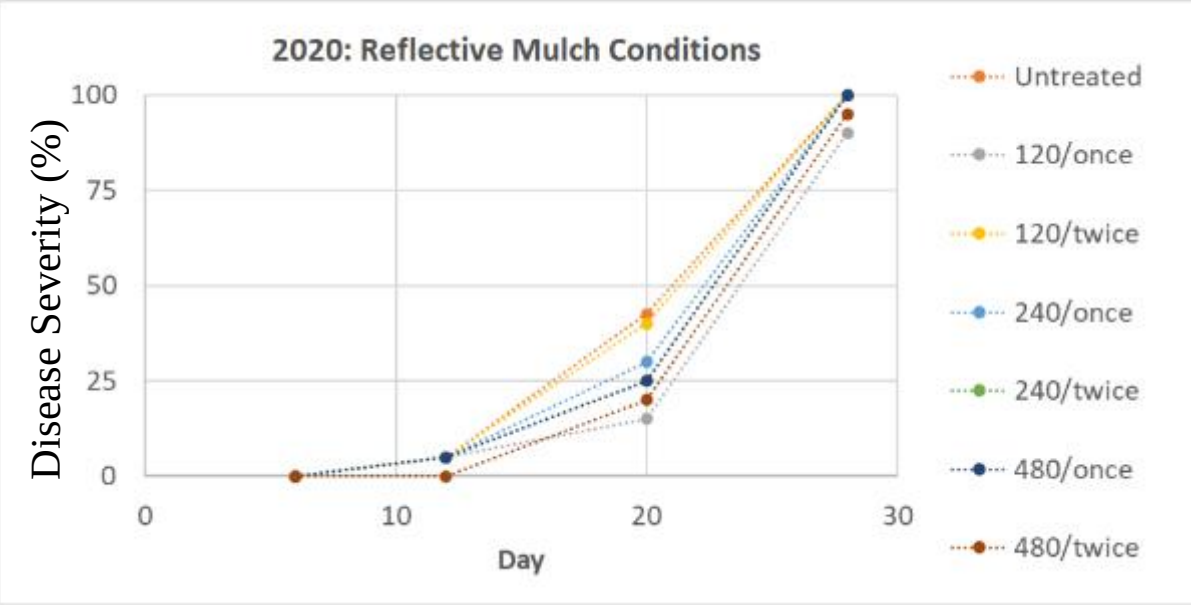
75%

100%

(photo credit: Teresa Rusinek)

# 2020 Field Trials – Disease Progress

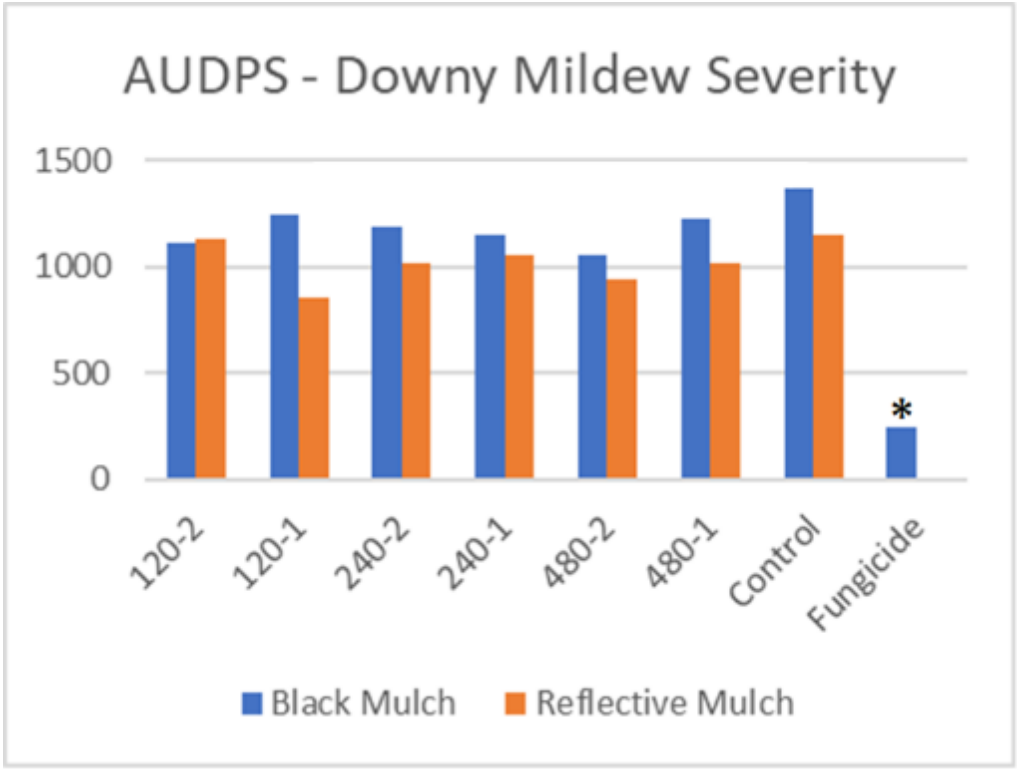



- Findings:
  - Dose level or frequency of application didn't significantly affect progress
  - Mulch did

# Area Under Disease Progress Stairs (Simko and Peipho, 2012)

- Overall measure of disease severity taking both severity and duration into account
- Conventional program was reliably different from all other treatments



# 2021 Field Trial

Treatments:

- Conventional
- UV Only
- UV + Conventional
- UV + Conventional Every Other Week
  - Added to determine if UV could reduce fungicide applications

- All treatments replicated on black and reflective mulch
  - (8 rows of each)
- All UV Conditions
  - 480 $J \cdot m^{-2}$
  - twice per week (M and Th)
  - after sunset
- Cucumber Variety: Raider
- Outcome Measure
  - Percent foliar DM severity

# Photographs of 2021 Field Trial

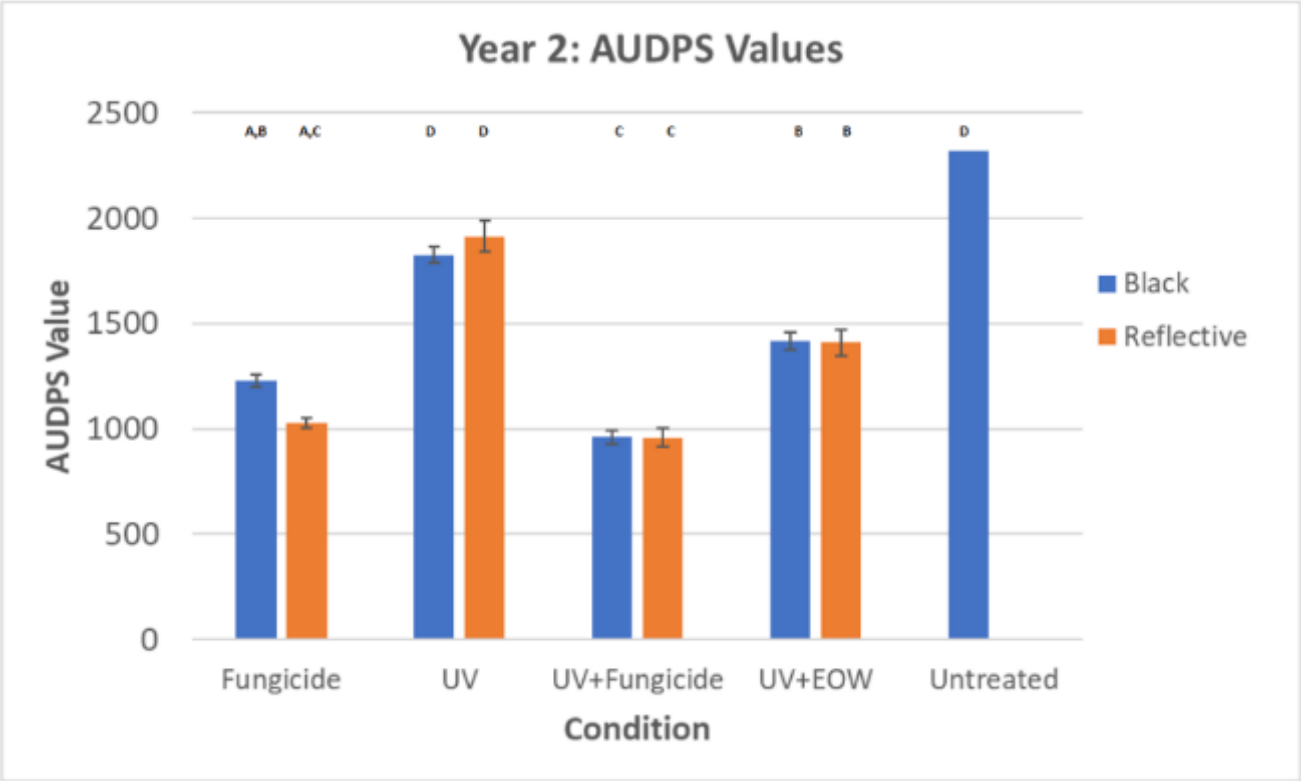
# Disease Severity Assessments

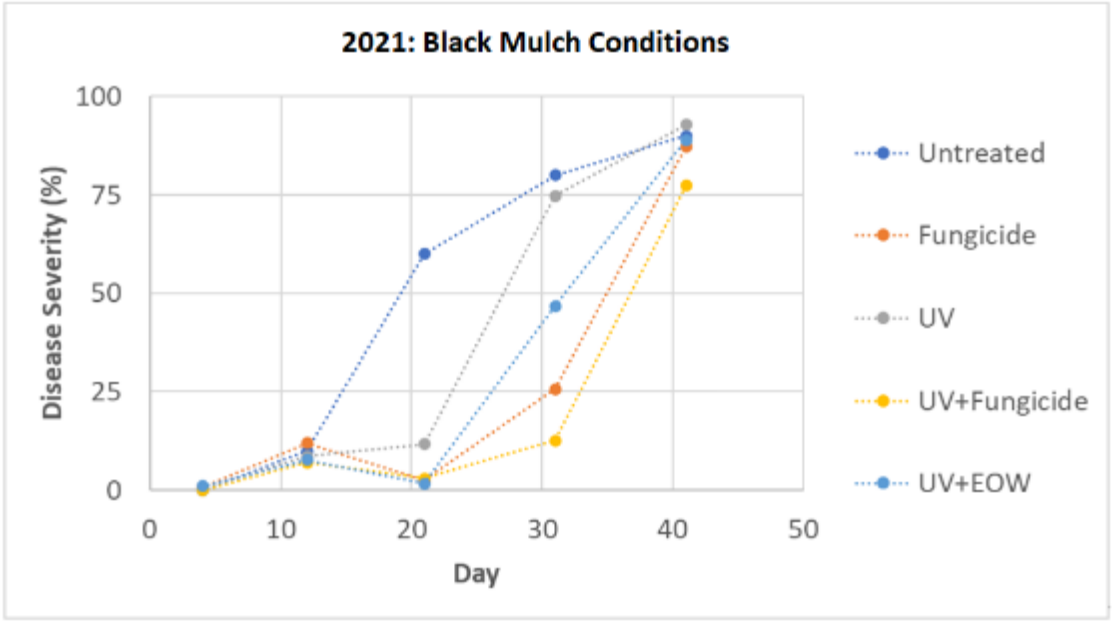
| 30 m | | | | | | | | | | Mulch Type |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 m | 3 m | 3 m | 3 m | 3 m | 3 m | 3 m | 3 m | 3 m | 3 m | |
| EOW Conventional + UV | | | | | | | | | | Black |
| Conventional | | | | | | | | | | |
| UV + Conventional | | | | | | | | | | |
| UV + Conventional | | | | | | | | | | |
| Conventional | | | | | | | | | | |
| EOW Conventional + UV | | | | | | | | | | |
| UV Only | | | | | | | | | | |
| UV Only | | | | | | | | | | Reflective |
| EOW Conventional + UV | | | | | | | | | | |
| UV + Conventional | | | | | | | | | | |
| Conventional | | | | | | | | | | |
| UV + Conventional | | | | | | | | | | |
| Conventional | | | | | | | | | | |
| EOW Conventional + UV | | | | | | | | | | |
| UV Only | | | | | | | | | | |
| UV Only | | | | | | | | | CNTL | Black |

- Rows divided in 10 segments
- Samples taken in a 2’ square area within each segment

# 2021 Trials – Results

- UV + EOW, UV + Conv, & Conv all significantly better than no treatment
- No significant effect of mulch




# Conclusions

- The treatments delayed DM onset to differing extents
- Once established, DM progresses at an equivalent rate regardless of treatment
- UV alone wasn't an effective treatment to manage DM
  - DM spores are heavily pigmented, which reduces UV lethality
  - Relatively small window of opportunity for UV-C exposure
- UV can offer additional protection above fungicide alone if needed
- UV combined with reduced fungicide applications can offer protection in certain situations.
- DM resistant variety may have responded more favorably

# We gratefully acknowledge the contributions of: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Thank you!

For more resources see:

lightandplanthealth.org