Using UV-C to Fight Tomato Powdery Mildew

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Background

- USDA statistics estimate 414 acres of production in Oregon with a farm value of over $14 million dollars in 2009 (USDA NASS 2011).
- Local market producers estimated each 12 inches of tomato row can net $12 in current markets.
- Tomato yields can be severely impacted by nighttime temperatures below 55°F or above 75°F
- Tomato production under plastic or in a glasshouse a good option for farms in the Willamette Valley
- Greenhouse conditions also increase potential for powdery mildew

Fungal Pathogens

Leveillula taurica: sparse, whitish powdery growth that is mostly on the underside of leaves.

Oidium neolycopersici: profuse, white powdery growth on the upper leaf surface. The underside of leaves can also have white, powdery growth when the relative humidity is high.

Powdery mildew infecting tomato in high tunnel production in western Oregon during 2016. Photo credits C.M. Ocamb.

Cultural Controls

- Ensuring that transplants are free from powdery mildew
- Avoid over-fertilization of plants and large doses of nitrogen fertilizers
- Prune plants and use plant spacing that allows for air movement around and within plant canopies
- Resistant cultivars
- Control overwintering hosts and crop residue

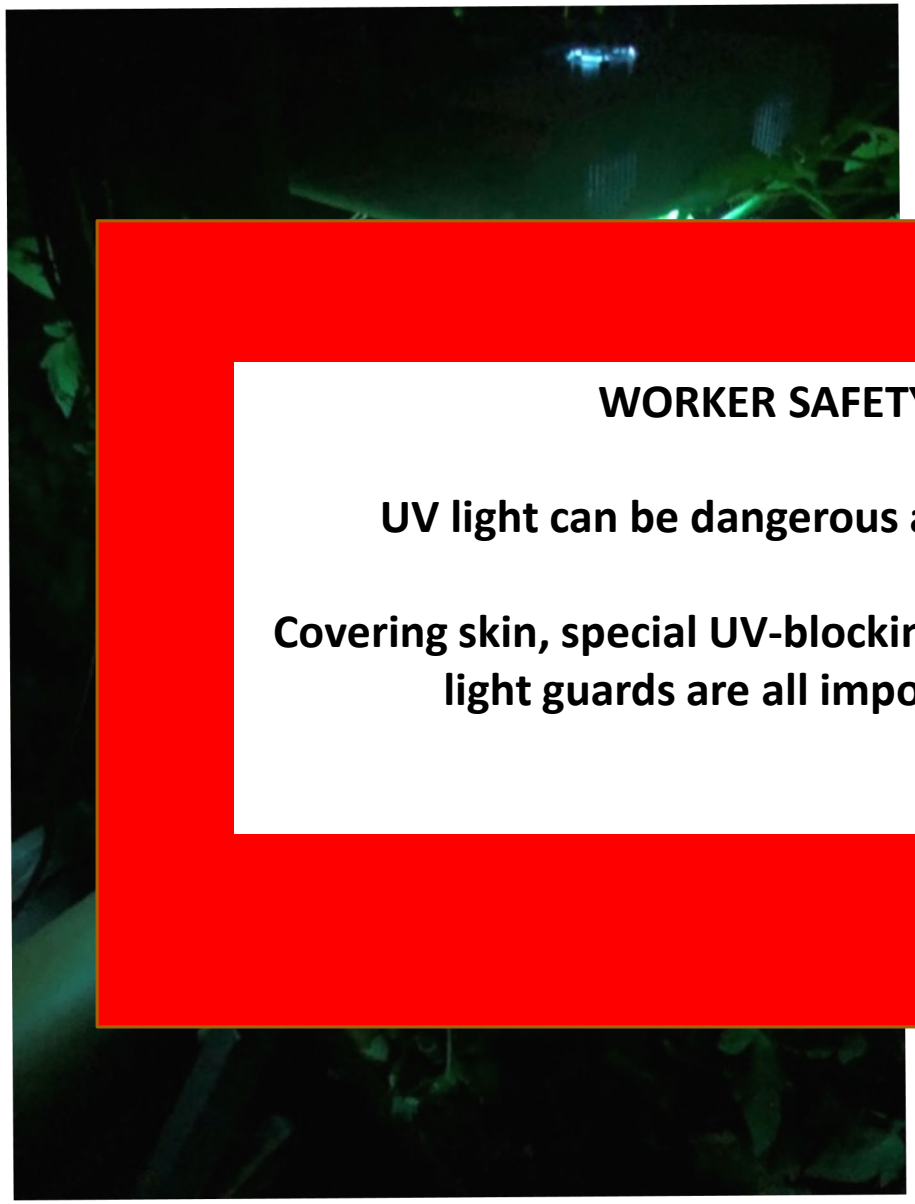
Chemical Controls

Check PNW Handbook

- Use of fungicides in greenhouse complicates worker safety concerns
- Risk not necessarily reduced or elimated with organic products
- Many greenhouse growers are choosing to produce without sprays

Organic Options

- Organic options: bicarbonates (Kaligreen or Milstop) or a sulfur formulation (Microthiol Disperss) on 7-day intervals
- Sulfur is fungitoxic only in vapor phase --when air temperatures promote volatilization (above 65°F), but sulfur becomes phytotoxic above 95°F so using it above 85°F is not recommended
- Potassium bicarbonates can leave residue on equipment and on fruit that needs to be managed
- UV light has been used in other crops/lab trials with success but not tested in greenhouse for tomato production



WORKER SAFETY WARNING!!!!

UV light can be dangerous and proper PPE is needed.

Covering skin, special UV-blocking safety glasses, and setting up light guards are all important safety measures.

Treatments applied after sunset to each individual tomato plant, every 3-4 days after first visual indication of PM observed

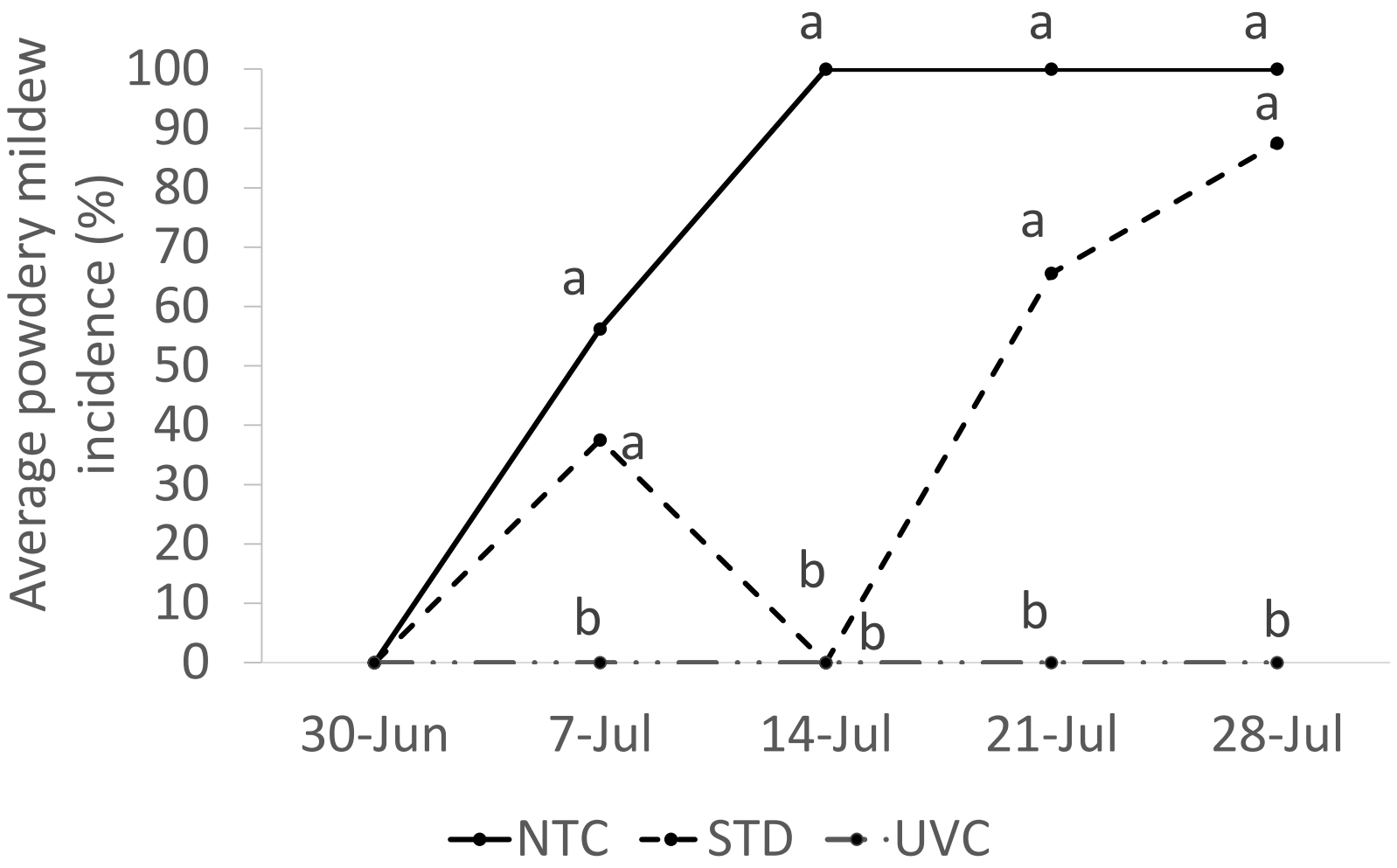
UV-C Damage

Treatment periods of 90 sec per plant caused phytotoxic effects

Treatment intervals with 60 sec per plant did not cause phytotoxic symptoms and still resulted in good disease control (incidence and severity).

Will UV-C provide adequate control?

Compare potassium bicarbonate, UV-C, and no control in two separate trials



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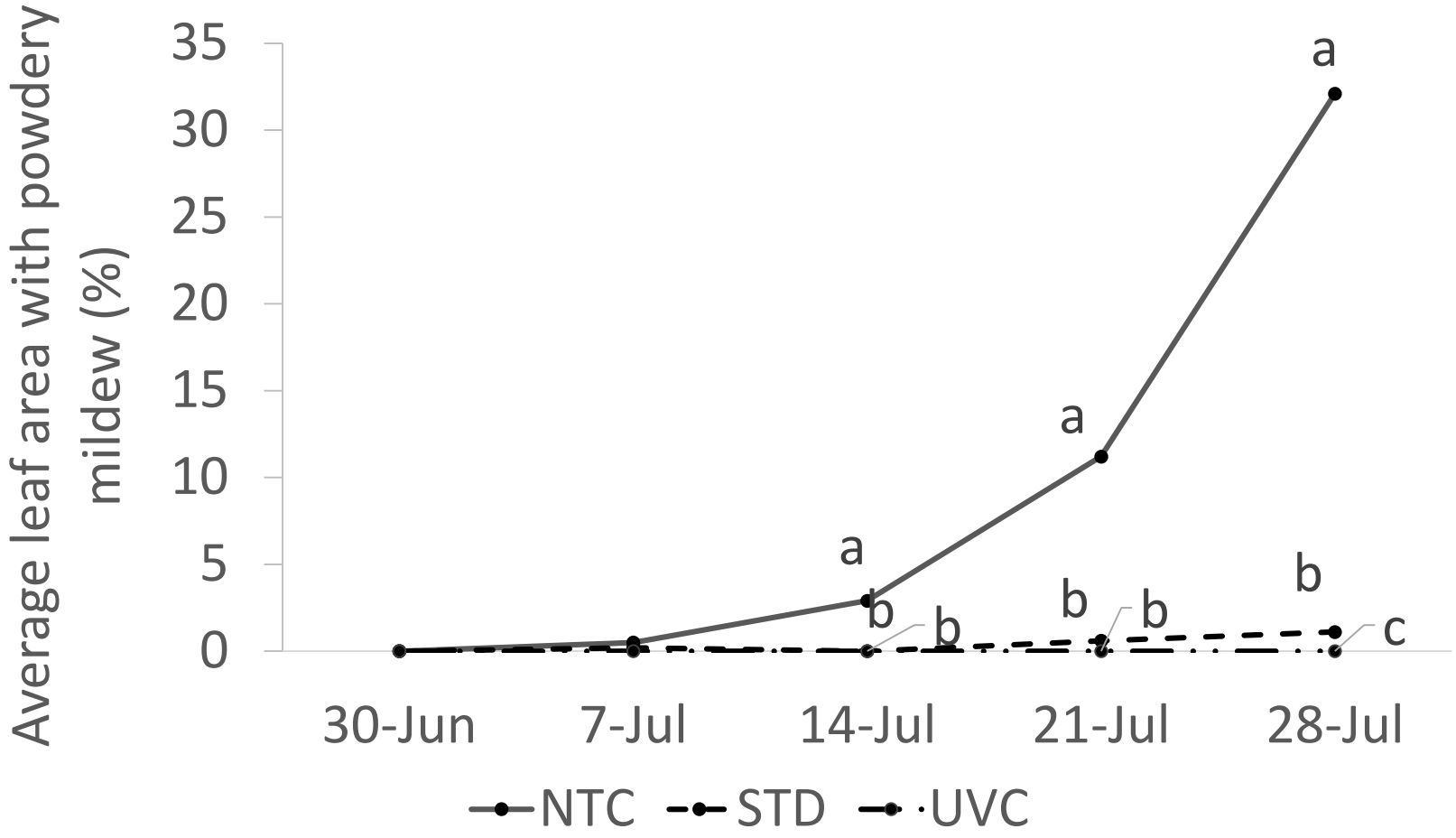

Reducing Powdery Mildew in High-tunnel Tomato Production in Oregon with Ultra Violet-C Lighting

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KEYWORDS. hoop house, *Leveillula taurica*, *Oidium neolycopersici*, *Solanum lycopersicum*, ultraviolet light

ABSTRACT. **Widespread outbreaks of tomato powdery mildew (*Leveillula taurica* and *Oidium neolycopersici*) are problematic in fresh market tomato (*Solanum lycopersicum*) crops in western Oregon, USA. In western Oregon, fresh market tomatoes are frequently grown in greenhouses or high tunnels where conditions can promote diseases such as powdery mildew. Heightened concerns about worker safety limit the pesticides available for use in enclosed systems. We studied the efficacy of ultraviolet-C (UV-C) light applications under high-tunnel conditions compared with a standard fungicide program. Plants treated with UV-C had zero incidence of powdery mildew on all sample dates in the first trial. In trial 2, disease incidence was lower on UV-C treated plants than both grower standard and nontreated control early in the study while disease severity remained lower in UV-C than nontreated control and similar to grower standard treatment. Additional research is needed to optimize UV-C treatment intervals to minimize negative effects on plant growth and maximize powdery mildew control.**

Fresh market tomatoes (*Solanum lycopersicum*) in the Pacific Northwest region of the United States are mostly grown under plastic or greenhouse systems. Recent outbreaks of tomato powdery mildew, incited by *Leveillula taurica* and *Oidium neolycopersici*, limit production because severe disease leads to defoliation of plants (Kiss et al. 2001, 2005). Chemical control options exist, yet many growers avoid pesticide use due to worker safety concerns. Alternatively, certain ultravio-

Materials and methods

Two replicate trials were conducted in 2020 in a high-tunnel at the Oregon State University North Willamette Research and Extension Center located near Aurora, OR, USA. The high-tunnel (30 ft × 96 ft × 8 ft) was covered with a double wall of 4-mil anticondensation polyethylene with no supplemental lighting or heating. Seeds of 'Cherokee Purple' tomato were sown on 16 Mar and 26 Jul; plants were transplanted by hand on 13 May and 20 Aug. Treatments included a nontreated

powdery mildew on 22 Jun and 22 Sep, then a 1-gal potted tomato infected with *O. neolycopersici* was placed at one end of each block.

Treatments commenced on 23 Jun and 21 Sep for trials 1 and 2, respectively. Applications of UV-C were made by three lights [2 ft × 0.5 ft (CleanLight XL; CleanLight, Naaldwijk, The Netherlands)] producing broadband ultraviolet-C at 253.7 nm. Two lights were vertical (parallel with plant stems), and the third light was on a horizontal arm over the plant canopy (Fig. 1A). Light was applied to individual plants due to the short effective range of UV-C. Worker safety is critical with UV-C lighting. Precautions included safety shields on lights, long sleeves and gloves, and protective eyewear. Plants in each plot received UV-C treatments twice per week (3- to 4-d intervals). During trial 1, plants received 90 s of UV-C for the first two treatments, then time was reduced to 60 s for 3 weeks more due to observed phytotoxicity presenting as leaf deformity and necrosis (Fig. 1B); UV-C treatment (60 s) was applied twice per week in

Read more here:

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Questions?

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