REPORT TO THE AGRICULTURAL RESEARCH FOUNDATION
FOR THE OREGON PROCESSED VEGETABLE COMMISSION
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Project Title: Field evaluation of carrot seed treated with germicidal light to reduce populations of seed-borne *Xanthomonas hortorum* pv. *carotae*

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Background: Bacterial blight of carrot is an important and common disease throughout carrot and carrot seed production worldwide. The causal organism, *Xanthomonas hortorum* pv. *carotae*, (formerly *X. camprestis* pv. *carotae*) is commonly seed-borne and the importance of seed contamination in subsequent disease has been demonstrated. Oregon and Washington produce major portions of the US and world carrot seed supply, making bacterial blight particularly important in the Pacific Northwest. The pathogen causes reductions in germination as well as blight of the foliage which affects seed yield and seed quality. Additional expenses may also be incurred if heavily contaminated seed lots are treated with hot water or a copper pesticide. The majority of carrot seed lots from Oregon and Washington fields are infested with *X. hortorum* pv. *carotae* and many seed lots are above threshold levels where subsequent plantings of these seed lots are at risk of bacterial blight epidemics.

Hot water treatments are recommended for infested seeds lots, which can destroy *Xanthomonas* but may reduce seed germination. One alternative to hot water treatment is germicidal light, which is relatively inexpensive and keeps the seed dry, eliminating the need to re-dry seed and associated risks. We have shown that UV light will reduce the incidence of *Fusarium* on sweet corn seed in most sweet corn seed cultivars tested.

There is a need in the OR and WA carrot and carrot seed industries to reduce seed-borne pathogen levels in an effort to manage bacterial blight. While germicidal light may not totally eliminate seed-borne pathogen levels, it is likely that germicidal light treatment would reduce pathogen levels so disease epidemics may be delayed or avoided. This could reduce the need for copper pesticides, helping carrot seed production to become more sustainable.

Objectives for 2010 and Accomplishments:

1. Conduct a field trial to evaluate the use of UV seed disinfestation on carrot growth and disease levels.

   Seed-borne pathogen levels were reduced in one carrot seed line when treated with UV light. That same line had the largest reduction in pathogen levels in healthy leaf tissue but the difference was not strongly significant (P = 0.068). Disease levels were reduced in one seed line but overall Xanthomonas populations and disease in the field were inconsistent.

Seed lines (5) with varying levels of *X. hortorum* pv. *carotae* were placed under germicidal light for 0 or 1 hour. Pathogen levels were assessed by soaking 0.1g of seed in 0.05% NaCl overnight and then dilution plating on a *Xanthomonas*-selective medium.

Subsamples of the putative *Xanthomonas* cultures transferred to a *Xanthomonas* differential medium.

Populations of *Xanthomonas* were significantly reduced in one seed line (Lot 63, Figure 1). All lines had lower frequencies of *Xanthomonas* than reported by the original seed source (assessed Fall of 2005). The reduction in population may be due to cells dying off over time; however the seeds all had high germination rates.

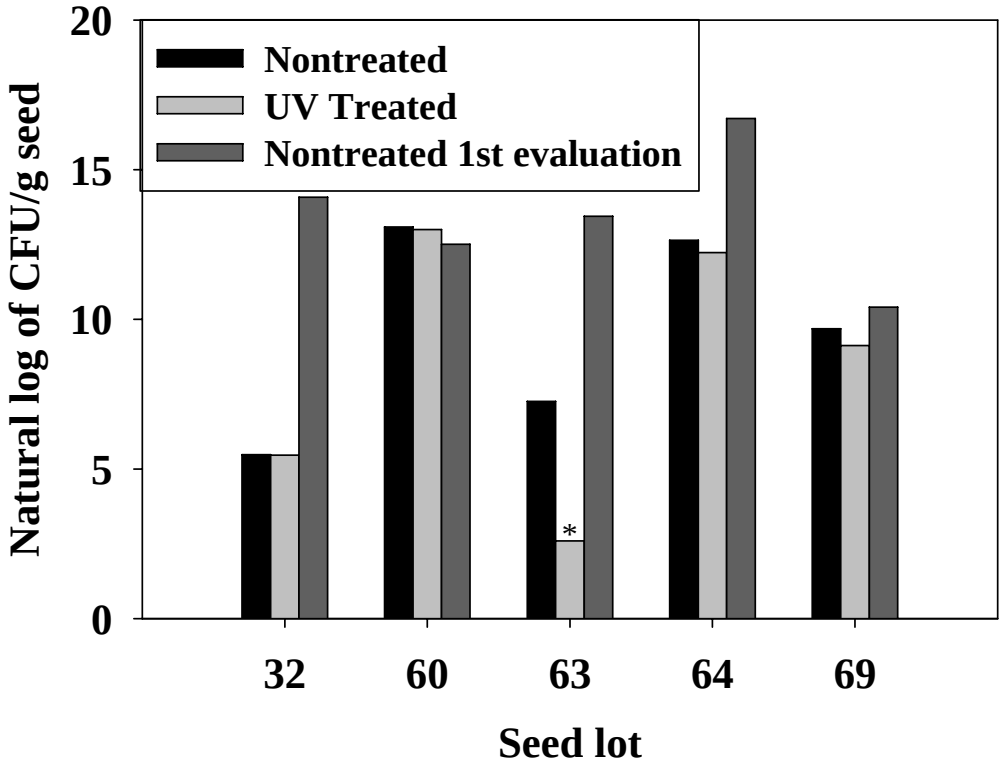

Figure 1. The effect of 1-hour UV light treatments on *Xanthomonas* (natural log of populations) populations on carrot seed. * indicates significant difference (P = 0.05) between UV-treated and nontreated seed.

Small plots were established on the OSU Botany Farm in a randomized complete block design (5 blocks). Each block was separated by 15 feet of bare ground and two rows of corn bordered each plot in order to isolate UV-treated seed from nontreated seed. Plots consisted of 3 carrot rows each 3 feet in length with 14" spacing between rows and 240 seeds were planted per plot (26 seeds per row foot). Plots were monitored throughout the season for bacterial blight and asymptomatic leaf tissue was sampled after disease started to appear. To assess pathogen levels in tissue, 1g of tissue was ground up in 3 ml of 0.05% NaCl and then dilution plated. Disease was assessed by counting the number of distinct areas of diseased tissue (strikes) within each plot.

There were no significant reductions in *Xanthomonas* populations detected in healthy leaf tissue and one seed lot appeared to have higher populations in the UV treated plots (#69 Figure 2A). Another seed lot (#60) did have a reduction in the number of disease strikes per plot, but this seed lot showed no reduction in seed-borne populations after UV treatment.

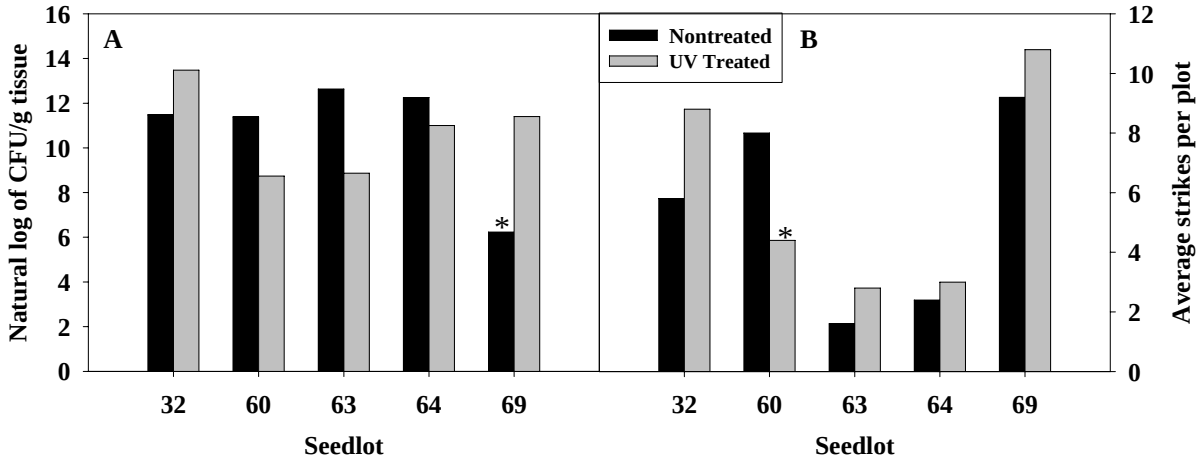

Figure 2. Natural log of *Xanthomonas* populations detected in healthy leaf tissue of plants grown from UV-treated and nontreated seed (**A**) and disease incidence levels within the test plots (**B**). * indicates significant difference (P = 0.05) between the recovery of *Xanthomonas from* UV-treated and nontreated seed for that seed lot.

One hour of UV light did reduce seed-borne populations of *Xanthomonas* in seed lot #69. This seed line also had more a reduction in *Xanthomonas* leaf tissue populations but it was not strongly significant statistically (P = .068). The age of the seed may have reduced population levels in all seed lines and it may be that the most superficially-located bacterial cells on the seed die the fastest, since they are most exposed to external stresses. If the most superficial cells die off faster, then we would expect to see a stronger effect of UV treatment when fresher seed is treated. It would be useful to conduct similar experiment with fresh seed and monitor seed-borne populations over time. It may also be possible that longer periods of germicidal light treatment are required for greater efficacy.