

**Report submitted to the Pennsylvania Vegetable Marketing and Research Program
Pennsylvania Vegetable Growers Association
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TITLE: Optimizing inoculation strategies to enhance the evaluation of disease management strategies for center rot of onion.

PRINCIPLE INVESTIGATOR:

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INTRODUCTION:

The bacterial disease center rot continues to be an on-going challenge for growers in Pennsylvania and in other onion production regions in the U.S. From the perspective of a researcher, one challenge to the development and evaluation of management practices is obtaining uniform disease pressure. Toothpick inoculation at the onset of bulbing (mid- to late-June) has been the relied up on initiate disease. However, this technique is highly artificial because the bacteria are being mechanically placed inside the plant tissue using a toothpick. Other techniques include the application of a bacterial suspension with an adjuvant to promote penetration or an abrasive such as diatomaceous earth to create small wounds that allow the bacteria to enter the plant simulating a wind-swept rain event. Inoculation timing is also critical, so we evaluated three different inoculation techniques at three different timings (1st leaf senescence, bulb initiation and bulb swell) to optimize this methodology. These results will help support the USDA-NIFA Specialty Crop Research Initiative proposal on onion bacterial diseases which was funded in June 2019 and will support a national team of researchers working collectively to address bacterial diseases of onion on a national scale.

METHODS:

To optimize bacterial inoculation method and timing replicated split plot field trial with timing as the whole plot (1st leaf senescence, bulb swell and bulb initiation) and inoculation method (uninoculated, toothpick inoculated, bacterial suspension with a surfactant, bacterial suspension with an abrasive e.g. diatomaceous earth) as the subplot was established at the Russell E. Larson Research and Education Center at Rock Springs. The trial was planted on 24 April with cv. Candy (sourced from SunBelt Transplants in Buckeye, AZ) on black plastic with a double row of drip irrigation. Each whole plot consisted of a 52-ft section of bed, 4 rows wide with 6-in. plant spacing within and between rows. Each whole plot was split into four 10-ft subplots with a 4-ft break between subplots. Treatments were replicated four times. The plots were inoculated with a bacterial suspension containing a mix of *Pantoea agglomerans* and *P. ananatis* isolated from symptomatic onions collected in PA using one of the three methods described above. There were also uninoculated control plots for comparison. Once inoculated, visual disease ratings were collected using a 0 (no symptoms) to 7 (all or nearly all leaves are bleached and wilted or dead) visual rating scale based on the progression of disease symptoms. Crop fertility, insects and weeds were managed using standard commercial production practices.

At harvest on 24 July, plants were topped and graded for size and marketability. The incidence of center and surface rots was recorded. Data was analyzed using PROC GLM and Fisher's LSD to evaluate main factor effects and interactions to determine which combination of inoculation method and timing

induced the highest center rot disease incidence and severity. A foliar disease severity rating index was calculated based on the rating data was calculated prior to analysis.

RESULTS AND CONCLUSION:

The first inoculation timing was misjudged so two application timings were evaluated using the three inoculation methods. Plants were inoculated at bulb initiation on 27 June and at bulb swell on 10 July. The whole trial was harvested on 24 July. Inoculating the onion plants at bulb initiation using the toothpick inoculation method resulted in a significantly higher incidence of center rot at harvest (45%) compared to the bacterial suspension with an abrasive (16%), bacterial suspension with a surfactant (14%) and the uninoculated control (11%). Inoculating 13 days later at bulb swell did not allow enough time before harvest for the bacterial infection to progress through the neck and then into the bulb. This demonstrates why harvesting early and sacrificing bulb size can be effective for reducing losses from center rot later in the season. The foliar disease rating index was also 7x higher for the plants inoculated using the toothpick method compared to the other methods (P<0.0001). Timing of inoculation did not have a significant effect on the foliar disease severity ratings.

Rainfall totals during the season were as follows: 24 to 31 April 0.51 in.; May 7.1 in.; June 3.76 in.; and 1 to 24 July 2.72 in. for a total of 14.1 in. For the same date ranges from April to July the temperatures ranged from 81.2 to 39.2°F; 81.9 to 38.6°F; 87.7 to 37.3°F; and 90.7 to 50.3°F.

ONION PROJECT BUDGET:

Hourly wages for summer help to assist in conducting proposed field work for	
12 wks at 12 hrs/wk at \$11.00/hr.....	\$ 1584.00
Fringe benefits (7.8%).....	\$ 123.71
Supplies to establish, maintain, and evaluate the replicated field trial.....	\$ 1200.00
Travel (in-state).....	\$ 100.00
Total.....	\$ 3007.71

Duration of Project: April 1, 2019 to November 30, 2019

Signature: 