United States Department of Agriculture

Progress Report

Title:	**Stop the rot: Combating onion bacterial diseases with pathogenomic tools and enhanced management strategies**

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Program Code: SCRI **Program Name:** Specialty Crop Research Initiative

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{NO DATA ENTERED}

Non-Technical Summary

Onion bulb crops are grown on ~140,000 acres/year in the U.S. at a farm-gate value of $925M. Bacterial pathogens cause >$60M in losses annually to this industry. Losses can be particularly severe for stored bulbs as bacterial bulb rots typically only develop in storage, after all production costs have been incurred. Poor scientific understanding of the diversity and epidemiology of bacterial pathogens, and the lack of systemic bactericides limit industry capacity to mitigate these losses; this is in sharp contrast to the significant work that has been accomplished with fungal pathogens of onion. This 'Stop the Rot' project organizes 24 scientists in diverse disciplines across the U.S. to research the complete system (host, pathogen, and environment) of bacterial diseases of onion. The long-term goal is to support profitability and sustainability of onion production in the U.S. using a coordinated, national survey of bacterial pathogens affecting onion crops combined with a stakeholder-focused, systems approach to investigate how production practices, inoculum sources, and environmental conditions can be managed to develop effective, practical, economically-viable, and environmentally-sound strategies to limit losses to bacterial diseases.

The project has two primary objectives linked iteratively in a systems approach. The first objectives utilizes comparative genomics to identify genetic factors that enable some bacteria to cause diseases on onion, and to develop practical diagnostic tools as well as phenotypic resistance screening methods for bacterial pathogens of onion. A survey of onion bacterial diseases over three seasons in each of 12 states representing the seven primary regions of onion production in the U.S. will be used to understand the diversity of onion bacterial pathogens in the U.S., and to develop a National Onion Bacterial Strain Collection. Genomic assessment of this bacterial collection will enable us to understand the genetic basis of bacteria that can cause diseases of onion across the U.S. This, in turn, will be used to design rapid, accurate, and robust methods of detecting and identifying onion bacterial pathogens. The collection also will be used to develop methods of screening onion germplasm for resistance to bacterial pathogens. The screening methods can then be used in breeding programs to develop cultivars with greater resistance than currently available. The second objective focuses on onion bacterial disease management by examining

how irrigation practices, fertility practices, pesticide programs, cultural practices, post-harvest practices, and bacterial disease modeling can be managed to develop effective, practical management programs. A 12-person, nation-wide onion Stakeholder Advisory Panel worked with our team from 12 states to prioritize the objectives and develop approaches for this project. Broad, stakeholder-based evaluations of the research results over the duration of the project will ensure results are delivered to constituents and that solutions developed are viable economically and environmentally.

Accomplishments

Major goals of the project

The ability of growers to manage bacterial diseases of onion is limited compared to many fungal diseases because of unique epidemiological and management aspects of the bacterial pathogens, which cause >$60 million/year in damages to the U.S. onion industry. Losses can be particularly severe for stored onions as bacterial bulb rots typically develop after harvest, with losses ranging from 5-100% in individual fields. The cost of sorting symptomatic bulbs can result in rejection of entire fields if the incidence of rot exceeds 30%. There are effective tools to manage other factors that can cause storage losses (e.g., sprouting and fungal bulb rots), in contrast to bacterial rots. This project takes a systems approach encompassing the pathogen, host, environment, economics, and stakeholder priorities to address the need to manage onion bacterial diseases far more effectively. The goal of this project is to support long-term profitability and sustainability of onion production in the U.S. using a stakeholder-informed, systems approach by:

1. Undertaking a national survey of onion bacterial diseases;
2. Developing a National Onion Bacterial Strain Collection (NOBSC);
3. Using this resource for genotypic characterization of the pathogens to design rapid, accurate, and robust methods for detecting and identifying onion bacterial pathogens across the U.S.;
4. Developing methods of screening onion germplasm for resistance to these bacteria;
5. Integrating the diagnostic and detection tools into comprehensive integrated disease management research trials;
6. Generating predictive bacterial disease models across diverse regions of onion production in the U.S.; and
7. Implementing a broad, Stakeholder Advisory Panel (SAP)-informed dissemination plan to deliver results to constituents.

The goal utilizes a coordinated, national survey of bacterial pathogens affecting onion crops combined with a stakeholder-focused, systems approach to investigating how production practices, inoculum sources, and environmental conditions can be managed to develop effective, practical, economically-viable, and environmentally-sound strategies to limit losses to bacterial diseases. The project has two primary objectives linked iteratively in a systems approach:
A: Utilize comparative genomics to identify virulence factors and develop practical diagnostic tools, as well as phenotypic resistance screening methods for bacterial pathogens of onion (60% of the effort for this project). The four activities for this objective entail: **A1**) national onion bacterial disease surveys and development of a National Onion Bacterial Strain Collection (NOBSC), **A2**) onion bacterial pathogenomics, **A3**) development of onion bacterial pathogen detection tools, and **A4**) development of onion phenotyping (screening) protocols for reactions to bacterial pathogens.

B: Examine how key production practices, environmental factors, and inoculum sources that impact bacterial disease outbreaks can be managed to develop practical solutions that are viable environmentally and economically (40% of the project effort). This will entail six areas of investigation: **B1**) irrigation management, **B2**) fertility management, **B3**) pesticide programs, **B4**) cultural management, **B5**) post-harvest management, and **B6**) bacterial disease modeling.
Objective A addresses the SCRI focus area of "efforts to identify and address threats from pests and diseases" by clarifying for stakeholders nationwide, using standardized protocols, the diversity of onion bacterial pathogens causing losses in each of three growing seasons. The National Onion Bacterial Strain Collection resulting from this project will provide an invaluable resource for this and future projects on genetic studies of pathogens and associated bacteria in/on onions, e.g., whole genome sequencing to find virulence factors in order to develop robust molecular tools to detect and differentiate pathogenic vs. non-pathogenic bacteria. This will facilitate development of effective phenotypic methods of screening onion germplasm for reactions to diverse bacterial pathogens, alone and in combinations, which will facilitate future efforts to breed for resistance.
Objective B addresses the SCRI focus area efforts to identify and address threats from pests and diseases" as well as "efforts to improve production efficiency, handling and processing, productivity, and profitability". This coordinated, multi-state objective will determine how regional onion production practices, environmental conditions, and inoculum sources can be managed using practical, economically-viable, and environmentally-sound strategies to limit losses to bacterial rots in fields, storage, and shipping.

What was accomplished under these goals?

A1: National bacterial disease surveys, and NOBSC: The NOBSC has 2,264 strains with 127 OR strains to be

added. Survey data from 3 seasons in NY/PA were compiled. Burkholderia strains from PA/NY were screened for copper tolerance. Of 116 strains tested, >85% exhibited copper insensitivity at 200 ppm copper sulfate pentahydrate. Isolates of Burkholderia were used for whole genome sequencing (Oxford Nanopore). A novel species of Burkholderia pathogenic to onion was identified. In 2023, the TX regional lab showed 19 of 179 bacterial strains were pathogenic to onion leaves. ID/eastern OR survey was completed with bulb, scale, and foliar testing completed. 40% of isolates were re-sequenced for identification, and other loci sequenced for species identification. Bulb assays are in progress for UT/CO strains. Scale, foliar, and bulb assays were completed for WA/CA strains, and PCR assays initiated to identify Pantoea species.

A2. Onion bacterial pathogenomics: A manuscript was submitted on genomic analysis of onion-associated strains of P. agglomerans. P. agglomerans plasmids can transfer pathogenicity plasmids to convert non-pathogenic strains to pathogenic strains. Genes for copper tolerance are co-associated with onion virulence genes. A manuscript on comparative genomics and biogeography of P. allii is in preparation. Metagenomics and 16s amplicon-sequencing community analysis of bacteria and viruses in bulbs from GA and WA was published. Diversity and traits of Rahnella and Enterobacter species from onions was assessed. New species, Ewingella allii, Kosakonia beerii, and Phytobacter allii, were identified and manuscripts are in preparation. A study was completed on antimicrobial resistance and multidrug resistance in Enterobacter ludwigii. Strains from onion had broad-spectrum resistance unrelated to geographic origin. Agricultural E. ludwigii isolates had different resistance profiles than clinical taxa. Alarmingly, clinically relevant resistance was prevalent in agricultural strains, emphasizing the need for antimicrobial stewardship in agriculture. Analysis of strains collected in the USA in 1920s-1986, prior to extensive use of antibiotics, will be done.

A3. Diagnostic tools: A HiVir-gene cluster real-time PCR assay was developed to detect pathogenic strains of Pantoea spp. from onion. For isolates of P. ananatis, P. agglomerans, P. allii, and P. eucalypti, the first 3 species were pathogenic and gave positive results with the assay. P. eucalypti isolates were not pathogenic and did not amplify. Of 73 Pantoea strains from CA/WA, 17 amplified and were pathogenic. The assay worked with a cut-off of 30 cycles in WA and OR labs. A real-time PCR assay for B. gladioli was developed, and a LAMP assay for P. agglomerans. The B. gladioli assay detected DNA from 27 isolates of B. gladioli. None of 6 Paraburkholderia isolates amplified. DNA was amplified from inoculated plants.

A4. Phenotypic screening methods: Published results of a NY phenotypic resistance screening trial. A CA trial comparing scale vs. bulb assays on fresh market and dehydration cultivars showed differences in bulb rot severity and lesion size among varieties, with assays negatively correlated. Varieties with larger scale lesions (fresh market types) had less bulb rot. Dehy onions had more bulb rot but little/no scale lesions. Scale assay results support evidence dehydration types are less susceptible. In a UT trial inoculated with B. gladioli, differences were observed among varieties. 'Marenge' and 'Cometa' had the least rot. Yellow varieties had more rot.

B1. Irrigation management: A 2023 irrigation trial in Tulelake, CA confirmed previous results with less rot under drip vs. sprinkler irrigation. Results for 2 years were published. A field trial evaluating irrigation frequency was completed in Pasco, WA. Storage evaluation of bulbs from the prior year's trial were conducted. Results were presented at the 2024 WSU Onion Field Day and published.

B2. Nitrogen management: Trials evaluating N application rates and timing on bacterial rot and yield were conducted in Othello, WA. Storage evaluations from a prior year's trials were completed. Results were presented at the 2024 WSU Onion Field Day and published.

B3. Pesticide programs: Results of a CA 2023 bactericide trial were published. None of 10 products controlled bacterial leaf blight or bulb rot. In GA, copper products and Lifegard reduced bacterial bulb rot. In a 2nd GA trial, a spray program with LifeGard and copper products reduced bulb rot. Some GA growers now use Lifegard and use less copper. Bulbs were evaluated in storage from a 2023-24 WA trial comparing chemigation (2,700 gpa) vs. spray boom (45 gpa) application of ManKocide, Badge SC, and Lifegard. No product controlled bacterial rot, regardless of application method, confirming prior bactericide trials in the Columbia Basin.

B4. Late-season cultural practices: A video was produced on rolling onion tops to reduce bacterial rot. A 2023-24 WA trial showed more bacterial rot when bulbs were topped early (91% neck moisture) vs. 2 weeks (60% moisture) or 4 weeks later (18% moisture). This confirmed prior trials showing greater risk the more moisture in the necks at topping.

B5. Postharvest practices: Published a NY report on early pulling and postharvest curing with heated air. Pre-harvest assessment of 12 NY fields showed foliar symptoms on 9-57% and bulb rot incidence of 0-29%. 4 fields had the tops rolled before a forecasted rain to prevent water collecting in upright tops, and . A field was pulled early to hasten drying. A 2023-24 WA trial showed postharvest application of ozone or disinfectants with peroxyacetic acid + hydrogen peroxide did not control bacterial bulb rot in storage, but peroxyacetic acid + hydrogen peroxide products killed P. agglomerans on cheesecloth. The inability to penetrate wrapper scales and contact infections inside bulbs prevents disinfectants from controlling bulb rots.

B6. Onion bacterial disease risk modeling: Collected weekly scouting data from onion fields in NY, and bulbs will be evaluated in Dec. The bacterial bulb rot risk model was evaluated on 2 Columbia Basin farms in 2023. Agronomists stated it was a valuable educational tool on factors contributing to risk.

B7. Economics: Economic analysis of bactericides for bacterial bulb rot in GA showed an increase in per-acre profit for producers vs. non-treated plots. Sensitivity analysis indicated economic returns are not sensitive to fluctuations in input or

onion prices, consistently giving a positive return. Over 3 years of field trials on economic returns of different input intensities for onions in GA, a higher input intensity yielded a positive economic return relative to a grower standard program. Even with elevated input prices, the return persisted due to less bulb rot under high inputs. Economic analysis of timing of topping, neck clipping length, and timing of undercutting revealed opportunities for growers to increase revenue (avoid losses) at little/no additional cost. In GA, clipping necks 2-3" long vs. ≤1" increased per-acre revenue by >$800. WA trials showed undercutting bulbs at 50% tops down reduced losses vs. undercutting at 100% tops down, increasing per-acre revenue. Given uncertainty around effectiveness of these strategies (baseline grower survey), there is potential for grower adoption and improved profitability. To assess current rates of adoption and shifts in grower perceptions, an endline grower survey was developed. Analysis is ongoing.

B8. Outreach and Extension: Refer to presentations, field days, posters, and other outreach events listed. Extensive revisions were made to Alliumnet (https://alliumnet.com/projects/stop-the-rot/), adding many resources, including Frequently Asked Questions (FAQs) to help stakeholders find information. This was led by Hoepting with Stakeholder Advisory Panel input. More FAQs will be added.

What opportunities for training and professional development has the project provided?

University of Georgia (KvitKo) and University of Pretoria (Coutinho)

- Adri Grobler, MS student, "Bacteriophages infecting pathogenic strains of Pantoea agglomerans". Start date: Jan. 2022, estimated date of completion: Dec. 2024.
- Christian van Blerck, MS student, "Metagenomic analysis of the progression of Enterobacter ludwigii in onion bulbs". Start date: Jan. 2024, estimated date of completion: Dec. 2025.
- BS honors student (4th year student): Mr. Aaron Berkman at WITS: "Raising the resistance bar: Enterobacter, antibiotics, and heavy-metals in a global world."
- PhD students:
  - Fanele Mnguni, 4th year. Thesis: Characterization of the bacterial pathogens associated with bulb rot in the USA and South Africa.
  - Sara Jordan, 4th year at KNAW, Switzerland. Thesis: Genomic analysis of Enterobacter strains isolated from environmental, clinical and plant habitats.

University of Georgia (Dutta)

- Postdoctorate Michelle MacLellan
- Postdoctorate Shatrupa Ray

Pennsylvania State University (Gugino)

- Ram Neupane, PhD student. Ram Neupane received the Storkan-Hanes-McCaslin Foundation Award ($10,000) in 2024.
- Three undergraduate students were trained for a total of 389 hours on aspects of this project through helping with the bacterial isolate survey collection and the bacterial isolate copper tolerance screening.

TX A&M University (Malla)

- Sarah Jendresky (undergraduate; API, Biolog, and others)
- Sa'Rye Wrancher (undergraduate; API, Biolog, and others)

Washington State University (du Toit, LaHue, Waters)

- Sahil Thapa, MS student working on irrigation and fertility practices for management of onion bacterial bulb rots. Committee chair: Gabriel LaHue. Committee member: Lindsey du Toit

How have the results been disseminated to communities of interest?

In this reporting period, we have reached out actively to growers and other onion stakeholders to: share new information generated by the project as well as current scientific understanding of onion bacterial diseases and their management; understand growers' current state of knowledge about causes and management of bacterial diseases of onion; and identify priority concerns for growers and the onion industry regarding management of bacterial diseases. Information has been shared with growers and stakeholders through a range of communication channels, including the Alliumnet website, research summaries, extension bulletins, articles in trade publications and presentations at growers' meetings and field days. Results were shared at professional scientific meetings, with the primary venues being Plant Health 2024 in Memphis, TN in July 2024; the Stop the Rot Annual Team Meeting in March 2023; many regional grower meetings and field days; and regional extension newsletters. Refer to the list of outputs/products. PD du Toit was invited to share results of this project with 7 onion stakeholders groups in South Africa and at the 2023 Conference of the Australasian Society of Plant Pathology in Adelaide, Australia, where she also met with onion stakeholders to discuss various onion diseases, including the Stop the Rot project.

We hold monthly team videoconferences to share preliminary results and experiences and discuss recent findings. Team meetings were held on 9/27/23, 10/25/23, 12/13/23, 1/31/24, 5/29/24, 7/24/24. An annual in-person team meeting (with Zoom access) was held on March 5-7, 2024 at the WSU Mount Vernon NWREC in Mount Vernon, WA, with 20 people attending in-person and 6 on Zoom. An annual 2-hour videoconference with Stakeholder Advisory Panel members was held on March 27, 2024. These monthly meetings of 1.5 to 2 hours have facilitated research and Extension collaborations. Almost all the project collaborators are also involved in extension services and education in their regions, which makes for efficient transfer of new information and research results from the team to extension professionals and thence to growers. Technicians and graduate students from each of the regional teams also join our monthly meetings and contribute actively to the discussions, providing feedback on methods and protocols and sharing their latest results with the full team in a collegial setting.

What do you plan to do during the next reporting period to accomplish the goals?

We received a second 1-year no-cost extension for the grant to complete objectives that were delayed due to COVID restrictions in Years 1-2 and extended periods of medical leave for key personnel in 2023-24.
A1: The regional labs will finish characterizing the strains from Seasons 1-3 that were not completed by the end of Year 5 (DNA sequencing for genus and species identification). UGA will continue to characterize the strains received for the NOBSC, and add results and metadata to the NOBSC database. The NOBSC dataset will be made available publicly on Alliumnet by the end of the grant. Regional labs will plan for long-term storage and back-up of their regional collections, since the NOBSC will only include a subset of strains from each regional lab. Publications on regional survey results are being developed by individual states or regions, as well as a final survey publication for the entire project, summarizing the combined survey results from all participating states over all three seasons.
A2: Projects in progress in Year 6 include a second metagenomic study on onion bulbs inoculated with E. ludwigii and sampled over time after inoculation. Sequencing results have been obtained and analysis is in progress. Using the same experimental design, an RNAseq study will be completed. Genome analysis of strains in the E. cloacae and E. hormaechi species complexes is in progress to resolve the confusing taxonomy of the genus and these species. Characterization of bacteriophages infecting strains of Pantoea agglomerans from onion also in progress. Additional publications planned: Identification of Rahnella species from the survey and those in South Africa; comparative genomics of isolates of R. perminowiae, R. aceris, and R. aquaticus; genome announcement of Rahnella strains; multiplex-PCR assay to identify species/strains of Enterobacter; comparative genomic study of Enterobacter ludwigii strains from surveys in years 1 and 2.
A3. Molecular diagnostic tools: Woodhall will test soil, seed, water, and plant samples received from various states, using the real-time PCR assays developed for onion-pathogenic Pantoea spp. and for B. gladioli for more rapid testing than traditional isolations followed by DNA sequencing.
A4. Phenotypic resistance screening methods: Results of 3 seasons of cultivar field trials in WA will be combined into a journal publication, along with a paper on the phenotypic assays vs. field trials in NY, CA, WA, and GA.
Objectives B1 to B6: Bulbs in storage from 2024-25 field trials in several states in Year 5 will be evaluated for bacterial rot, the data analyzed, and results published. Results will be shared with growers and other stakeholders on Alliumnet, at grower and other professional meetings, and in various outreach materials. For each of objectives B1 to B5, results from related trials across multiple states will be combined into summary papers for publication in relevant journals. The field-scale risk-assessment model will be tested on more growers' fields, and using field trial data from field trials over 5 seasons, in collaboration with the WSU Decision Aid System program.
B7. Economic analysis: Results of the end-line survey administered in 2023-24 are being analyzed and contrasted with the baseline survey administered in Year 1. Economic analysis of field trials aimed at assessing the relative efficacy of alternative products (bactericides), input intensities (nitrogen), and cultural practices (undercutting, timing of topping, and length of necks at topping) will be updated with the final trial results to provide multi-year averages.
B8. Outreach and extension: In Year 6, we will direct attention to synthesizing work from the four seasons to highlight regional and national trends in bacterial diseases and options for management. Results from field trials in Year 5 will be shared with growers, industry representatives and other interested parties at grower meetings, field days, on Alliumnet, and in trade and outreach publications. A video summarizing results of the Stop the Rot onion bacterial project has been initiated in collaboration with the WSU CAHNRS Office of Communication, to complement the highly successful 14-minute video made at the start of the project, summarizing the situation and gaps in knowledge. The wrap-up video will highlight key results readily adoptable by growers to limit losses to onion bacterial pathogens. The Alliumnet.com website will be updated to include more Frequently Asked Questions (FAQs) to help stakeholders fine information more efficiently on key management practices, given the large number of resources now posted on the site. Alliumnet.com will also serve as a home for national onion research collaborations, including other USDA projects, the National Allium Research Conference, links to National Onion Association meetings and events, and the W-1008, W-2008, W-3008 and W-4008 onion multi-state project reports, activities, and meeting details.

Participants

Accession No. 1020312 **Project No. WNP03104**

Actual FTE's for this Reporting Period

Role	Non-Students or faculty	Students with Staffing Roles			Computed Total by Role
		Undergraduate	Graduate	Post-Doctorate	
Scientist	1.2	1	4.1	0.1	6.3999999999999995
Professional	0	0	0	0	0
Technical	2.3	0	0	0	2.3
Administrative	0.1	0	0	0	0.1
Other	0	0	0	0	0
Computed Total	3.6	1	4.1	0.1	8.7999999999999995

Student Count by Classification of Instructional Programs (CIP) Code

Undergraduate	Graduate	Post-Doctorate	CIP Code
8	5	1	26.03 Botany/Plant Biology.
	2		01.01 Agricultural Business and Management.

Target Audience

Stakeholders involved in the US onion industry are the primary audience for this project. This includes onion producers (farmers), packers, shippers, and associated stakeholders engaged in various capacities in onion production, distribution, and marketing, e.g., agronomists, crop consultants, farm managers, field workers; personnel associated with agricultural supply companies (fertilizer and pesticide dealers, irrigation supply companies, etc.), seed companies, and dealers; onion breeders (public and private); and onion storage and shipping/transport personnel and companies. Public and private research and extension specialists, undergraduate students, graduate students, and postdoctorates working with diverse aspects of onion production are also a target audience for this project.
The project's 14-member Stakeholder Advisory Panel represents onion farms, regional onion associations, and major vegetable seed companies (including onion breeders and plant pathologists) from across the US, with one international member. Panel members conducted further outreach to their own networks on behalf of the project. Panel members who are grower representatives include Greg Bird (President of the Michigan Onion Committee), Bob Ehn (California Garlic and Onion Research Advisory Board), Charles Hall (Executive Director of the Georgia Fruit and Vegetable Growers Association), Michael Locati (President of the Columbia Basin Onion Research Committee), Joe DiSalvo (NY grower), and Kalie Christensen (WI grower). The onion seed industry is represented by Peter Rogers and Juan Carlos Brevis (Nunhems), Scott Hendricks (Bayer), and Margreet Asma (Bejo Zaden).
Refer to the list of presentations, posters, field day, scouting events, and other outreach/extension activities listed in this report. The Stop the Rot section of the Alliumnet website is increasingly utilized by onion stakeholders as we have increased the amount of information, results, and resources posted on this website.

Products

DR 1020-006 Certification Statement

Yes, any applicable scholarly publications have been submitted to the National Agricultural Library's (NAL) PubAg and any applicable data assets have been submitted to NAL's Ag Data Commons. These submissions included the NIFA grant or accession number and digital persistent identifiers for the publication or data asset (such as DOI) and the authors (such as ORCID).

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Peer Reviewed Journal	Published	2024	YES

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Author ORCID(s)

Citation

Liakos, C., Ibanez, V., Lebre, P. H., Derie, M. L, van der Waals, J., du Toit,L., Dutta, B., Kvitko, B., Cowan D.A., and Coutinho, T. A. 2024. The bacterial and viral communities associated with onion bacterial bulb rot. Phytobiomes Journal: in press, PBIOMES-11. ORCID(s): 0000-0001-9841-257X;0000-0002-0602-835X;0000-0002-9094-4069;0000-0002-3227-4343

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Author ORCID(s)

Citation

Paudel, S., Zhao, M., Dutta, B., and Kvitko, B. 2024. Thiosulfinate tolerance gene clusters are common features of Burkholderia onion pathogens. Mol. Plant Microbe Interact. 37:507-519. ORCID(s): 0000-0002-9094-4069;0000-0001-9841-257X

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0000-0003-1025-2108;0000-0003-1470-9419

Citation

Wilson R., Aegerter B., and LaHue, G. T. 2024. The influence of sprinkler and drip irrigation on the incidence and severity of bacterial disease in onions grown in northeast California. Plant Health Progress 25:293-298.

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Author ORCID(s)

Citation
Dutta, B., and Tyson, C. 2023. Evaluation of digging methods on post-harvest incidence of external and internal bacterial bulb in onion, Georgia, 2022. PDMR 17:V006. ORCID: 0000-0001-9841-257X

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Author ORCID(s)

Citation
Dutta, B., and Tyson, C. 2023. Evaluation of harvesting methods on post-harvest incidence of external and internal bacterial bulb rot in onion, Georgia, 2022. PDMR 17:V007. ORCID: 0000-0001-9841-257X

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Dutta, B., and Tyson, C. 2023. Evaluation of neck-clipping length on post-harvest incidence of external and internal bacterial bulb rot in onion, Georgia, 2022. PDMR 17:V008. ORCID: 0000-0001-9841-257X

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Author ORCID(s)

Citation
Dutta, B., Donahoo, W.M., and Foster, M.J. 2023. Evaluation of bactericides and LifeGard programs to manage internal bacterial rot of onion in Georgia, 2022. PDMR 17:V009. ORCID: 0000-0001-9841-257X

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0000-0002-3384-3528

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Hoepting, C. A., and Caldwell, S. K. 2024. Effect of pulling onions early and fast curing with artificially heated forced air on a drying wall in a box storage on bacterial bulb rot in onion, 2023. Plant Disease Management Reports 18:V113.

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0000-0002-3384-3528

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Hoepting, C. A., Gropp, N. K., and Caldwell, S. K. 2024. Evaluation of two phenotypic screening assays for bacterial bulb rot of onion, Elba, NY, 2022-2023. Plant Disease Management Reports 18:V112.

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Citation
Sidhu, J., Dubose, J., Fernberg, J., and Aegerter, B. J. 2024. Evaluation of bactericides for management of bacterial leaf blight and bacterial bulb rot in onions, 2022. Plant Disease Management Reports 18:V064.

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0000-0002-0713-5878;0000-0003-1025-2108

Citation
Sidhu, J., Dubose, J., Fernberg, J., and Aegerter, B. J. 2024. Evaluation of varietal susceptibility to bacterial foliar disease and bacterial bulb rot in onions, 2022. Plant Disease Management Reports 18:V063.

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Author ORCID(s)

Citation

Thapa S., du Toit L., Waters T., Derie M., Schacht B., and LaHue, G. T. 2024. Effects of irrigation frequency on onion bacterial bulb rot in the Columbia Basin of Washington State, 2023-24. Plant Disease Management Reports 18:CF075. ORCID(s): 0009-0005-2651-985X;0000-0003-1470-9419;0000-0002-0602-835X

Type	Status	Year Published	NIFA Support Acknowledged
Peer Reviewed Journal	Published	2024	YES

Digital Object Identifier (DOI)

10.1094/PDMR18

Author ORCID(s)

Citation

Thapa S., du Toit L., Waters T., Derie M., Schacht B., and LaHue, G. T. 2024. Effects of nitrogen management on onion bacterial bulb rot in the Columbia Basin of Washington State, 2023-24. Plant Disease Management Reports 18:CF076. ORCID(s): 0009-0005-2651-985X;0000-0003-1470-9419;0000-0002-0602-835X

Type	Status	Year Published	NIFA Support Acknowledged
Peer Reviewed Journal	Published	2023	YES

Digital Object Identifier (DOI)

10.1016/j.agwat.2023.108476

Author ORCID(s)

Citation

Belo, T. R., du Toit, L. J., Waters, T. D., Derie, M. L., Schacht, M., and LaHue, G. T. 2023. Reducing the risk of onion bacterial diseases through managing irrigation frequency and final irrigation timing. Agricultural Water Management 288:108476. ORCID(s): 0000-0003-1470-9419;0000-0002-0602-835X

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Peer Reviewed Journal	Published	2023	YES

Digital Object Identifier (DOI)

10.1094/PDIS-11-22-2710-RE

Author ORCID(s)

Citation

Koirala, S., Myers, B., Shin, G. Y., Gitaitis, R., Kvitko, B. H., and Dutta, B. 2023. Evaluating options to increase the efficacy of biocontrol agents for the management of Pantoea spp. under field conditions. Plant Disease 107:2701-2708. ORCID(s): 0000-0002-9094-4069;0000-0001-9841-257X

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Derie, M., Aegerter, B., Colson, G., Coutinho, T., Cramer, C., Dutta, B., Gugino, B., Hoepting, C., Kvitko, B., LaHue, G., MacKay, H., Malla, S., Nischwitz, C., Shin, G., Uchanski, M., Waters, T., Woodhall, J., and du Toit, L. 2023. Progress at combating onion bacterial diseases with pathogenomic tools and enhanced management strategies. Keynote presentation, Joint Meeting of the National Allium Research Conference and National Onion Association, San Antonio, TX, 30 Nov.-2 Dec. 2023. (~150 people)

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

LaHue G. T., Belo T., du Toit, L. J., Waters, T., Derie, M., and Schacht, B. 2023. Impacts of irrigation frequency and final irrigation timing on onion bacterial diseases. Oral presentation at the 2023 ASA, CSSA, SSSA International Annual Meeting, St. Louis, MO, 1 Nov. 2023.

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Awaiting Publication	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

MacLellan, M. P., Ray, S., Bushong, K., Paret, M., Potnis, N., Bull, C., Jones, J., and Dutta, B. 2024. Genetic traits of Pseudomonas allivorans strains isolated from plants in the southeastern United States. Poster presented at Plant Health 2024, Memphis, TN, 24-30 July 2024. Phytopathology (Abstract). In press.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Awaiting Publication	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Neupane, R., Mazzone, J., Hoepting, C., and Gugino, B. 2024. Peeling the rotten onion: A three-year bacterial survey of onion fields across Pennsylvania and New York. Poster presented at Plant Health 2024, Memphis, TN, 24-30 July 2024. Phytopathology (Abstract). In press.

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Hoepting, C.A. 2023. Rolling onions that are “dying standing up” to Stop the Rot. Joint Meeting of National Allium Research Conference and National Onion Association, San Antonio, TX, 30 Nov. 2023 (70 participants).

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Neupane, R.C. Bacterial rot of onion and copper resistance. FAO Science and Innovation Forum, Rome, Italy. Food and Agriculture Organization (FAO) and World Food Forum (WFF), 17 Oct. 2023. (60 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Wood, B., and Woodhall, J.W. 2023. Development of a real-time LAMP assay for the detection of Pantoea agglomerans in onions. National Allium Research Conference, San Antonio, TX, 30 Nov. 2023. Poster. (70 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Conference Papers and	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Woodhall, J.W., Wood, B., Kinnear, M., and Cumagun, C. 2023. The potential of on-site testing for onion pathogens using isothermal methods. National Allium Research Conference, San Antonio, TX, 30 Nov. 2023. Oral presentation. (70 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Neupane, R., Mazzone, J. D. and Gugino, B. K. 2024. Rotten to the Core: The Center Rot Disease of Onion. PennState Extension. https://extension.psu.edu/rotten-to-the-core-the-center-rot-disease-of-onion. Online.

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Neupane, R., and Gugino, B. 2024. Peeling the rotten onion: Bacterial diseases and copper bactericides. Proceedings of the Mid-Atlantic Fruits and Vegetable Growers Convention, 31 Jan. 2024, Hershey, PA.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Bhatta B.P., M. Khanal, and Malla, S. 2023. Whole genome and 16S rRNA dataset of Pectobacterium carotovorum strain 21TX0081 isolated from a symptomatic onion foliage in Texas. Data Brief 46:108823.

Type	Status	Year Published	NIFA Support Acknowledged
Peer Reviewed Journal	Published	2023	YES

Digital Object Identifier (DOI)

10.1094/PDIS-09-22-2206-SR?

Author ORCID(s)

0000-0002-0338-1780

Citation

Khanal M., Bhatta, B. P., and Malla, S. 2023. Isolation and characterization of bacteria associated with onion and first report of onion diseases caused by five bacterial pathogens in Texas, U.S.A. Plant Disease 107:1721-1729.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Khanal M., and Malla, S. 2023. Draft genome sequence and annotation of Pseudomonas carnis strain 20TX0167 isolated from onion (Allium cepa). Microbiol. Resour. Announc.:e01051-22.

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Kvitko, B., Hoepting, C., and du Toit, L. 2023. Using DNA evidence to address cases of mistaken identity of bacteria causing onion diseases. Onion World September/October 2023:20-22. https://issuu.com/columbiamediagroup/docs/onion_world_september-october_2023?fr=sODNiYzY0NzE0Mz

Type	Status	Year Published	NIFA Support Acknowledged
Other Journal	Published	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Schwiezer, C. 2023. Onion Field Day. Growers get chance to learn, network with experts. Basin Business Journal 27 Sep. 2023:13-17.

Type	Status	Year Published	NIFA Support Acknowledged
Peer Reviewed Journal	Published	2023	YES

Digital Object Identifier (DOI)

10.1002/crso.20305

Author ORCID(s)

Citation

LaHue, G., Belo, T., and du Toit, L. 2023. Cultural management strategies to reduce the risk of onion bacterial diseases. Crops & Soils Magazine September-October 2023:2-8. ORCID(s):0000-0002-0602-835X;0000-0003-1470-9419

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Hoepting, C. A. 2024. How much rot you got? Pre-harvest assessment of bacterial bulb rot in onion and management options. Cornell Cooperative Extension – Cornell Vegetable Program Newsletter, Veg Edge 20(20):6-8.

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Published	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Wohleb, C.H., Waters, T.W., and du Toit, L.J. 2024. Washington State University Extension Onion Alerts. WSU Onion Alert on bacterial diseases, 18 July 2024: Summary of results from Stop the Rot project on symptoms of bacterial diseases, bactericide efficacy in the Columbia Basin, and irrigation effects.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Vegetable Seed Pathology: Research projects review. Invited presentation and discussion with Bayer vegetable specialists, 24 Apr. 2024, online (9 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. “Stop the Rot”: Grower-relevant results from a national onion bacterial project. Invited 2-h presentation and discussion with Wisconsin Muck onion growers, 25 Mar. 2024, online. (10 people)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Conquering recalcitrant diseases using the art and science of plant pathology. Invited seminar to Dept. of Plant Pathology, The Ohio State University, 12 Feb. 2024, Columbus, OH. (~60 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Applied outcomes and practical solutions from emerging from the ‘Stop the Rot’ onion bacterial project. Invited presentation, Wisconsin Muck Farmers’ Association Annual Research Meeting and Wisconsin Potato and Vegetable Growers’ Annual Meeting, 7 Feb. 2024, online presentation. (22 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. “Stop the Rot”: Grower-relevant results from a national onion bacterial project. Invited presentation, Annual Meeting of Idaho-Malheur Co. Onion Grower Association, 6 Feb. 2024, Ontario, OR (~150 people)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Stop the Rot: A national effort to minimize the impact of onion bacterial diseases. Invited presentation to vegetable seed industry personnel, followed by discussions on disease management in vegetable seed crops, 31 Jan. 2024, Oudtshoorn, South Africa. (70 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Stop the Rot: A national effort to minimize the impact of onion bacterial diseases. Invited presentation to du Toit Farms production team, followed by general discussion on onion disease management, 30 Jan. 2024, Ceres, South Africa. (20 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Stop the Rot: A national effort to minimize the impact of onion bacterial diseases. Invited presentation to KORKOM Onion Producers', followed by general discussion on disease management in onion crops, 30 Jan. 2024, Ceres, South Africa. (25 people)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Stop the Rot: A national effort to minimize the impact of onion bacterial diseases. Invited presentation to Northern Cape Onion Producers' Association, followed by general discussion on disease management in onion crops, 29 Jan. 2024, Kimberly, South Africa. (60 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Stop the Rot: A national effort to minimize the impact of onion bacterial diseases. Invited presentation to ZZ2 Farms production team, followed by general discussion on vegetable disease management, 27 Jan. 2024, Mooketsi, Limpopo Province, South Africa. (15 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Conquering recalcitrant diseases using the art and science of plant pathology. Keynote presentation, 53rd Congress of the Southern African Society of Plant Pathology, 22-25 Jan. 2024, Golden Gate National Park, South Africa. (150 people)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2023. 'Stop the Rot' and other onion disease research at WSU. Invited presentation to AusVeg and HortInnovation meeting with onion growers/stakeholders in South Australia, 27 Nov. 2023, Murray Bridge, Australia. (35 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2023. Stakeholder engagement in research and extension programming: An essential aspect of management recalcitrant plant diseases. Invited presentation, 2023 Conference of the Australasian Plant Pathology Society, Adelaide, Australia, 20-24 Nov. 2023. (~250 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2023. Environmental influences on plant diseases in the Pacific Northwest. Invited presentation, WSU Research Symposium on Integrated Pest Management in a Changing Climate, Tilth Conference, 26-28 Oct. 2023, Port Townsend, WA. (~70 people)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Dutta, B., Management of onion and cucurbit diseases and fungicide update. 25 Jan. 2024, Turner Co., GA (30 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Dutta, B. 2024. Vidalia Onion Update. 23 Jan. 2024. Georgia. (52 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Dutta, B. 2024. Fungicide update and disease management in vegetable crops. 12 Jan. 2024. Georgia. (44 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Dutta, B. 2024. Onion Disease Management. Vegetable training (Production, pest and diseases). Tifton, GA. 13 Dec. 2023

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Neupane, R., and Gugino, B., Peeling the rotten onion: Bacterial diseases and copper bactericides. Mid-Atlantic Fruits and Vegetable Growers Convention - 2024. 31 Jan. 2024. Hershey, PA. (150 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Woodhall, J. Onion Disease Update. Idaho Eastern Oregon Onion Growers Conference. 6 Feb. 2024. Ontario, OR.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Uchanski, M. Stop the Rot Project Poster Presentation. Colorado State University AES Annual Meeting, 9-11 Jan. 2024, Alamosa, CO.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Hoepting, C. Finishing Strong: Harvest practices that reduce bacterial bulb rot. Empire State Producers Expo, 24 Jan. 2024, Syracuse, NY. (22 participants)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Aegerter, B. Combating Onion Bacterial Disease. California Garlic and Onion Symposium, 12 Feb. 2024, Tulare, CA. (Processors, growers, and pest control advisors = 100 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Hoepting, C. Stop the Rot Finale: Progress towards understanding and managing bacterial bulb rot in onion. Orange Co. Onion School, 28 Feb. 2024, Pine Island, NY. (50 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Hoepting, C. Stop the Rot Finale: Progress towards understanding and managing bacterial bulb rot in onion. Oswego & Wayne Co. Muck Onion Growers Preseason Meeting, 20 Mar. 2024, Pheonix, NY. (24 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Hoepting, C. Stop the Rot Finale: Progress towards understanding and managing bacterial bulb rot in onion. Elba Muck Onion Growers Preseason Meeting, 29 Mar. 2024, Elba, NY. (13 participants)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Hoepting, C. 2024. Stop the Rot Finale: Progress towards understanding and managing bacterial bulb rot in onion. Elba Muck Onion Growers' Pre-Season Meeting, 29 Mar. 2024, Elba, NY. Stop the Rot Finale ppt.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Uchanski, M. Poster Presentation on StR project "Take home messages/Summary". Colorado Fruit and Vegetable Growers Association Annual Meeting, 27-28 Feb. 2024, Denver, CO.

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Waters, T. D., and du Toit, L. J. 2023. 'Stop the Rot' onion bacterial project: Grower-relevant results. Invited presentation, Onion Session, Pacific Northwest Vegetable Association Annual Convention & Trade Show, 15-16 Nov. 2023, Kennewick, WA. (~250 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. and Waters, T. D. 2024. WSU Onion Field Day, 29 Aug. 2024, Hartley Farms, Horse Heaven Hills, WA. Presented onion bacterial research update and proposed pink root and Fusarium basal rot research. Field day attended by onion growers, seed industry, extension personnel, researchers, consultants, and diagnosticians (~100 people).

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Washington Specialty Crop Tour. Invited presentation on vegetable seed production and seed crop pathology to state legislators, ag industry representatives, WA State Dept. of Agriculture, Ecology, and Labor & Industries; WSU CAHNRS administrators, etc., on 23 Jul. 2024 as part of a 3-day tour organized by the WA Commission on Integrated Pest Management, Mount Vernon, WA. (~60 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2024. Invited panelist to address ‘Women and Farming in Washington State’ for Les Dames d’Escoffier Seattle Chapter (philanthropic organization), 26 Feb. 2024, Hot Stove Society, Hotel Ändra, Seattle, WA. (40 people)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2023	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

du Toit, L. J. 2023. Meetings with onion growers, consultants, and field representatives in the Murray River area of South Australia, 25-28 Nov. 2023, at the invitation of Michael Rettke, South Australia Research & Development Institute, Adelaide, Australia. (35 people)

Accession No. 1020312 **Project No. WNP03104**

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Dutta, B. Vegetable Field Demonstration Training. Tifton, GA, 3 Jun. 2024. (16 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Dutta, B. Vidalia Onion Field Day. Lyons, GA, 9 Apr. 2024. (35 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

Dutta, B. Onion Disease Management. Vidalia Onion Research Update, Lyons, GA, 18 Jul. 2024. (45 participants)

Type	Status	Year Published	NIFA Support Acknowledged
Other	Other	2024	YES

Digital Object Identifier (DOI)

Author ORCID(s)

Citation

LaHue G. T. Irrigation management impacts on onion bacterial bulb rot. WSU Onion Field Day, Horse Heaven Hills, WA, 29 Aug. 2024.

Other Products

Type
Audio or Video

DOI or Other Persistent Identifier
https://www.youtube.com/watch?v=pTYmdIwjbao

Associated Publication DOI(s)

Author ORCID(s)
0000-0002-3384-3528

Description
Hoepting, C. A. and Caldwell, S. K. 2024. How to identify foliar symptoms of bacterial diseases in onion. Video (4:19 minutes). Posted 1 Apr. 2024: https://www.youtube.com/watch?v=pTYmdIwjbao. (426 views by 26 Sep. 2024).

Changes/Problems
Sadly, two unexpected medical issues occurred in 2023-24 for staff on this project. In June 2023, the Project Manager had to go on medical leave, and resigned in Oct. 2023. In spring 2024, Wendy Britton was hired as a part-time (10 h/week) Project Manager to help with some aspects of the project, particularly budget management. In Feb. 2024, a severe medical situation was incurred by a technical support person involved in the project. That individual was still on medical leave by Oct. 2024, and for the foreseeable future. This caused significant delay in completion of some aspects of the project by du Toit's program. In Sep. 2024, du Toit hired additional technical support to ensure the work can be completed in Year 6 of the project. Given the delays and constraints imposed on the project by the COVID pandemic, as well as the issues noted above, a detailed request was submitted to and approved by NIFA for a 2nd year of no-cost extension for this project. The termination date for the project is now August 31, 2025.