2011 WSU Onion Cultivar Demonstration & Field Day

Friday, August 26th
9:00 a.m. – 1:00 p.m.

Skone & Connors Produce, Inc.
in the Frenchman Hills

WASHINGTON STATE UNIVERSITY EXTENSION

WSU Extension programs and employment are available to all without discrimination. Evidence of noncompliance may be reported through your local Extension office.
# Table of Contents

Onion Cultivar Entries ........................................................................... 3

Onion Cultivar Plot Map ........................................................................ 4

Fertility Research
   Onion Fertilization – *Horneck & Clough* ............................................. 5

Weed Research
   Onion Weed-Related Research – *Boydston* ........................................ 7

Entomology Research
   Thrips IPM – *Rondon* .................................................................... 8
   Thrips Control in Onions – *Waters & Walsh* .................................... 10

Disease Research
   Development of a DNA Macroarray for Rapid Detection and Differentiation of Onion Bulb Rot Pathogens – *Schroeder, et al* .................... 14
   Onion ipmPIPE ............................................................................. 16

Sponsored by WSU Extension and the Pacific Northwest Vegetable Association

Hosted by Skone & Connors Produce, Inc. • Planted by Monsanto Vegetable Seeds

Organized by Tim Waters, 509-545-3511, twaters@wsu.edu
and Carrie Wohleb, 509-754-2011 x. 413, cwohleb@wsu.edu

BBQ luncheon following the field day sponsored by:

*American Takii, Inc.* • *Bayer CropScience* • *Bejo Seeds, Inc.* • *Champion Seed Co.*
*Clearwater Supply* • *Crookham Company* • *Gowan Co.* • *Keithly-Williams Seeds*
*Monsanto Vegetable Seeds* • *Nippon Norin Seed Co.* • *Nunhems USA, Inc.*
*Osborne Seed Co. LLC* • *Pure Sense* • *Syngenta*
<table>
<thead>
<tr>
<th>Seed Company</th>
<th>Cultivar</th>
<th>Plot Number</th>
<th>Seed Company</th>
<th>Cultivar</th>
<th>Plot Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Takii</td>
<td>Centerstone</td>
<td>101 201 318</td>
<td>Nippon Norin</td>
<td>NN 65</td>
<td>129 226 316</td>
</tr>
<tr>
<td>American Takii</td>
<td>Milestone</td>
<td>102 212 327</td>
<td>Nunhems USA</td>
<td>Arcero</td>
<td>130 211 328</td>
</tr>
<tr>
<td>American Takii</td>
<td>Ruby Ring (R)</td>
<td>103 239 344</td>
<td>Nunhems USA</td>
<td>Cometa (W)</td>
<td>131 234 326</td>
</tr>
<tr>
<td>American Takii</td>
<td>Trailblazer</td>
<td>104 209 306</td>
<td>Nunhems USA</td>
<td>Granero</td>
<td>132 220 340</td>
</tr>
<tr>
<td>American Takii</td>
<td>Y-0903</td>
<td>105 224 322</td>
<td>Nunhems USA</td>
<td>Joaquin</td>
<td>133 245 308</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Calibra</td>
<td>106 217 325</td>
<td>Nunhems USA</td>
<td>Marenge (R)</td>
<td>134 240 343</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Crockett</td>
<td>107 238 301</td>
<td>Nunhems USA</td>
<td>Montero</td>
<td>135 228 331</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Delgado</td>
<td>108 223 321</td>
<td>Nunhems USA</td>
<td>Ranchero</td>
<td>136 202 332</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Gunnison</td>
<td>109 210 323</td>
<td>Nunhems USA</td>
<td>Solstice (W)</td>
<td>137 243 348</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Legend</td>
<td>110 203 319</td>
<td>Nunhems USA</td>
<td>Vaquero</td>
<td>138 231 303</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Redwing (R)</td>
<td>111 222 305</td>
<td>Sakata Seed</td>
<td>Bello Blanco (W)</td>
<td>139 232 353</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Sedona</td>
<td>112 206 314</td>
<td>Sakata Seed</td>
<td>Ovation</td>
<td>140 246 315</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Talon</td>
<td>113 248 346</td>
<td>Sakata Seed</td>
<td>Spanish Medallion</td>
<td>141 247 311</td>
</tr>
<tr>
<td>Bejo Seeds</td>
<td>Tamara</td>
<td>114 236 304</td>
<td>Sakata Seed</td>
<td>XON-659Y</td>
<td>142 218 339</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Advantage</td>
<td>115 215 307</td>
<td>Monsanto</td>
<td>Affirmed</td>
<td>143 227 350</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Avalon</td>
<td>116 219 341</td>
<td>Monsanto</td>
<td>Barbaro</td>
<td>144 207 317</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Brundage</td>
<td>117 216 329</td>
<td>Monsanto</td>
<td>Belmar</td>
<td>145 230 347</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Esteem</td>
<td>118 235 333</td>
<td>Monsanto</td>
<td>Elbrus</td>
<td>146 208 334</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Morpheus</td>
<td>119 251 336</td>
<td>Monsanto</td>
<td>EX 14593 (R)</td>
<td>147 237 352</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Oracle</td>
<td>120 205 335</td>
<td>Monsanto</td>
<td>Orizaba (W)</td>
<td>148 233 324</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Pontiac</td>
<td>121 253 345</td>
<td>Monsanto</td>
<td>Rainier (W)</td>
<td>149 242 330</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>The Rock</td>
<td>122 244 320</td>
<td>Monsanto</td>
<td>Ruffian</td>
<td>150 204 302</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>Trigger</td>
<td>123 214 309</td>
<td>Monsanto</td>
<td>Swale</td>
<td>151 241 342</td>
</tr>
<tr>
<td>Crookham Co.</td>
<td>White Cloud (W)</td>
<td>124 252 338</td>
<td>Solar Holdings Intl.</td>
<td>Polo</td>
<td>152 249 351</td>
</tr>
<tr>
<td>Nickerson-Zwaan</td>
<td>2020</td>
<td>125 221 349</td>
<td>Solar Holdings Intl.</td>
<td>Stanley</td>
<td>153 229 337</td>
</tr>
<tr>
<td>Nickerson-Zwaan</td>
<td>2025</td>
<td>126 250 313</td>
<td></td>
<td>(R) Red Onion</td>
<td></td>
</tr>
<tr>
<td>Nickerson-Zwaan</td>
<td>4012</td>
<td>127 213 312</td>
<td></td>
<td>(W) White Onion</td>
<td></td>
</tr>
<tr>
<td>Nickerson-Zwaan</td>
<td>7026</td>
<td>128 225 310</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PLANTED: March 24, 2011 (planted by Monsanto Vegetable Seeds)

COOPERATOR: Bruce Swindler, Skone & Connors Produce, Inc.

LOCATION: Block 80, Unit 36.

IRRIGATION: Drip

ENTRIES: 53 entries, from 10 seed companies

PLOT SIZE: 34 inches x 30 feet, two double-rows per plot, 5-foot alleys between plots

REPLICATIONS: 3 in randomized complete block design

OTHER NOTES: Plots were planted with a Stahnay belt planter.
Onion Fertilization
Don Horneck and George Clough
Oregon State University – Hermiston

Improved Nitrogen Use
Ten year project by River Point Farms

Before planting additions
- <2000: 100# N/acre
- 2003-2004: 50 # N/A
- 2005-2006: 35 #/A
- 2007-2009: 7 #/A

During the season additions
- <2000: 200-300#/A
- 2003-2004: 165 #/A
- 2005-2006: 142 #/A
- 2007-2009: 117#/A

- Reduced N use by 93%
- Reduced N use by 53%

Total reduction of N use = 225 # N/A or 67%

2008 Onion Yield

Source

- Medium
- Jumbo
- Colossal
- Total
Simulated Glyphosate Drift Trial on Onions.

With increasing acreage of Roundup Ready crops (alfalfa, field corn, canola, sugarbeets, soybeans, etc.) and the extensive use of glyphosate in perennial crops (trees and vines) the chance of glyphosate drift to susceptible neighboring crops is increasing. Field studies were initiated in 2011 at WSU-Prosser and in Ontario, OR (Dr. Joel Felix, OSU) to determine the effects of simulated glyphosate drift on onions.

Glyphosate was applied at six doses (0.0077, 0.023, 0.077, 0.26, 0.39, and 0.77 lb ae/a) at flag leaf, 2-leaf, 4-leaf, and 6-leaf stages of onion growth. Data is being collected on onion injury symptoms, growth, shikimic acid accumulation (1 wk after application), onion yield and size grades, onion bulb centeredness (single versus multiple centers).

Initial data indicates onions are much more tolerant of low dose applications of glyphosate at the 6-leaf stage than at earlier stages of application. The top three glyphosate doses applied at the earlier stages of onion growth are unlikely to have any marketable onions to harvest. Data collected from the two studies will provide onion producers information on onion injury symptoms and expected outcomes from glyphosate drift incidents. Shikimic acid, which accumulates rapidly in plants following glyphosate application, can potentially be used as a diagnostic tool to verify that glyphosate drift occurred and to help predict the extent of onion injury and effects on onion yield from a drift incident.

Weed control in organic onions with mustard seed meal.

Research conducted in 2008-2010 on commercial organic onion fields using mustard (Sinapis alba) seed meal (MSM) for weed suppression will be published in the next issue of Weed Science journal in August. Preprint copies are available now. For copies of the article contact Rick Boydston (rick.boydston@ars.usda.gov or call 509 786-9267).
Onion Entomology Research

Thrips IPM – Onions in Oregon
Silvia I. Rondon, Extension Entomologist Specialist
Oregon State University, Hermiston Agricultural Research and Extension Center

Onion is an economically important crop in the United States with an annual farm gate value of $1 billion. Close to half of the US production (bulb and seed) comes from the western region of the U.S. Onions are one of the top ten commodities in Oregon. Other major onion production regions: Colorado, New Mexico, Texas, Wisconsin, Michigan, New York, Georgia.

There are three major thrips pests of onion: onion thrips, western flower thrips, and tobacco thrips. In OR, the onion thrips is the most abundant in onion fields (98% onion thrips; 2% western flower thrips).

Thrips Management

Monitoring: Monitor thrips adults and larvae by beating or shaking leaves onto a sheet of paper or a beating tray or sheet. Adult thrips can also be monitored using bright yellow sticky cards. Blue sticky traps are most effective for capturing western flower thrips, but thrips are harder to discern on this darker background.

Biological Control: Predatory thrips and other beneficial insects and mites, including minute pirate bugs and predaceous mites help to control plant-feeding thrips species. Certain predators and parasites of thrips are produced commercially and can be purchased through the mail. In intensive agriculture, releasing purchased natural enemies in most situations is unlikely to provide satisfactory pest control.

Cultural Control: Thrips-transmitted Iris yellow spot virus (IYSV), first found in the Treasure Valley of Idaho in the early 1990s, has spread rapidly across the western United States since 2000 and is causing economic impact on both seed and bulb onion production. Current management tactics for IYSV outbreaks are limited to certain cultural practices. Some suggestions include avoiding planting susceptible plants and avoiding planting near weeds that can serve as alternate hosts of certain thrips. Healthy plants normally outgrow thrips damage; keep plants well irrigated, avoid excessive applications of nitrogen fertilizer, which may promote higher populations of thrips. Remove culls from fields.

Chemical Control: While viruses vectored by thrips such as onion thrips may cause plant loss, insecticide sprays are not recommended to prevent viruses because thrips are not killed fast enough to prevent the transfer of the virus to new plants. Most labeled insecticides perform poorly against onion thrips in onion. Reasons: tiny size, great mobility, hidden feeding behavior, and protected egg and pupal stages. Incorrect timing of application, failure to treat the proper plant parts, and inadequate spray coverage are also common mistakes that can influence the effectiveness of the chemical application.
Preliminary list of insecticide performance that control onion thrips, Hermiston, OR - Rating by Rondon

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lannate (methomyl)</td>
<td>2 pt/a</td>
</tr>
<tr>
<td>Assail (acetamiprid)</td>
<td>5.0 oz/a</td>
</tr>
<tr>
<td>Pennco M (methyl parathion)</td>
<td>2.0 pt/a</td>
</tr>
<tr>
<td>*Carzol (formetanate hydrochloride)</td>
<td>1 lb/a</td>
</tr>
<tr>
<td>Trilogy (Neem)</td>
<td>2.4 pt/a (1% v/v)</td>
</tr>
<tr>
<td>Warrior (lambda-cyhalothrin)</td>
<td>3.0 oz/a</td>
</tr>
<tr>
<td>Radiant (spinetoram)</td>
<td>8.0 oz/a</td>
</tr>
<tr>
<td>Surround (kaolinite)</td>
<td>20 lb/a</td>
</tr>
<tr>
<td>Movento (spirotetramat)</td>
<td>8.0 oz/a + MSO 0.25% v</td>
</tr>
</tbody>
</table>

* No label for Oregon

Research in Oregon

• Natural enemies
• Population dynamics of thrips
• Distribution of Iris yellow spot virus in eastern Oregon
• Population dynamics of Iris yellow spot virus in eastern Oregon
• Effect of overwintering sites on Iris yellow spot virus incidence
• Rotation of biopesticides
• Rotation of pesticides

Summary Results

• Onion thrips is the most prevalent species
• Onion thrips is present since early in the season
• Preliminary data show that onion fields planted next to overwintering onions, a potential source of onion thrips for the following season, did not increase the mean number of onion thrips per plant per week in the field planted adjacent to it. However, numbers of symptomatic leaves were higher in field planted next to overwintering onion plots (25%) as compared to the field planted on the bare area (4%). Leaves will be tested later this year to confirm this observation
• Biopesticides work better under low thrips pressure
• Conventional chemicals still work better at medium or high thrips pressure
Thrips Control in Onions
Tim Waters and Doug Walsh
Washington State University

Thrips can be a serious pest on a number of crops in the Columbia Basin. Several species of thrips have been found in the Columbia Basin, but the prevalent pest species on onion are onion thrips, \textit{Thrips tabaci} Lindemann, and Western flower thrips, \textit{Frankliniella occidentalis} (Pergande). Both species can negatively impact onion bulb size and storage stability. Where the two species differ is in their potential threat to onion crops. Onion thrips vector the devastating iris yellow spot virus making them the greater of two evils.

Section 18 Labels 2011
- Mvento (spirotremat) Section 18 for 2011. Label issues occurred. Full Federal Label expected for 2012. Translaminar, apply when populations are low. 5 fl. oz. per acre. Use penetrating non-ionic surfactant.
- Agri-Mek 0.15 EC (abamectin) Section 18 for 2011. 10-16 fl. oz. per acre. Use penetrating non-ionic surfactant.

Methods: For all thrips insecticide efficacy plots, unless otherwise specified applications are made with a CO2 backpack sprayer applying 30 gallons of water per acre at 35 psi. A non-ionic surfactant is used, a 0.25% volume, and the pH of the water is acidified to pH 6.0. Plots are evaluated 4 days after application by counting the number of adult and immature thrips on ten plants per plot. Data is analyzed using ANOVA and means separated using Fisher’s PLSD where \( p < 0.05 \).

![Chemigation Trial Onion Thrips 2011](image)

Figure 1. Evaluation of insecticides applied by chemigation for onion thrips control. Applications made using 0.1 inches of water. Evaluations done July 18, 2011, four days after the most recent application. \textbf{Mvento is not currently labeled for application in this manner.}
Figure 2. Evaluation of Various Insecticides Applied by Ground Application. Evaluations done July 18, 2011, four days after the most recent application. Tolfenpyrad is not currently labeled for use.

Figure 3. Evaluation of thrips populations to plots with different timing and forms of nitrogen application. These plots were treated with insecticides to manage thrips populations. Yields will be evaluated at the end of the season.

Funding and Materials for this work was provided by:
Rhizoctonia Seedling Blight of Onion and Pea Crops in the Columbia Basin

Lindsey du Toit, Washington State University; Tim Paulitz and Lyndon Porter, USDA ARS; and Phil Hamm, Oregon State University.

Problem: There have been increasing reports of problems with development of severely stunted patches of plants in onion bulb and pea crops planted in the Columbia Basin after incorporating cover crops such as wheat and barley (Fig. 1). The patches occur primarily when onion or pea seed is planted very soon after incorporation of a cover crop, with strips of the cover crop left between the rows of onion or pea to protect emerging seedlings against wind- and sand-blasting. Patches range from a few feet to >30 feet in diameter (Fig. 2). Stunted onion plants have sparse, short roots with a 'spear-tipping' effect (Fig. 3A). Roots may be slightly discolored, with more branching than normal. Affected pea plants have sparse, short roots, with sunken, red-brown lesions on the roots and hypocotyl.

![Fig. 1. Aerial, infra-red photo of an onion bulb crop with numerous patches of severely stunted plants.](image1)

![Fig. 2. A patch of stunted plants in an onion bulb crop.](image2)

![Fig. 3. Spear-tipping of onion roots (A); dark mycelium of *Rhizoctonia* on roots (B) and hypocotyl (C, magnified) of stunted onion seedlings.](image3)

Causal agent: Symptoms have been associated with *Rhizoctonia* species, in particular *R. solani* isolates from anastomosis groups AG-8 and AG-4. Affected roots usually have coarse, dark mycelium of the fungus visible microscopically (Fig. 3B and 3C). Symptoms can resemble injury from nematodes and *Pythium* spp. The dark *Rhizoctonia* mycelium is on the surface of roots so care should be taken not to wash roots prior to examination. Surface-sterilizing the roots can prevent the fungus from being detected.
**Contributing factors:** The over-riding factor associated with crops in which this problem is observed is the presence of significant decomposing plant material in the soil into which onion or pea seed is planted within a week or two of incorporating the previous crop. Cover crops are important in fields with sandy soils to prevent wind- and sand-blasting of onion and pea seedlings. *Rhizoctonia* colonizes the decomposing plant tissue, e.g., after incorporating the crowns and roots of cereal cover crops, resulting in a rapid increase ("flush") in inoculum of this pathogen. When onion or pea seeds germinate in the soil among the residues colonized by *Rhizoctonia* spp., the fungi feed on the roots and hypocotyls of the onion and seedlings. Similar symptoms have also been observed in corn crops in the Basin.

**Management options:** The problem does not appear to occur in the absence of significant decomposing plant material in the rooting zone of onion or pea seedlings. Dr. Tim Paulitz has investigated a similar phenomenon in cereal crops in the Palouse for many years. Their studies suggest that delaying planting of a crop for 3 to 6 weeks after spray-down and/or incorporation of residues of the previous crop could eliminate the problem. A longer duration may be needed in cold or dry soils because microbial degradation of residues is slower in cold and/or dry soils.

**Current research:** Research is in progress to assess fungicide seed treatments, broadcast fungicide applications, soil fumigation, timing cover crop incorporation prior to planting onion and pea crops, tillage, seed priming, selection of cultivars (screening for resistance), soil testing methods to predict the risk of patching, and other practices for reducing losses to this disease. Results in Table 1 are for a 2011 field trial in which we evaluated banded and incorporated applications of azoxystrobin (Quadris) applied over the bed just prior to planting onion seed.

**Table 1. Evaluation of banded applications of Quadris over the bed just prior to planting onion seed, for management of stunting caused by *Rhizoctonia* spp.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cumulative area of patches/plot (ft²)</th>
<th>Number of patches</th>
<th>Severity of patches (0 to 3 scale)</th>
<th>Patch index (area x severity rating)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>949 a</td>
<td>35 a</td>
<td>1.89 a</td>
<td>1,990 a</td>
</tr>
<tr>
<td>Quadris at 9.5 oz/acre</td>
<td>382 b</td>
<td>17.3 b</td>
<td>1.53 b</td>
<td>487 b</td>
</tr>
<tr>
<td>Quadris at 19.0 oz/acre</td>
<td>303 b</td>
<td>15.3 b</td>
<td>1.46 b</td>
<td>379 b</td>
</tr>
</tbody>
</table>

Both rates of Quadris significantly reduced the area of patches by ~60%, number of patches by ~60%, and severity of patches by ~20%. The effects were not significantly different (*P < 0.05*) for 9.5 vs. 19.0 oz/acre rates of Quadris application.

**Funding & other support:** Funding has been provided by the WA State Commission on Pesticide Registration (2010) and the WSDA Specialty Crop Block Grant (2011-2013), with significant in-kind support from grower-cooperators, and product donations from cooperating seed and chemical companies. We are also collaborating with Drs. Trevor Wicks and Simon Anstis, Plant Pathologists with the South Australian Research and Development Institute, who have documented significant losses associated with *Rhizoctonia* in onion crops following wheat crops in south Australia.

*Please contact Lindsey du Toit (duoit@wsu.edu or 360-848-6140) with your comments and recommendations.*
Development of a DNA Macroarray for Rapid Detection and Differentiation of Onion Bulb Rot Pathogens

Brenda K. Schroeder, Lindsey J. du Toit, Cheryl Armstrong, Jodi Humann and Sowmya Ramachandran, Dept. of Plant Pathology, Washington State University

Development of a DNA Macroarray: Correctly determining the causal agent(s) associated with a particular case of onion storage rot can be time-consuming and labor-intensive because of the multitude of pathogens that may be involved. Accurate diagnosis is very important, however, if we are to suggest appropriate course of actions to stakeholders. Adding to the complexity is the fact that bulb infections are typically latent in nature at harvest and, thus, are not usually detected prior to storage.

To aid in the diagnosis of onion storage rot, we received funding from the USDA Western Regional IPM program and the USDA Specialty Crops Research Initiative to develop a DNA macroarray for onion bulb rot pathogens. The ultimate goal of this DNA-based tool is to enable identification and differentiation of the 11 bacteria, 14 fungi, and one yeast known to cause storage rots of onion bulbs. The project was initiated in 2010. The DNA macroarray should facilitate timely diagnoses of storage rots and, potentially, serve as a tool to test onion bulbs at harvest as a prediction of the risk of onion bulb rots in storage. This should enable stakeholders to make appropriate decisions regarding how long specific bulb lots should be stored, in order to minimize losses to storage rots.

Development Process: The macroarray development process entails 6 steps:

1) Obtain a diverse collection of the pathogens that cause onion storage rots from onion producing areas across the United States.
2) Use DNA sequencing of these pathogen isolates to identify regions of DNA unique to each pathogen, to facilitate differentiation of the target pathogens.
3) Design probes from the DNA sequences that will selectively bind to the targeted pathogens, if present in a bulb sample.
4) Spot the various pathogen probes onto an appropriate matrix (membrane) to allow simultaneous screening for all pathogens on a bulb sample using a single procedure.
5) Sample bulbs from fields and storage facilities to test the DNA macroarray to determine the presence/absence of storage rot pathogens.
6) Test the macroarray on bulbs sampled at harvest for predicting the risk of storage rots.

Figure 1: Whatman FTA card. Card will turn from pink to white when samples are added.
**Sampling procedure:** In order to avoid shipping whole bulbs for sampling purposes, a relatively new sampling procedure that involves the use of Whatman FTA cards (Figure 1) is under investigation. Sampling involves rubbing the cut surface of a bulb across the face of the card until the indicator (color) turns from pink to white. The card is then placed in a microwave oven at a high setting for 1 minute to render any pathogens on the card non-viable (Figure 2). The entire card can then be shipped via US mail to the WSU laboratory for the cost of a postage stamp. The DNA on the cards remains intact (Figure 3), and a subsample of the card can then be removed in the laboratory and processed for testing with the DNA macroarray.

![Image of petri dishes](image)

**Figure 2:** FTA card punches placed on growth media for 48 hours, which either did (A) or did not receive (B) microwave treatment. The absence of bacterial growth in the 3 plates on the left (A) demonstrates the bacterial pathogen was not viable after microwave treatment.

![Image of microwave treatments](image)

**Figure 3:** DNA amplified via polymerase chain reaction (PCR) assay from microwave-treated FTA cards.

**Progress:** Isolates are being collected from all over the United States for development of the DNA macroarray. Over the last year, 539 fungal and bacterial isolates have been collected, as shown below:

<table>
<thead>
<tr>
<th>State</th>
<th># of fungal isolates</th>
<th># of bacterial isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>GA</td>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>ID</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>MI</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td>NV</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>NM</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>WA</td>
<td>133</td>
<td>253</td>
</tr>
<tr>
<td>WI</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

To date, DNA from 245 isolates has been sequenced, and design of the probes for the target pathogens is in progress.

If you have questions regarding the DNA macroarray or would like to contribute any fungal, bacterial, or yeast isolates (or onion bulbs exhibiting storage rots), please contact the following:

Brenda Schroeder at bschroeder@wsu.edu or 509-335-5805 (tel)
Lindsey du Toit at dutoit@wsu.edu or 360-848-6140 (tel).
Vision Statement:
The long-term goal of this proposal is to develop, fully deploy, and evaluate a sustainable online information management platform called the Onion ipmPIPE (Onion Integrated Pest Management Platform for Extension and Education) to optimize sound pest management decision-making in specialty crops.

Objective 1: ipmPIPE Network Infrastructure and Operations:
- Validate scouting protocols for priority pests of onion system.
- Provide management tools to stakeholders that relate descriptive stages of plant growth to weather, pest and disease thresholds with timely management strategies.
- Enhance management resources to include an image gallery to aid in-field and laboratory identification of key diseases and pests which will be linked to a wiki-information tool.
- Add economic monitoring of onion crop markets to help stakeholders make more timely and informed decisions for crop production and pest management.
- Assess the adoption level of these tools and resources used by growers, advisors and other key stakeholders.

Objective 2: Innovative Pathogen Diagnostic Development and Validation:
Develop and enhance a DNA macroarray detection method for bacterial diseases, viruses, and fungal pathogens affecting onions in the field and storage.

DNA Macroarray Design and Implementation
- Sequencing and Data Mining
- DNA Macroparray Design
- Print DNA Macroarray
- Hybridization
- Hybridization Analysis and Diagnosis
- Modified from Zhong et al., 2008

Objective 3: Incorporation of Disease Risk Decisions with Economic Justification:
Economic, Social and Environmental Benefits:
The real-time price discovery tool for specialty crop commodities will help onion stakeholders make more timely decisions in relation to disease and pest management options and strategies. This scalable commodity component will enhance the overall utility and economic value of the ipmPIPE to specialty crop stakeholders, and sustainability of production and pest management systems throughout the USA.

Stakeholder Engagement:
Producers and other onion industry stakeholders have been involved with the development of regional and national Pest Management Strategic Plans; dialogue between specialists and commodity groups at the state, regional and national levels and the ipmPIPE Steering Committee members contributed to development of the project. The Advisory Committee (listed below) oversees the project and provides critical feedback throughout the duration of the project.

ADVISORY COMMITTEE:
- Wayne Minter, Executive Secretary of the National Onion Association
- Bill Dean, Board Member with Pacific Northwest Vegetable Association
- Paul Ruzicka, Chairperson, New York State Onion Industry Council
- Morgan Roeder, President, Utah Onion Association
- Robert Sakata, Onion Grower and President of the Colorado Onion Association