AGENDA & REPORTS

January 27, 2021

North Star Lanes
400 Prosser Place
Antigo, WI 54409
Wisconsin Seed Potato Improvement Association, Inc.
61st Annual Meeting Agenda
January 27, 2021
North Star Lanes, 400 Prosser Ave., Antigo or Virtual Via Zoom

12:30 p.m. Introduction and Welcome by Jeff Fassbender, President

Certification Program Reports

12:35 p.m. Renee Rioux, Administrative Director WSPCP
  • Certification Program Updates & Future Strategy
1:00 p.m. Alex Crockford, Program Director WSPCP
  • Program Outlook
  • Program Budget
  • State Farm Updates
1:25 p.m. Amanda Gevens, UW Plant Pathology
  • Potato Mop Top Virus Update

State Farm Reports

1:35 p.m. Matt Cogger, Field Operations Specialist
  • State Farm Report
1:45 p.m. Clover Spacek, Inspector
  • Post Harvest Test Report

2:00 p.m. BREAK

Guest Speakers

2:15 p.m. Eric Cooley, Co-Director of Discovery Farms
  • Discovery Farms: What We Do
2:30 p.m. Cole Lubinski, LARS Manager and Kevin Gallenberg, AgSource Laboratories
  • Langlade County Ag Research Station Update
  • Lime Study - Results from 2020 and Plans for 2021
2:45 p.m. Jeff Endelman, UW Horticulture
  • Creating a New Paradigm for Potato Breeding Based on True Seed
3:10 p.m. Dan Heider, UW Horticulture
  • Influence of 2,4-D Application Timing and Potato Cultivar on Color Enhancement in Red Potatoes
3:35 p.m. Tamas Houlihan, WPVGA Executive Director
  • WPVGA Update
3:50 p.m. Brooke Babler, Research Specialist, WSPCP
  • Tissue Culture & Diagnostics Lab Updates

Annual Business Meeting
4:00 p.m. Consideration of January 29, 2020 Annual Meeting Minutes
  • Review and Approval of Treasurer’s Report - Jeff Suchon
  • Committee Reports
    Promotion and Marketing - Matt Mattek
    Regulatory - Roy Gallenberg
    Advisory - JD Schroeder
  • Old Business & New Business
    Election of New Board Member
    Leadership Award Presentation & Recognition of Outgoing Board Member
  • Adjourn
COCKTAILS & DINNER WILL FOLLOW THE MEETING.
COCKTAILS @ 4:30 PM, DINNER @ 5:30 PM

GOLDRUSH SPONSOR
Gowan USA
Insight FS
Kretz Truck Brokerage LLC
Nichino America-Torac Insecticide
Nutrien Ag Solutions-Great Lakes
Swiderski Equipment, Inc.
Syngenta Crop Protection
Volm Companies

SILVERTON SPONSOR
AMVAC Chemical Corp.
Bio-Gro
Riesterer & Schnell, Inc.
Roberts Irrigation Company, Inc.
Southside Tire Co., Inc.
T.I.P., Inc. / Ag Grow Solutions

SUPERIOR SPONSOR
AgCountry Farm Credit Services
AgSource Laboratories
BASF
Big Iron Equipment, Inc.
BMO Harris Bank
Chase Bank
Jay-Mar, Inc.
Rural Insurance Co. – Antigo
TH Agri-Chemicals, Inc.
Warner & Warner, Inc.
SEED ANNUAL MEETING
JANUARY 27, 2021
12:30 PM

Join Zoom Meeting
https://uwadison.zoom.us/j/95010058392?pwd=MTIKRFuRFhF2tHcEYrRlpZbUZLUT09

Meeting ID: 950 1005 8392
Passcode: 812193
One tap mobile
+13017158592,,95010058392#,,,,0#,,812193# US (Washington D.C)
+13126266799,,95010058392#,,,,0#,,812193# US (Chicago)

Dial by your location
+1 301 715 8592 US (Washington D.C)
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)
+1 253 215 8782 US (Tacoma)
+1 346 248 7799 US (Houston)
+1 669 900 6833 US (San Jose)
Meeting ID: 950 1005 8392
Passcode: 812193
Find your local number: https://uwadison.zoom.us/u/ad3rmzm7wN

Join by SIP
95010058392@zoomcrc.com

Join by H.323
162.255.37.11 (US West)
162.255.36.11 (US East)
115.114.131.7 (India Mumbai)
115.114.115.7 (India Hyderabad)
213.19.144.110 (Amsterdam Netherlands)
213.244.140.110 (Germany)
103.122.166.55 (Australia)
149.137.40.110 (Singapore)
64.211.144.160 (Brazil)
69.174.57.160 (Canada)
207.226.132.110 (Japan)
Meeting ID: 950 1005 8392
Passcode: 812193
WSPIA Annual Meeting
Minutes
January 29, 2020
North Star Lanes, Antigo, WI

Meeting called to order by WSPIA President Dan Kakes at 12:30 pm

Introduction and Welcome by Dan Kakes

Certification Program Reports

Renee Rioux, Administrative Director WSPCP

- Certification Program Updates and Future Strategy
  - State Terminology Updates, a number of states are starting to change field year terminology to become more succinct.
  - True Potato Seed, increasing interest, still only in research thus far.
  - Changes Coming to Seed Certification, modernizing certification, direct tuber testing.
  - Dickeya – detected in surface water in Maine; current research shows Dickeya not spread by seed cutting.
  - Tissue Culture Lab Updates.

Alex Crockford, Program Director WSPCP

- Program Outlook
  - Finish refurbishing Spudnik Dry Grader/Eliminator, pivot controller upgrade, back up power to greenhouse complex.

- Program Budget
  - Seed price same as last year.

- Seed Certification Updates
  - ELISA testing alongside visual readings, direct tuber testing.

State Farm Reports

Keith Heinzen, State Farm Manager

- State Farm Reports
  - Excellent growing year at State Farm, good quality crop this fall. Big year for infrastructure and updates at State Farm.

Clover Spacek, Inspector

- Post-Harvest Test Results
- Very slow start to Atlantics. Snowdens grew great this year. Superiors were very troublesome. There was a high amount of rainfall this year.
- This year had an uptick in virus, as compared to last year and historical trends.

**Guest Speakers**

**Chuck Bolte, GPS/NMP Manager, AgSource Laboratories**

- Edge of field monitoring stations; soil structure will play a huge role in runoff during non-frozen soil part of year. Higher pH, higher biological activity in the soil. Lined up funding for a third edge of field monitoring station.

**Cole Lubinski, LARS Manager**

- Cole’s first year as LARS Manager went well; all test plots were planted and harvested. Was able to use new hardhose that the Seed Board donated this summer; Cole said it worked as well as he could have imagined. Looking forward to 2020 growing season; any test plots are welcomed at LARS.

**Amanda Gevens, UW Plant Pathology**

- Amanda gave an overview of current disease management. She specifically talked in detail about the current status of common scab. Amanda will continue to have a common scab trial at LARS. She also gave information about different products and efficacies for common scab.

**Tamas Houlihan, Executive Director, WPVGA**

- Tamas stressed that with Governor Tony Evers and his new administration that a very large focus will be placed on water quality in Wisconsin. He also gave an overview of another stressful year for potatoes which include: all time precipitation records, cold wet spring, heavy overcast growing days, excessive heat in September, and of course an extremely wet fall harvest.

**WSPIA Annual Business Meeting was called to order by President Dan Kakes**

- Consideration of January 30, 2019 Annual Meeting Minutes
  - M/S/P Jim Mattek and Jeff Suchon: To Approve
- Review and Approval of the Treasurer’s Report – Matt Mattek
  - Ending Balance as of 12/31/2019 – $38,014.06
  - M/S/P Charlie Mattek and Mike Shafel: To Approve
- Promotion and Marketing Report – Jeff Fassbender
  - Ending Balance as of 12/31/2019 – $8,878.93
  - M/S/P James Spychalla and Eric Schroeder: To Approve
- Regulatory – Roy Gallenberg - Issues were covered in the Annual Meeting.
- Advisory – J.D Schroeder – Issues were covered in the Annual Meeting.
• Old Business – None

• New Business
  
  o Election of new board member
    ▪ Jim Mattek nominated Jeff Suchon to be the new WSPIA board member. This was seconded by John Mattek: M/S/P To approve
  
  o Dan Kakes was selected to receive the Leadership Award for his service and commitment to the Seed Potato industry. This year Dan was integral in getting many key positions filled in the potato industry. He also was lead point on making sure the State Farm would get another person hired to follow in Keith Heinzen’s role. Along with that he was part of hiring Dr. Renee Rioux, the new Administrative Director, and Cole Lubinski the new LARS Manager. The board also thanked Dan Kakes for his service as President on the Seed Board and presented him with a plaque.

• Adjourn
  
  o M/S/P Ron Krueger and Aaron Kakes: To adjourn

Dan Kakes called a short WSPIA Board meeting to order to elect new positions

• Jeff Fassbender for new WSPIA Board President
  
  o M/S/P Roy Gallenberg and J.D. Schroeder: To Approve

• J.D Schroeder for WSPIA Board Vice President
  
  o M/S/P Roy Gallenberg and Jeff Fassbender: To Approve

• Jeff Suchon for WSPIA Board Secretary/Treasurer
  
  o M/S/P Roy Gallenberg and Matt Mattek: To Approve

• Jeff Fassbender appointed Matt Mattek as Promotions Committee Chairman

• Jeff Fassbender declared the meeting Adjourned.
WISCONSIN SEED POTATO IMPROVEMENT ASSOCIATION
STATEMENT OF REVENUE AND EXPENSES
JANUARY 1 - DECEMBER 31, 2020

BALANCE AS OF DECEMBER 31, 2019: $38,014.06

REVENUE

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spud Seed Classic Golf &amp; Dinner</td>
<td>$10,720.00</td>
</tr>
<tr>
<td>Spud Seed Classic Golf Donations</td>
<td>$19,745.00</td>
</tr>
<tr>
<td>Seed Annual Meeting Donations</td>
<td>$ 7,100.00</td>
</tr>
<tr>
<td>Interest Earned</td>
<td>$ 8.29</td>
</tr>
<tr>
<td><strong>TOTAL REVENUE</strong></td>
<td><strong>$37,573.29</strong></td>
</tr>
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</table>

EXPENSES

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Meetings</td>
<td>$137.70</td>
</tr>
<tr>
<td>Office Supplies</td>
<td>$136.39</td>
</tr>
<tr>
<td>Postage and Mailing</td>
<td>$88.50</td>
</tr>
<tr>
<td>Plaques for Board</td>
<td>$126.00</td>
</tr>
<tr>
<td>Seed Annual Meeting</td>
<td>$3,016.72</td>
</tr>
<tr>
<td>Spud Seed Classic Golf Outing</td>
<td>$15,724.26</td>
</tr>
<tr>
<td>Administrative Fees</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Miscellaneous Expenses</td>
<td>$1,460.00</td>
</tr>
<tr>
<td>Filing Fee for Wis. Non-Stock Corporation Annual Report, Christmas Gifts to Tamas, Karen, Julie, Dana, Joe, Jane, Doug &amp; Dale, Memorials or Plants for Funerals</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL EXPENSES</strong></td>
<td><strong>$21,689.57</strong></td>
</tr>
</tbody>
</table>

NET REVENUE (EXPENSES) $15,883.72
DECEMBER 31, 2020 ENDING BALANCE $53,897.78
WISCONSIN SEED POTATO IMPROVEMENT ASSOCIATION
WPVGA PROMOTIONS ACCOUNT - SEED PROMOTION FUNDS
STATEMENT OF REVENUE AND EXPENSES
JANUARY 1 - DECEMBER 31, 2020

BALANCE AS OF DECEMBER 31, 2019: $8,878.93

REVENUE
WPIB Funding for July 1, 2020 - June 30, 2021 Fiscal Year $41,799.98
Income from Seed Directory Ads $ 5,975.00
Sale of Disorder Charts $ 85.00
Interest Earned $ 0.86
TOTAL REVENUE $47,860.84

EXPENSES
Advertising $12,070.85
- Badger Common'Tater - $10,670.85
- WPVGA Buyer's Guide - $300.00
- Spudman Buyer’s Guide - $200.00
- NPC Stat Yearbook - $900.00
Nov. 2020 Mailing of CT Seed Issue to all Growers & Handlers $7,000.00
2020 Wisconsin Seed Potato Directory $5,656.33
   Includes Printing 6,000 Copies, Mailing 4,844 Copies & Commission on Ad Sales
Feb. 2020 Grower Ed Booth Space & Portion of Reception in Stevens Point $3,224.50
2020 Potato Expo in Las Vegas $9,250.13
2021 Potato Expo in TX $2,255.00
Website Hosting and Maintenance $653.50
Booth, Directors & Offices, Crime Bond & Cyber Liability Coverage on WPVGA’s Insurance Policy $391.00
Seed Tote Bags & Decals $1,572.79
Miscellaneous Expenses $3,700.00
   Sponsorship for Relay for Life
   Donation towards trailer at Rhinelander State Farm
   Donation to put logos on apparel for Antigo Bowling Team
TOTAL EXPENSES $45,774.10

NET REVENUE (EXPENSES) $ 2,086.74
BALANCE AVAILABLE AS OF DECEMBER 31, 2020 $10,965.67
Certification Program Updates & Future Strategy

WSPIA Annual Meeting
January 27, 2021
Renee A. Rioux
Assistant Professor, UW-Madison Dept. of Plant Pathology
Administrative Director, Wisconsin Seed Potato Certification Program
National Certification Updates

• NPC Seed Certification Annual Meeting
  • Dec. 2, 2020 (Virtual)

• PAA Seed Certification Section Annual Meeting
  • Dec. 3, 2020 (Virtual)

• Industry reports
• Regulatory updates
• Research highlights
Industry Reports

• Very good conditions in most states
  • Exception = drought in Northeast

• Seed acreage increased nationally

• Post-harvests tests different for most states
  • Many in FL
  • A few remain in HI
  • Increasing greenhouse testing

<table>
<thead>
<tr>
<th>State</th>
<th>Acreage Change from 2019 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>+5.76</td>
</tr>
<tr>
<td>ID</td>
<td>+0.08</td>
</tr>
<tr>
<td>ME</td>
<td>-4.2</td>
</tr>
<tr>
<td>MI</td>
<td>-2.9</td>
</tr>
<tr>
<td>MN</td>
<td>-6.42</td>
</tr>
<tr>
<td>MT</td>
<td>+4.6</td>
</tr>
<tr>
<td>NE</td>
<td>+10.5</td>
</tr>
<tr>
<td>ND</td>
<td>+11.6</td>
</tr>
<tr>
<td>OR</td>
<td>+15.4</td>
</tr>
<tr>
<td>WA</td>
<td>0.0</td>
</tr>
<tr>
<td>WI</td>
<td>+0.7</td>
</tr>
<tr>
<td>Total</td>
<td>+6.4</td>
</tr>
</tbody>
</table>

Data presented by Nina Zidack, 2021 NPC Seed Certification Meeting
Regulatory Updates: Pale Cyst Nematode

Idaho Eradication

• 400 acres of associated fields released since 2018
• 1,897 acres eligible to return to potato production

CAN/US PCN Guidelines

• US completing public consultation process
• Continued process to amend 4-year crop exemption→3-year crop exemption
Regulatory Updates: Golden Nematode (NY)

- Quarantine areas in 8 counties
  - Western NY
  - Long Island

- 101,955 acres regulated
  - Removal of 45,562 acres in Suffolk County 5,945 acres remain infested
  - >1 million acres deregulated since 2010
Regulatory Updates: Potato Wart (CAN)

• Surveillance ongoing in PEI and Newfoundland
  • Export
  • Regulatory

• Detections from two PEI fields in 2020 as part of ongoing surveillance
  • Two fields, same farm
  • Resting spores in soil
  • No infested/symptomatic tubers

• Halt on seed potato export to US
  • No seed from the infected area shipped to US in the past four years

Potato Wart
• Fungal pathogen
• Forms long-lived resting spores in soil
• USDA Select Agent
  • Zero-tolerance
Regulatory Updates: Necrotic Virus Management Plan

• Last updated in 2004

• Focus on tuber necrotic viruses
  • PVY
  • Potato Mop Top Virus
  • Tobacco Rattle Virus
  • *Alfalfa Mosaic Virus* (2004 only)

• APHIS reviewing 2019 revision provided by industry with consideration of export markets
  • Some concern about increased tolerances
  • Next steps are comments to industry then review by CFIA

• Unlikely to see implementation in 2021
PMTV & TRV

**Potato Mop Top Virus**
- Soil-borne
- Vectored by the powdery scab pathogen
- Foliar symptoms rare
- Controlled by:
  - Clean seed
  - Powdery scab management
  - Sanitation

Photos from Neil Gudmestad, NDSU

https://blogs.cornell.edu/potatovirus/

**Tobacco Rattle Virus**
- Corky ringspot, spraing
- Vectored by stubby root nematodes
- Broad host range
- Foliar symptoms rare
- Controlled by:
  - Certified seed
  - Avoidance of ornamentals
  - Soil testing & nematode management

https://hort.extension.wisc.edu/articles/corkyringspot
# Regulatory Updates: Necrotic Virus Management Plan

- Removal of Alfalfa Mosaic Virus
- Internal & external necrosis scored
- Increased tolerances for commercial use
- Pre-harvest clearance

<table>
<thead>
<tr>
<th>Internal and External Tuber Necrosis</th>
<th>Seed Intended for Recertification</th>
<th>Seed Intended for Commercial Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal to 0.5%</td>
<td>Eligible</td>
<td>Eligible</td>
</tr>
<tr>
<td>Above 0.5%, but less than or equal to 2.0%</td>
<td>Eligible if lab tests or symptomatic tubers for PVY, PMTV, or TV is less than or equal to 0.5%</td>
<td>Eligible</td>
</tr>
<tr>
<td>Above 2.0%, but less than or equal to 5.0%</td>
<td>Not eligible</td>
<td>Eligible if lab tests or symptomatic tubers for PVY, PMTV, or TV is less than or equal to 5.0%</td>
</tr>
<tr>
<td>Over 5%</td>
<td>Not eligible</td>
<td>Not eligible</td>
</tr>
</tbody>
</table>

Notes:
1. Some diseases may be present in a seed potato lot and not exhibit symptom expression in plants or tubers at the time of a regular inspection
2. Internal tuber necrosis will be calculated as percent incidence \( \frac{\text{(number of tubers with internal necrosis/number of tubers samples)}}{100} \)
Regulatory Updates: Necrotic Virus Management Plan

Pre-clearance of seed lots

- Collect 2 x 200 tuber samples at harvest
- Hold in storage at least two months
- Inspect one 200 tuber sample
- If tolerances exceeded, check second sample
- If the average exceeds tolerances, submit to Certification Program for follow-up testing

Additional 2 x 200 tuber samples taken at harvest

Different shipping point process if not pre-cleared
National Research Updates: PVY (Dr. Alex Karasev, U. of Idaho)

- Potato Virus Y
  - Strain composition continues to change
  - Decreasing PVY₀, increasing recombinant strains
  - Data from Pacific NW

- National necrotic virus grant funded
  - Groves & Rioux as collaborators
  - Field demos in 2022
National Research Updates:
Dormant tuber testing

• Vision 2025 poll
  • Desire for good info, faster and without additional cost

• Research on sampling methods & throughput
  • Cornell over 23,000 data points for sampling site
  • On-farm sampling tested
  • Optimizing for PVY, TRV, and PMTV
National Research Updates: Dormant Tuber Testing

• Two methods currently under evaluation:
  • FTA card (Jason Ingram, Cornell)
  • Immunocapture (Dr. Nina Zidack, Montana)

• Primary concerns are:
  • Variability with high virus
  • Cost
  • Fit with PHT
  • Detection method

Jason Ingram, Cornell University

MSU – Fall 2018 Newsletter
http://montanaspud.org/newsletters.html
National Research Updates: *Dickeya*

• National project led by Dr. Gary Secor (North Dakota State University & Dr. Amy Charkowski (Colorado State University))

• Highlights:
  • Detection methods (Dr. Gary Secor, NDSU)
  • Strain diversity (Dr. Jay Hao, UMaine)
  • Prevalence in water (Dr. Jay Hao, UMaine)
  • Spread through seed cutting (Dr. Gary Secor)
  • Host resistance (Dr. Adam Heuberger, CSU)
National Research Updates: *Dickeya* detection

- Standardized testing procedure
  - >3/16 subsamples indicates higher risk
- Not zero-tolerance pathogen
- Risk associated with:
  - Environment
  - Generation
  - Incidence

---

Gary Secor, NDSU – EAPR Pathology and Pests Symposium, Sept. 3, 2019
WSPCP Updates: Tissue Culture Lab

• Relocation likely in next year
  • COVID-related delays

• Relocation study completed and quote generated

• Initial consult with APHIS on BRR accreditation
  • Possibly in place by next harvest
  • COVID-dependent
WSPCP Updates: Tomato Spotted Wilt Virus

- TSWV detected in state farm greenhouses in spring/summer 2020
  - A small number of infected FY1 plants also identified
TSWV

• Global distribution
• >1,000 hosts
• Vectored by thrips
  • Insecticides are effective
• Primarily a greenhouse pathogen
• Finds in potato fields are rare
  • Associated with increased thrips presence
  • Does not increase over generations

http://blogs.cornell.edu/livegpath/gallery/potatoes/tomato-spotted-wilt-virus-tswv/; Frank Peairs, Colorado State University, Bugwood.org
TSWV Response

• Consultation with experts
  • UW-Madison: Drs. German, Groves, Gevens
  • National: Other seed states
  • International: Dr. Calum Wilson (Australia)

• All indications for risk are low
  • Only WI tests for TSWV
  • No indication of spread in-field
  • Poor environment for TSWV/thrips
  • Infected plants perform poorly
Future Strategy & Research
Research

Biology & epidemiology of potato soft rot pathogens

*Water testing for soft rot bacteria starting in spring/summer 2021*

Applications of beneficial microbes in seed potato propagation systems

Host-pathogen interactions between potato and powdery scab pathogen

Evaluation & development of detection methods for seed potato pathogens

Acknowledgements

Rioux Lab
Jenna Rach
Jack Knoke
Smita Shrestha
José Gallego Sanchez
Lily Buccholz
Kutay Ozturk
Ana Maria Vazquez-Catoni

WSPCP
Alex Crockford
Andy Witherell
Brooke Babler
Clover Spacek
Dianna Kessler
Cole Lubinski
Keith Heinzen
Matt Cogger
Joshua Kunzman
Bob Arndt
Jim Meyer

UW-Madison
Amanda Gevens
Russell Groves

Funding
UW-Madison OVCGRE
Dept. of Plant Pathology
WPVGA
USDA-Hatch
USDA-SCBG

Contact:
rriox@wisc.edu
608-358-5101
@renee_rioux
Let your motto be, good seed, true to name and type, free from varietal mixture and from disease, and all the other good things of life will be added unto you.

William Stuart, USDA researcher, 1913

WSPIA Annual Meeting 2021

Alex Crockford, Program Director
UW-Madison, Department of Plant Pathology
Wisconsin Seed Potato Certification Program

January 27, 2021
Outline

• Certification Program Trends
• Program Pectobacterium & Dickeya Update
• TSWV Strategy & Nuclear Program Updates
• Program Budget
• Program Outlook
• Introductions
• Post Harvest Test Strategies
• Work on Pathogen Detection
• Program Budget
• State Farm Updates
Post Harvest Test Changes

• Cooperator in Hawaii did not have land and COVID-19 concerns. Sent notice to end contract.

• The UW Bid process for bids of $50,000+ takes months

• Simple Bid Process on less acres
  • 2 vendors in Hawaii and 1 vendor in Florida

• Alger Farms, Homestead, FL was sole and lowest bidder.
## Post Harvest Testing Strategy 2020

<table>
<thead>
<tr>
<th>Florida Field (Visual &amp; ELISA)</th>
<th>Greenhouse Grown (ELISA)</th>
<th>Direct Tuber Tests (IC PCR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearly All Grower Lots</td>
<td>All State Farm Lots, some researcher lots, problem varieties, duplicate samples</td>
<td>Duplicate Samples on larger lots &gt;50 acres</td>
</tr>
<tr>
<td>200 or 400 tuber samples planted in the field in Homestead, FL</td>
<td>200 or 400 tuber samples planted in greenhouse trays, 50 tubers per tray at West Madison Research Station, green leaflets tested</td>
<td>400 tubers tested as 10 tuber composites with formula derived result.Reported in lab results on Health Certificate and ELISA</td>
</tr>
<tr>
<td>495 samples (136 samples also ELISA)</td>
<td>83 lots (ELISA Results only)</td>
<td>40 samples tested</td>
</tr>
<tr>
<td>Results reported as VISUAL &amp; LAB when tested</td>
<td>Results reported as LAB</td>
<td>Results reported as LAB</td>
</tr>
</tbody>
</table>
### ELISA/IC-PCR Testing a Tool Alongside Visual Readings

<table>
<thead>
<tr>
<th>Year of Testing</th>
<th>Number of Lots tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY2014</td>
<td>78</td>
</tr>
<tr>
<td>CY2015</td>
<td>140</td>
</tr>
<tr>
<td>CY2016</td>
<td>300</td>
</tr>
<tr>
<td>CY2017</td>
<td>420</td>
</tr>
<tr>
<td>CY2018</td>
<td>490</td>
</tr>
<tr>
<td>CY2019</td>
<td>500</td>
</tr>
<tr>
<td>CY2020</td>
<td>280</td>
</tr>
</tbody>
</table>

- **Foundation**
- **Certified**
- **Rejected**

Percentage of Lots (%) vs. Certification Year

Future Post Harvest Testing Plans

- Rebid for a multi-year contract
- Have our own planter
- Visual Plots will remain important part for their inexpensive approach to PVY, PLRV, Mixture, and Blackleg ratings
Seed Size

ATCP 156.06 (3)(c)

“Each tuber shall be 1¾ to 2¼ inches in diameter and no more than 2½ inches long. The college shall plant the tubers in a winter growing location chosen by the college. The college shall inspect the potato plants and potatoes grown from those tubers for compliance with the standards under s. ATCP 156.03 (4) (a).”
Pectobacterium and Dickeya Updates

• Diagnostic methods
• Diagnostic tools
• Testing Outcomes
• Program Status
• Commercial Concerns
Current Pecto/Dickeya Diagnostic Program (Since 2018)

**Summer Inspections**
- During first inspection Blackleg is included in an official plant count. A minimum of 1000 plants are counted on small lots. Up to 5 disease plants are collected for diagnostic testing.
- Weekly these plants are tested with proven PCR primers.

**Winter Grow Out**
- During planting the plot, softrot ratings are noted. During the visual readings of the post harvest test, Blackleg is counted. Disease development is monitored.
Downclassing Lots for Excessive Blackleg

ATCP 156.03 (3)(b)1.

(b) The college may decline to certify a lot of seed potatoes if any of the following apply: 1. The planted or harvested lot is materially affected by a disease, pest infestation or condition, not identified in Table 1, which adversely affects the growth, quality or value of the seed potatoes. Note: For example, par. (b) 1. may include diseases, pest infestations and conditions such as late blight, soft rot, frostbite, slow emergence, missing hills or excessive weed growth.
Tomato Spotted Wilt Virus

- Weed control around greenhouses, alternative hosts
- Increased phytosanitary measures, thrips are vector
- Uniforms for picking staff
- Concrete floors in greenhouse
- Scouting Program
- Systemic Insecticide Program
- Testing
### Program Expenses (FY 2016-2021)

<table>
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<tr>
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<th>ACTUAL FY 16-17</th>
<th>ACTUAL FY 17-18</th>
<th>ACTUAL FY 18-19</th>
<th>ACTUAL FY 19-20</th>
<th>BUDGET FY 20-21</th>
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## Program Revenues 2019-2020

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<th>sf18 CY19</th>
<th>CY20</th>
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<tr>
<td><strong>SEED SALES</strong></td>
<td><strong>E-2 cwt @ avg price $30.00</strong></td>
<td><strong>E-2 cwt @ base price $30.00</strong></td>
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<tr>
<td><strong>Total CY19 crop</strong></td>
<td><strong>E-1 cwt @ avg price $50.00</strong></td>
<td><strong>E-1 cwt @ base price $50.00</strong></td>
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<td><strong>Pallets, minitubers &amp; credits</strong></td>
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<td><strong>9,360 A @ base fee/A = $40.00</strong></td>
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<tr>
<td><strong>WINTER TEST FEES 19</strong></td>
<td><strong>459 samples @ $220</strong></td>
<td><strong>360 samples dipped @ $60</strong></td>
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<td><strong>SEED SALES sf19 CY20</strong></td>
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<tr>
<td><strong>Total CY20 crop</strong></td>
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<td><strong>MISC.</strong></td>
<td><strong>Lab services, ghs inspections, res seed</strong></td>
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<td><strong>TOTAL INCOME</strong></td>
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<td><strong>$1,455,005</strong></td>
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- SEED SALES sf18 CY19: E-2 cwt @ avg price $30.00 - $163,054
- E-1 cwt @ avg price $50.00 - $354,609
- Pallets, minitubers & credits
- ACREAGE FEES 19: 9,360 A @ base fee/A = $40.00 - $354,609
- WINTER TEST FEES 19: 459 samples @ $220 - $131,200
- 360 samples dipped @ $60
- SEED SALES sf19 CY20: E-2 cwt @ base price $30.00 - $765,322
- E-1 cwt @ base price $50.00
- MISC. Lab services, ghs inspections, res seed - $40,820
- TOTAL INCOME - $1,455,005
# Program Revenues 2020-2021

<table>
<thead>
<tr>
<th>Description</th>
<th>CY20</th>
<th>CY21</th>
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<td>Pallets, minitubers &amp; credits</td>
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<td><strong>TOTAL INCOME</strong></td>
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Update on Potato Mop Top Virus in WI

Amanda Gevens
Chair, Professor & Extension Plant Pathologist
Dept. of Plant Pathology, Univ. of Wisconsin-Madison

Wisconsin Seed Potato Improvement Association Inc.
61st Annual Meeting 2021
January 27, 2021 – 1:25-1:35PM
Potato Mop Top Virus (PMTV)

- Originated in South America Andes Region
- Problematic in many countries around the world
- Transmitted either mechanically (lab) or by the powdery scab pathogen, *Spongospora subterranea*
- Complex virus with 3-part RNA genome
- Yellow mottling ‘mop top’ of leaves from seedborne infections (Europe and South America, rare in US)
- Spraying or internal tuber necrosis in tubers most damaging due to reduction in tuber quality (common in US)

(Foliar: http://www.dpvweb.net/dpv/showfig.php?dpvno=389&figno=01
Tuber: http://www.potatogrower.com/2014/03/a-growing-threat)
Potato Mop Top Virus (PMTV)


- Was confirmed in WI in late summer of 2020 from tubers grown in WI in 2019 and held in storage

- Surveys in 2009-2011 and ad hoc testing over past decade have not detected PMTV prior to this 2020 finding
Potato Mop Top Virus

- Infected seed tubers typically pass virus on to just ~40% of progeny tubers; complete virus not found in all parts of an infected plant
- Not known to reduce yield; symptoms can worsen in storage
- Controls:
  - Avoidance/Prevention through clean seed
  - Control powdery scab pathogen vector – plasmodiophorid or slime mold: *Spongospora subterranea*
Powdery scab

- Symptoms restricted to underground plant structures
- Causes three diseases
  - Tuber scab
  - Root dysplasia
  - Root galling
- Scab and galls increase pathogen population in soil
  - Primary: root galls

Root gall photo: W.R. Stevenson
History of Powdery Scab Incidence and Spread

1841
- Disease first reported in Braunschweig, Germany

1892
- Additional reports in Quito, Ecuador
  - Near origin of true potato

1911
- First reports in northeastern United States (US)
  - Shipments from Europe

Today – in US
- Not regulated by federal government
- Present in many states with growing concerns
- 2003: First Wisconsin report of powdery scab
- 2020: First Wisconsin report of PMTV from WI grown tuber

(Gau et al., 2013; DATPC Fact Sheet, Cooperative Extension Publication-UMaine)
• Pathogen diversity is limited:
  • Globally: 3 variants
  • North America: 1 variant

(Gau et al., 2013)
Powdery scab

- Significantly impacts appearance and quality of tubers resulting in economic losses
- Present in all potato-producing regions of the globe
- Once pathogen is established in the soil, it is persistent for greater than 10 years
- Some fields in WI are known to be infested, but still considered an emerging disease concern
- Few to no effective control measures
  - Some varietal resistance
  - Few fungicides, fumigants (fluazinam or Omega; chloropicrin)

Powdery scab

- Broad host range (nightshade family, goosefoot family, asters family, and others)

- Field contamination
  - Water and soil movement
  - Infected seed tubers

  - Overwintering structures are cystosori (spore balls)
  - Each spore ball is an aggregate of resting spores cysts with 200-1000 cysts

https://projects.ncsu.edu/cals/course/pp728/Spongospora/Spongospora_subterranea.htm
Potato Powdery Scab Disease Cycle

**Early Season**
- When conditions are ideal (high soil moisture and low temps), resting spores release primary swimming zoospores which infect roots and stolons.

**Late Season**
- Late-season infection of mature tubers and root hairs leads to lesion and root gall formation.
- Lesions and galls are filled with spore balls (sporospor), which hold numerous thick-walled resting spores.

**Powdery Scab Disease Cycle**
- Spore balls overwinter in soil, volunteer potatoes, and alternate hosts in the potato family.

**Winter**
- Infected seed

Clark & Gevens
Environmental Conditions Favoring Powdery Scab

- Wet, water-logging conditions
  - Zoospores require free water to swim to host
- Roots exudates
  - Metabolites
  - Low molecular weight compounds
- Cool Temperatures for infection
  - Tuber symptom development: 9-17°C
  - Root symptom development: 11-25°C
  (Thangavel 2015; van de Graaf 2007; Harrison et al. 1997)
- Soil type
- Active at broad range of pH 4.7-7.6

Top: Merz, 1997
Bottom two photos: Falloon et al., 2016
Powdery scab & PMTV Management

- Plant clean seed in non-infested soil
- Do not move infested soil (equipment, cull potato spreading)
- Select powdery scab tolerant varieties
- Limit soil moisture during tuberization
- Limit storage length for cultivars with tendency for tuber necrosis
- PCR-based seed and soil tests available for both pathogens
- No current certification standards
For more management information:

**Emergence and Prevalence of PMTV**
Dr. Julie Pasche, NDSU
February 2, 2021 2:30-3:00PM
WPVGA/UW Madison Div of Extension Virtual
Grower Education Conference
Growing Season Overview

- **Planting**
  - May 12th to June 9th 2020
  - Overall favorable conditions
  - Later start due to cool temperatures

- **Lots of Colorado Potato beetles**

- **High temperatures in early July**
  - Second set in some varieties
Harvest

- Replaced on harvester
  - Bearings
  - Chains and sprockets
  - Clutches
  - Rollers
  - Primary and vine webbing

- Air head tuning
  - Thanks to Roy Gallenberg and Loren Barske!
  - Improved separation
  - Able to operate in sub optimal conditions
Harvest

- Crop condition
  - Overall good quality
  - Air head tuning
  - Spudnik Eliminator
Amounts of major varieties
Farm improvements

- Drop nozzles on Zimmatic pivot
- Humidicel
- Three phase power to grading room
- Hard line to pivots
Thanks to

- Seed Board
  - Heartland trailer
  - Farm visit

- Hafner Farms
  - Grading line

- Jeff Suchon
  - Farm visit
  - Tour of Bushmans

- Gallenberg Farms
  - Harvester improvements
  - Farm visit
Post Harvest Test 2020

Return to Homestead, FL

Clover Spacek
Outreach Specialist
WI Seed Potato Certification Program
Alger Farms Inc is a family farm in Homestead, Florida that specializes in Fresh Winter Sweet Corn, Snap Beans, and Landscape Materials.
Winter Test Collection

Dormancy Break
Planting conditions were wet. This was followed by cooler than normal Florida temperatures in December and more wet weather.
Our plants on December 11, 2020
  23 days after planting

- Weekly Scout Reports in 2020 were a positive change.
Readings started January 3
48 days after planting

South end of field really struggled in growth.
Superior Through the Years
The Results

- **2020** –
  - **Foundation** – 73%
  - **Certified** – 25%
  - **Rejected** – 2%

- **2019** –
  - **Foundation** – 71.5%
  - **Certified** – 27.7%
  - **Rejected** – 0.8%

- **5-Year average**
  - **Foundation** = 78.18%
  - **Certified** = 20.74%
  - **Rejected** = 1.08%

- **3-Year average**
  - **Foundation** = 73.8%
  - **Certified** = 25.1%
  - **Rejected** = 1.1%
Visitors to the Field
Thank YOU! Thank YOU!

A Special Thank you to:

Josie and Dianna – For answering our questions from the field and for all the behind the scene work.

Brooke, Andy and The Lab - For the testing and retesting.
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<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Red Prairie</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Reveille Russet</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Russet Burbank</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Russet Norkotah</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Russet Norkotah Sel 8</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Russet Norkotah TX 296</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Silverton</td>
<td>27</td>
<td>13</td>
<td>4</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Snowden</td>
<td>21</td>
<td>6</td>
<td>3</td>
<td>11</td>
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<tr>
<td>Soraya</td>
<td>1</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Superior</td>
<td>18</td>
<td>11</td>
<td>0</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Umatilla Russet</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Vanguard Russet</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>W12078-76</td>
<td>1</td>
<td>1</td>
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<tr>
<td>W8893-1R</td>
<td>2</td>
<td>2</td>
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<td></td>
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<tr>
<td>W9433-1RUS</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>W9742-3RUS</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Waneta</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>White Pearl</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Yukon Gold</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>388</strong></td>
<td><strong>214</strong></td>
<td><strong>70</strong></td>
<td><strong>97</strong></td>
<td><strong>6</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>55%</th>
<th>18%</th>
<th>25%</th>
<th>2%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>284</strong></td>
<td>73%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Florida winter test plot results - Crop Year 2020

Lots from the following growers are not included in the compilation: State Farm, UW Potato Breeding Farm and Frito Lay

*The numbers above reflect individual lots and counts multiple samples from the same lot as one.
Table 6. Winter test plot results: number of lots meeting certification class tolerances between 1983 - 2020

<table>
<thead>
<tr>
<th>Crop Year</th>
<th>Foundation (%)</th>
<th>Certified (%)</th>
<th>Rejected (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>71</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>1984</td>
<td>71</td>
<td>28</td>
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<tr>
<td>1985</td>
<td>67</td>
<td>32</td>
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<tr>
<td>1986</td>
<td>79</td>
<td>20</td>
<td>1</td>
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<tr>
<td>1987</td>
<td>84</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>1988</td>
<td>81</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>1989</td>
<td>No Winter test completed due to freeze damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>75</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>1991</td>
<td>71</td>
<td>27</td>
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<tr>
<td>1992</td>
<td>73</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>1993</td>
<td>80</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>1994</td>
<td>Limited winter test data due to drownout of plot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>86</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>1996</td>
<td>83</td>
<td>17</td>
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<tr>
<td>1997</td>
<td>93</td>
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<td>1998</td>
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<td>0</td>
</tr>
<tr>
<td>1999</td>
<td>66</td>
<td>33</td>
<td>1</td>
</tr>
<tr>
<td>2000</td>
<td>74</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>2001</td>
<td>63</td>
<td>32</td>
<td>4</td>
</tr>
<tr>
<td>2002</td>
<td>67</td>
<td>31</td>
<td>2</td>
</tr>
<tr>
<td>2003</td>
<td>68</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>2004</td>
<td>83</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>2005</td>
<td>89</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>2006</td>
<td>77</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>73</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>2008</td>
<td>72</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>2009</td>
<td>85</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>94</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>89</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>87</td>
<td>12</td>
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</tr>
<tr>
<td>2013</td>
<td>74</td>
<td>21</td>
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<tr>
<td>2014</td>
<td>73</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>83</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>2016</td>
<td>86.8</td>
<td>11.6</td>
<td>1.6</td>
</tr>
<tr>
<td>2017</td>
<td>82.7</td>
<td>16.8</td>
<td>0.5</td>
</tr>
<tr>
<td>2018</td>
<td>76.9</td>
<td>22.6</td>
<td>0.5</td>
</tr>
<tr>
<td>2019</td>
<td>71.5</td>
<td>27.7</td>
<td>0.8</td>
</tr>
<tr>
<td>2020</td>
<td>73</td>
<td>25</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 7. Comparison of winter test plot results for crop year 2020 by year that the ancestral seed for the growers' lot originated from State Farm seed*

<table>
<thead>
<tr>
<th>Year</th>
<th>Clean</th>
<th>Other</th>
<th>Certified</th>
<th>Rejected</th>
<th>Total lots</th>
<th>Percent of all SF lots</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>4</td>
<td>2</td>
<td>17</td>
<td>0</td>
<td>23</td>
<td>10.6%</td>
</tr>
<tr>
<td>2019</td>
<td>44</td>
<td>23</td>
<td>38</td>
<td>2</td>
<td>107</td>
<td>49.3%</td>
</tr>
<tr>
<td>2020</td>
<td>10</td>
<td>22</td>
<td>55</td>
<td>0</td>
<td>87</td>
<td>40.1%</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>47</td>
<td>110</td>
<td>2</td>
<td>217</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Percent of all SF lots: 26.7% Clean, 21.7% Other, 50.7% Certified, 0.9% Rejected, 100%

Percentage of all lots that originated at the State Farm meet Foundation Class tolerances.

*Does not include lots from the State Farm that were sold from grower A to grower B, reselected by tuber units, or originating from other states.
Langlade Agricultural Research Station

Cooperative Extension

Wisconsin Potato & Vegetable Growers Association
and the People of Langlade County

COLE LUBINSKI
Research Trials

Early Blight/Late Blight Monitoring
(Amanda Gevens)

Predicting Risk for PVY Transmission – Timing Oil Applications
(Russ Groves)

Herbicide Efficacy Trial
(Dan Heider, Jed Colquhoun)

Alternative Crops for Wisconsin
(Jed Colquhoun)

RPE Physiology and Variety Evaluations
(Mike Copas)

pH Trial
(Kevin Gallenberg)

Cover Crop Trial
(Jamie Patton, Dan Marzu)

Clonal Garden
(UW State Farm)
Updates/Improvements

Future improvements
- Converting irrigation pipe to ring lock
- Gravel around the shed

Labor
- Unable to find part time help during the growing season
- Had multiple volunteers for harvest.
Virtual Field Day 2020

https://youtu.be/FvvKeJ1ff8E

Thursday
July 23
1PM-3PM
Thank You

Questions?
Objective: Trial PureSpray Green (PSG) in a season long trial and evaluate for control of Potato Virus Y, versus a competitive product.

Experimental design: This trial was conducted at the Langlade County Airport, northeast of Antigo, Wisconsin (45.156639, -89.113850) on a silt loam soil in 2020. Potato, *Solanum tuberosum* cv. ‘Silverton Russet’ B-size tubers were machine planted May 20. Four replicates of 5 plots were arranged in a randomized complete block design. Plots measured four rows (12 ft.) wide by 20 ft. long.

Treatments: This trial included one untreated check and 4 oil application programs employing a combination of an at-plant in-furrow and foliar applications. Oil programs included three rates of PureSpray Green (PSG, 0.5, 0.75, 1.0 gal/ac), and one rate of JMS Stylet Oil (0.75% v/v at 20 gal/ac). Treatments were applied using a CO₂ pressurized backpack sprayer equipped with a 6 ft. boom, operating at 30 psi and delivering 20 gal/ac through 4 flat-fan nozzles (Tee Jet XR 8002-VS) spaced 18 in. apart while travelling at 3.5 ft./sec. Oil applications were performed on a roughly 7-day interval in July, followed by a 5-day interval in August, totaling 11 applications. Complete treatment details are available in Table 1.

Plant health: All plots achieved high levels of emergence and no signs of treatment-related phytotoxicity or reduced plant vigor were observed. Plots were maintained according to standard commercial practices. A record of all maintenance activities is presented in Table 2.

Harvest. Oil applications are known to cause yield drag in potato so yield comparisons relative to control plots are relevant when evaluating treatment programs. The center two rows from each plot were harvested on Sep 29 to determine yield and tuber quality. Tubers were graded into A’s and B’s by size and weights were obtained for A’s, B’s, and culls. Damaged or unmarketable tubers were classified as culls.

Post-harvest grow-out. During harvest, undersize and B-size tubers were collected and sent to Florida for grow-out and PVY ratings. Tubers were planted on Nov 21, 2020 in Homestead, FL. Emergence and stand establishment varied somewhat between replicates and treatments, due in part to different numbers of tubers sent from the Antigo harvest, and due to blackleg affecting some parts of the field. Stand counts are shown in Table 4. PVY symptom ratings were performed on Jan 11 and 20, 2021, by Wisconsin Seed Potato Certification Program staff. Percent symptomatic plants are reported in Table 4.

Data analysis: Treatment main effects were determined using analysis of variance. Means separation letter codes were generated using Tukey’s HSD procedure (α=.05).

Results: Graphical summaries of the results are presented in this report. Additional numerical summaries and statistical tests are available in the supporting spreadsheet.
Table 1. Treatments

<table>
<thead>
<tr>
<th>Trt No.</th>
<th>Trt Type</th>
<th>Trt Name</th>
<th>Form Conc</th>
<th>Form Unit</th>
<th>Form Type</th>
<th>Rate Amt</th>
<th>Rate Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CHK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ADJ</td>
<td>PureSpray Green</td>
<td>98</td>
<td>%</td>
<td>L</td>
<td>0.5</td>
<td>gal/a</td>
</tr>
<tr>
<td>3</td>
<td>ADJ</td>
<td>PureSpray Green</td>
<td>98</td>
<td>%</td>
<td>L</td>
<td>0.75</td>
<td>gal/a</td>
</tr>
<tr>
<td>4</td>
<td>ADJ</td>
<td>PureSpray Green</td>
<td>98</td>
<td>%</td>
<td>L</td>
<td>1</td>
<td>gal/a</td>
</tr>
<tr>
<td>5</td>
<td>ADJ</td>
<td>JMS Stylet Oil</td>
<td>97.1</td>
<td>%</td>
<td>L</td>
<td>0.75</td>
<td>% v/v</td>
</tr>
</tbody>
</table>

*Oil applications were performed on a roughly 7-day interval in July, followed by a 5-day interval in August. Application dates shown in Table 2.*

Table 2. Field Maintenance

<table>
<thead>
<tr>
<th>Date</th>
<th>Product(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-Jun</td>
<td>Herbicide app: Glory (metribuzin) 2/3lb/ac, Medal 2 (S-Metolachlor) 2pt/ac</td>
</tr>
<tr>
<td>01-Jul</td>
<td>Agrimek 3.5oz with LPH/ams</td>
</tr>
<tr>
<td>03-Jul</td>
<td>Oil</td>
</tr>
<tr>
<td>08-Jul</td>
<td>Echo/Torac</td>
</tr>
<tr>
<td>11-Jul</td>
<td>Oil</td>
</tr>
<tr>
<td>17-Jul</td>
<td>Echo/Torac</td>
</tr>
<tr>
<td>17-Jul</td>
<td>Oil</td>
</tr>
<tr>
<td>22-Jul</td>
<td>Oil</td>
</tr>
<tr>
<td>24-Jul</td>
<td>Echo</td>
</tr>
<tr>
<td>28-Jul</td>
<td>Oil</td>
</tr>
<tr>
<td>31-Jul</td>
<td>Oil</td>
</tr>
<tr>
<td>31-Jul</td>
<td>Echo</td>
</tr>
<tr>
<td>05-Aug</td>
<td>Oil</td>
</tr>
<tr>
<td>07-Aug</td>
<td>Echo</td>
</tr>
<tr>
<td>10-Aug</td>
<td>Oil</td>
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<tr>
<td>15-Aug</td>
<td>Oil</td>
</tr>
<tr>
<td>19-Aug</td>
<td>Oil</td>
</tr>
<tr>
<td>24-Aug</td>
<td>Oil and vine kill (1.5pt Reglone w/aqualight)</td>
</tr>
<tr>
<td>24-Aug</td>
<td>Echo</td>
</tr>
<tr>
<td>01-Sep</td>
<td>Vine kill 2 (1.5pt Reglone w/aqualight)</td>
</tr>
</tbody>
</table>
### Table 3. Yield metrics

<table>
<thead>
<tr>
<th>Trt No</th>
<th>Name</th>
<th>Total yield (cwt/ac)</th>
<th>Yield A's (cwt/ac)</th>
<th>Yield B's (cwt/ac)</th>
<th>Yield culled (cwt/ac)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD HSD</td>
<td>Mean ± SD HSD</td>
<td>Mean ± SD HSD</td>
<td>Mean ± SD HSD</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Untreated</td>
<td>344.70 ± 22.55 a</td>
<td>300.90 ± 16.54 a</td>
<td>43.83 ± 9.83 a</td>
<td>17.33 ± 3.90 a</td>
<td>0.52</td>
</tr>
<tr>
<td>2</td>
<td>PSG (0.5 gal/ac)</td>
<td>320.90 ± 66.41 a</td>
<td>293.90 ± 74.47 a</td>
<td>26.95 ± 9.04 a</td>
<td>12.07 ± 6.85 a</td>
<td>0.12</td>
</tr>
<tr>
<td>3</td>
<td>PSG (0.75 gal/ac)</td>
<td>294.60 ± 63.85 a</td>
<td>260.30 ± 74.36 a</td>
<td>34.30 ± 14.99 a</td>
<td>10.80 ± 2.71 a</td>
<td>0.36</td>
</tr>
<tr>
<td>4</td>
<td>PSG (1 gal/ac)</td>
<td>351.30 ± 27.67 a</td>
<td>302.40 ± 40.04 a</td>
<td>48.82 ± 24.74 a</td>
<td>12.25 ± 4.75 a</td>
<td>0.19</td>
</tr>
<tr>
<td>5</td>
<td>JMS Oil (0.75 %v/v)</td>
<td>319.20 ± 36.69 a</td>
<td>260.30 ± 41.31 a</td>
<td>58.89 ± 20.12 a</td>
<td>9.07 ± 5.63 a</td>
<td></td>
</tr>
</tbody>
</table>

Means followed by same letter code(s) are not significantly different (Tukey’s HSD, α=0.05).

### Figure 1. Yield metrics

![Antigo PureSpray Green PVY Trial: Yield results](image_url)

### Table 4. PVY Incidence (Florida tuber grow-out)

<table>
<thead>
<tr>
<th>Trt No</th>
<th>Name</th>
<th>Prp PVY+ (1st count)</th>
<th>Prp PVY+ (2nd count)</th>
<th>Stand count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD HSD</td>
<td>Mean ± SD HSD</td>
<td>Mean ± SD HSD</td>
</tr>
<tr>
<td>1</td>
<td>Untreated</td>
<td>1.5% ± 1.8% a</td>
<td>3.6% ± 0.9% a</td>
<td>54.25 ± 14.82 a</td>
</tr>
<tr>
<td>2</td>
<td>PSG (0.5 gal/ac)</td>
<td>0.0% ± 0.0% a</td>
<td>1.4% ± 2.8% a</td>
<td>47.50 ± 8.81 ab</td>
</tr>
<tr>
<td>3</td>
<td>PSG (0.75 gal/ac)</td>
<td>0.4% ± 0.8% a</td>
<td>0.8% ± 1.6% a</td>
<td>50.00 ± 10.74 a</td>
</tr>
<tr>
<td>4</td>
<td>PSG (1 gal/ac)</td>
<td>0.0% ± 0.0% a</td>
<td>0.5% ± 0.9% a</td>
<td>38.00 ± 15.90 ab</td>
</tr>
<tr>
<td>5</td>
<td>JMS Oil (0.75 %v/v)</td>
<td>0.8% ± 1.7% a</td>
<td>2.5% ± 3.2% a</td>
<td>30.00 ± 6.98 b</td>
</tr>
</tbody>
</table>

Means followed by same letter code(s) are not significantly different (Tukey’s HSD, α=0.05). Tubers were planted in Homestead, FL, on November 21, 2020. PVY symptom ratings were performed Jan 11 and 20, 2021.
Creating a New Paradigm for Potato Breeding Based on True Seed

Jeffrey Endelman
University of Wisconsin-Madison
USDA Grant from the Specialty Crop Research Initiative (SCRI)

- Sept. 1, 2019 – Aug. 31, 2023
- $3,000,000 from the USDA, matched by
  - $2M from the land-grant universities in the project
  - $1M from PepsiCo for genomics
### Paradigm Shift

<table>
<thead>
<tr>
<th></th>
<th>Present</th>
<th>Future</th>
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<tbody>
<tr>
<td><strong>Beginning of the Supply chain</strong></td>
<td>Tissue culture plantlets</td>
<td>True potato seed (TPS)</td>
</tr>
<tr>
<td><strong>Variety genetics</strong></td>
<td>Outbred tetraploid</td>
<td>Hybrid diploid</td>
</tr>
<tr>
<td><strong>Parental genetics</strong></td>
<td>Outbred tetraploid</td>
<td>Inbred diploid</td>
</tr>
</tbody>
</table>

“Inbred-Hybrid Breeding”
Benefits for Breeders

• Only two complete sets of chromosomes (diploid) instead of four sets (tetraploid)
  • Simpler to understand and manipulate

• Genetic stocks will be inbred lines
  • Can be maintained as true seed instead of tubers or in tissue culture

• New traits can be introduced without changing other characteristics
  • Backcross breeding
Backcross Breeding

In less than 2 years, we can introduce a resistance gene into elite genetic background

This is impossible with our current breeding system.
Benefits for Growers

• Seed has greater value because of genetic improvements in agronomics, quality and resistance to pests (disease, insects, weeds)
  • Lower production costs

• International trade is easier
  • Handful of true potato seed can plant 1 acre
  • Very few diseases can be transmitted through true seed

• Early generation seed tubers are cheaper
  • Year 1 production will likely shift from using minitubers to transplants
Economic model (acreage basis)
Estimating the value of seed

Seed → Crop → Multiplication Rate (M) → Seed

Other Costs → Profit → 1 crop acre can plant M seed acres
Economic model (acreage basis)
Estimating the value of seed

\[ X'' \#\$ = \frac{X_{\&\prime} + C}{M} \]

Example Calculation (per acre)
\( X_{in} = 30 \text{ cwt} \times \$30/\text{cwt} = \$900 \)
\( C = \$4500 \)
\( M = \frac{300 \text{ cwt yield}}{30 \text{ cwt seed}} = 10 \)

\[ X'' \#\$ = \frac{\$900 + \$4500}{10} = \$540 \]
Multi-Year Analysis

\[ X_t = \text{value of Year } t \text{ seed} \]

\[ X_s = \frac{X_{s12} + C_s}{M_s} \]
Example Calculation (per acre)

- Minituber cost estimated at $0.55 \times 18,000/acre
- Early generation seed farm is smaller and therefore has higher costs + profit per acre

<table>
<thead>
<tr>
<th>Year</th>
<th>Seed Price ($X_{in}$)</th>
<th>Costs + Profit (C)</th>
<th>Mult. (M)</th>
<th>Value for the Next Year ($X_{out}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>$6,000</td>
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<tr>
<td>3</td>
<td>$800</td>
<td>$5,000</td>
<td>10</td>
<td>$580</td>
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</table>
How will true potato seed (TPS) change the seed system?

Three different scenarios can be imagined:

1. **No TC:** Replace tissue culture plantlets with TPS but continue to produce greenhouse minitubers

2. **No minis:** Eliminate greenhouse minitubers and use TPS to produce Year 1 seed tubers

3. **One and done:** Use TPS for the commercial crop
How will true potato seed (TPS) change the seed system?

• **One and done**: Use greenhouse transplants for the commercial crop
  • Too much commercial acreage
  • Not enough yield

• **No TC**: Replace tissue culture plantlets with TPS but continue to produce greenhouse minitubers
  • Eliminating tissue culture would lower operating costs, but greenhouse labor and fixed costs would be similar
No minis: Use TPS to produce Year 1 seed tubers

• Field production is cost-effective compared to greenhouse
• Cost of vegetable transplant: $0.03  (Sources: University of Georgia, University of California)
  • About $500/acre

<table>
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<tr>
<th>Year</th>
<th>Seed Price ($X_{in}$)</th>
<th>Costs + Profit (C)</th>
<th>Mult. (M)</th>
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<td>$5,000</td>
<td>10</td>
<td>$580—$569</td>
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</table>

FY1 seed is MUCH cheaper, but FY3 seed is about the same
Implications

• Hybrid TPS varieties have the potential to dramatically change Year 1 seed production

• Unless TPS varieties reduce production costs, there is no financial incentive for commercial grower
  • Seed will not be cheaper

• But hybrid TPS varieties WILL have traits to incentivize adoption
  • Reduced need for pesticides could save hundreds $/acre
  • Some value will be passed onto growers, some captured by breeding companies
AGRICULTURAL ECONOMIC INSIGHTS

Real Soybean Seed Expense vs. % of Total Expense

(Source)
FAQ

• When will this happen?
  • Hybrid TPS varieties for the US market are 15–20 years away

• Why hasn’t this happened already?
  • Inherited wisdom among potato breeders was that diploid varieties could not compete with tetraploids for yield and tuber size
  • Previous efforts to commercialize TPS (1960’s & 70’s) varieties from tetraploids did not work
    • Need inbred parents to create uniform hybrid seed, and inbreeding takes too long in tetraploids
USDA SCRI Project Objectives

1. **Self-Fertility.** Determine the genetic basis and environmental stability of self-fertility in potato

2. **Genetic Diversity.** Generate diploids that capture the genetic diversity of elite tetraploid potato for the chip processing, russet and red markets

3. **Breeding.** Develop improved inbreds through recurrent selection on tuber traits and true seed production

4. **True Potato Seed.** Conduct agronomic and economic research on the use of true seed in the commercial seed system
For more information

https://potatov2.github.io/

University of Wisconsin: Endelman, Mitchell, Shi
Michigan State University: Douches, Buell
USDA ARS: Jansky, Bethke
University of Minnesota: Shannon
University of Maine: Tan
Cornell University: De Jong
Oregon State University: Sathuvalli
Potatoes USA
Many collaborators
Red Potato Varietal Color Response to 2,4-D Application

Dan Heider, Jed Colquhoun & Richard Rittmeyer
UW - Horticulture
2,4-D

- Growth regulator/auxin type herbicide
- Mimics natural plant hormones
- Within plant
  - Uptake
  - Translocation to the growing point
  - Uncontrolled growth
- Visual symptoms
2018 / 2019
Materials and Methods

• Red Norland – 4 reps
• Arlington Ag Research Station
• All applications at 2.33 oz/a Weedone LV4 in 20GPA
• Treatments (application timing)

Single Application:
4-6”
7-10”
Bud
Tuber Init
Tuber Init+7d

Double Application:
4-6” & 4-6”+7d
7-10” & 7-10”+7d
Bud & Bud+7d
Tuber Init & Tuber Init+7d
Tuber Init+7d & Tuber Init+14d
## 2018 Harvest Color Evaluation

<table>
<thead>
<tr>
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### Single application treatments

### Double application treatments
# 2018 Storage Color Evaluation

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<td>62.5 ab</td>
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Single application treatments

Double application treatments
# 2019 Harvest Color Evaluation

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**Single application treatments**

**Double application treatments**
## 2019 Storage Color Evaluation

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<td></td>
</tr>
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</table>

**Single application treatments**

**Double application treatments**
Summary

• Timing of application does in fact play a role
  • Bud stage most critical across multiple years

• Multiple applications don’t always have an additive effect and may play a bigger role in hitting the best timing
2020
Materials and Methods

• 4 Varieties, 4 Reps
  • Red Norland
  • Dark Red Norland
  • Red Lasoda
  • Red Prairie

• Arlington Ag Research Station

• All applications at 2.33 oz/a
  Weedone LV4 in 20GPA

Application Timing:
Bud
Tuber Initiation
Bud + Tuber Initiation
Materials and Methods

• Standard pest management practices
• Vine dessication 14d prior to harvest
• Harvest: 2020 – Sept. 3
• 2 – 40 tuber subsamples collected (fresh & storage evaluation)
• Tubers evaluated fresh and at 3.5 months of storage
  • Tubers washed and digitally captured in high resolution light box
  • Images converted to HSV color scale to quantitatively differentiate treatments
HSV Color Scale
HSV Color Scale: Hue=6-14, Saturation=57, Value=56
Saturation can range from 0 to 100

Values decreasing towards zero indicate a color with more gray producing a faded effect

HSV Color Scale: Hue=10, Saturation=54-61, Value=56
Value can range from 0 to 100

0 is completely black and 100 is the brightest, revealing the most color

HSV Color Scale: Hue=5, Saturation=60, Value=51-53
# Red Norland 2020 Harvest Color Evaluation

<table>
<thead>
<tr>
<th>Trt</th>
<th>Appl Timing</th>
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<th>Saturation</th>
<th>Value</th>
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Visual Difference: Δ 4  Δ 4  Δ 2
Red Norland - Harvest

Untreated

Bud

Tuber Init.

Bud+Tuber Init.
### Red Norland 2020 Storage Color Evaluation

<table>
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<tr>
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Visual Difference: $\Delta 4$  $\Delta 4$  $\Delta 2$
Red Norland - Storage

Untreated  Bud  Tuber Init.  Bud+Tuber Init.
Dark Red Norland  
2020 Harvest Color Evaluation

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Visual Difference: \( \Delta 4 \)  \( \Delta 4 \)  \( \Delta 2 \)
Dark Red Norland - Harvest

Untreated  Bud  Tuber Init.  Bud+Tuber Init.
# Dark Red Norland
## 2020 Storage Color Evaluation

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Visual Difference: Δ 4  Δ 4  Δ 2
Dark Red Norland - Storage

Untreated  Bud  Tuber Init.  Bud+Tuber Init.
### Red Lasoda 2020 Harvest Color Evaluation

<table>
<thead>
<tr>
<th>Trt</th>
<th>Appl Timing</th>
<th>Hue</th>
<th>Saturation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC</td>
<td>14.2</td>
<td>57.5</td>
<td>b</td>
</tr>
<tr>
<td>2</td>
<td>Bud</td>
<td>15.2</td>
<td>61.5</td>
<td>a</td>
</tr>
<tr>
<td>3</td>
<td>Tuber Init.</td>
<td>11.7</td>
<td>60.2</td>
<td>ab</td>
</tr>
<tr>
<td>4</td>
<td>Bud+Tuber Init.</td>
<td>13.7</td>
<td>59.3</td>
<td>ab</td>
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Visual Difference: $\Delta 4 \quad \Delta 4 \quad \Delta 2$
Red Lasoda - Harvest

Untreated  Bud  Tuber Init.  Bud+Tuber Init.
Red Lasoda
2020 Storage Color Evaluation

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<tbody>
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<td>Tuber Init.</td>
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<tr>
<td>4</td>
<td>Bud+Tuber Init.</td>
<td>17.6</td>
<td>66.8</td>
<td>-</td>
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Visual Difference: \( \Delta 4 \)  \( \Delta 4 \)  \( \Delta 2 \)
Red Lasoda - Storage

Untreated  Bud  Tuber Init.  Bud+Tuber Init.
Red Prairie
2020 Harvest Color Evaluation

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<tbody>
<tr>
<td>1 UTC</td>
<td>11.4 a</td>
<td>55.7 ab</td>
<td>55.6 -</td>
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<tr>
<td>2 Bud</td>
<td>10.5 ab</td>
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<td>58.4 -</td>
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<td>57.1 a</td>
<td>56.5 -</td>
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<td>4 Bud+Tuber Init.</td>
<td>9.9 ab</td>
<td>56.4 ab</td>
<td>57.3 -</td>
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Visual Difference: Δ 4  Δ 4  Δ 2
Red Prairie - Harvest

Untreated  Bud  Tuber Init.  Bud+Tuber Init.
# Red Prairie

2020 Storage Color Evaluation

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<tr>
<td>2</td>
<td>Bud</td>
<td>13.3 b</td>
<td>62.0 b</td>
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<td>Tuber Init.</td>
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<td>Bud+Tuber Init.</td>
<td>15.6 a</td>
<td>64.8 a</td>
<td>55.1</td>
</tr>
</tbody>
</table>

Visual Difference: Δ 4  Δ 4  Δ 2
Red Prairie - Storage
Summary

• Color or color intensity improved with 2,4-d application in Red Norland and Dark Red Norland at both harvest and out of storage

• No clear trend and minimal if any color improvement was observed in Red Lasoda or Red Prairie

• Mechanism of how 2,4-D affects red tuber color is not understood
  • As a result, other variables may have a role that are currently un-accounted for
Trialing a Direct Tuber PVY Assay

Brooke Babler

Research Specialist/Wisconsin Seed Potato Certification Program

University of Wisconsin-Madison
Background

→ 2020 winter test samples were
  → Grown in Homestead, FL on Alger Farms
  → Grown in the UW West Madison Greenhouse
  → Direct tuber tested

→ 40-400 tuber sample was selected for direct tuber testing
  → Lots of 50 acres or more with duplicate samples
  → Immnocapture real-time PCR assay (IC-PCR) used
  → Tested only for Potato Virus Y (PVY)
  → IC-PCR results were compared with visual and ELISA readings
Method

400-tuber sample

40-10 tuber samples

2 cores (stolon/apical end)

20 cores/10 tuber sample
Method
Initial Results

- Just starting to analyze data.....
- IC-PCR detection levels appear to be slightly less than visual and ELISA readings
  - More accurate for samples presenting with lower levels of PVY

<table>
<thead>
<tr>
<th>Lot</th>
<th>Visual</th>
<th>ELISA</th>
<th>IC-PCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.78%</td>
<td>.51%</td>
<td>0%</td>
</tr>
<tr>
<td>B</td>
<td>.78%</td>
<td>.51%</td>
<td>.25%</td>
</tr>
<tr>
<td>C</td>
<td>7.25%</td>
<td>7%</td>
<td>6.24%</td>
</tr>
</tbody>
</table>
Future Goals

→ Need to analyze current data
→ Collect more data across growing seasons
→ Examine different methods of prepping samples to increase accuracy
  → Tuber core selection
    → location, # cores, etc.
  → Extracting RNA vs immnocapture technique
→ Develop direct tuber assays for other potato viruses
Special thanks to all the individuals that assisted with 2020 Winter Testing

→ Wisconsin Seed Potato Certification Program staff
→ Wisconsin Seed Potato Certification Tissue Culture Lab staff and students
→ Dr. Renee Rioux’s lab members
→ Dr. Julie Dawson’s lab members
→ Alger Farms
→ Walnut St Greenhouse Staff