**WERA-89 Meeting Report**

**Attendees**

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| Attendee | Institution |
| Adam Winchester | North Dakota State University Seed Certification |
| Alex Karasev | University of Idaho |
| Alex Scalzo | USDA-ARS |
| Alice Pilgrim | Montana State |
| Amer Fayad | USDA-ARS |
| Amy Charkowski | Colorado State University |
| Andrew Houser | Colorado State University Potato Seed Certification |
| Andrew Plant | Maine Seeed Certification |
| Aymeric Goyer | Oregon State University |
| Brooke Babler | Wisconsin Seed Certification |
| Chakradhar Mattupalli | Washington State University |
| Chris McIntosh | University of Idaho |
| Emma Tracy | Seed Certification Montana |
| Erik Wenninger | University of Idaho |
| Esra Yilmaz | Colorado State University |
| Jennifer Dillinger | Nebraska Seed Certification |
| Jennifer Rushton | Colorado State University |
| Jessica Chitwood-Brown | Colorado State University |
| Joe Coombs | Michigan State |
| Jonathan Whitworth | USDA-ARS |
| Josie Spurgeion | Wisconsin Seed Certification |
| Julie Pasche | North Dakota State University |
| Kasia Duellman | University of Idaho |
| Keith Schunetz | Agdia |
| Kelie Yoho | University of Idaho |
| Ken Frost | Oregon State University |
| Kent Sather | North Dakota State University Seed Certification |
| Kylie Swisher-Grimm | USDA-ARS |
| Lisa Tran | University of Idaho |
| Mahbuba Fatema | Colorado State University |
| Mark Pavek | Washington State University |
| Mathuresh Singh | Seed Certification New Brunswick |
| Max Feldman | USDA-ARS |
| Melissa Bertram | University of Idaho |
| Michelle Leckler | Colorado State University Potato Seed Certification |
| Mohamad Chickh-Ali | Colorado State University |
| Nathan Gelles | University of Idaho |
| Presely Mosher | North Dakota State University |
| Rabecka Hendricks | University of Idaho |
| Russel Groves | University of Wisconsin |
| Tara Gauthier | Agdia |
| Teresa Almeida | Colorado State University Potato Seed Certification |
| Vidyasagar Sathuvalli | Oregon State University |
| Walter DeJong | Cornell University |

**Accomplishments**

The group continued to conduct research, extension programs and other outreach related to potato viruses and virus-like organisms. For example:

An SCRI grant, led by Dr. Alex Karasev at the University of Idaho, was awarded in fall of 2021. Numerous collaborators across multiple states have made progress in four areas and continue efforts to develop management solutions for necrotic viruses (PMTV and PVY) that infect potato.

Almost all seed certification labs are performing molecular assay based dormant tuber testing for PVY along with winter grow out. Advances in dormant tuber testing for PVY (potato virus Y) continue. However, the industry is not yet at the point of replacing seed-lot grow outs, particularly since dormant tuber testing cannot efficiently detect chemical injury and variety mix. There are some major challenges with this process. Dr. Chakradhar Mattupaulli presented on some of the challenges he faced when trying to perform direct tuber testing for PVY on the farm. The rigorous labor demands needed for sampling limit this approach are a real financial challenge. An estimate of cost is $175 labor cost/seed lot. Processing speed increased with experience. Correlation between PCR and ELISA testing is very high (> 90 %). Working with automation engineers may provide capacity to make this sampling process easier. Breaking dormancy for winter tests can be a challenge. Nathan Gelles tested several different methods to break dormancy including temperature fluctuations, gibberellic acid (GA) treatment, and smoke treatment. Both GA and smoke treatment were effective.

Research continues into PVY strain composition, reducing the spread of PVY in season using crop oils, and assessing the yield penalty for PVY infection. Jennifer Rushton evaluated PVY strain composition on over 700 samples collected in Colorado. PVY strain N-wilga was the primary strain found but saw some mixed infections of PVY 0 and PVY NTT too. For some samples, the primers were not able to detect a virus even though it was ELISA positive. Next generation sequencing is being used to catalog viruses at scale. Kelie Yoho demonstrated reduced rates of PVY infection when crop oils are used, even under overhead pivot irrigation schemes. Did not see any effect on beneficial insects. In season spread of PVY is being evaluated by researchers in Colorado and Idaho. Rabecka Hendricks found that effect varies by cultivar with impacts on yield or grade of tubers.

Although Potato mop-top virus continues to be an emerging problem based upon the molecular testing of Dr. Kylie Swisher-Grimm, identifying resistant germplasm has proven challenging. Dr. Jonathan Whitworth reported some of the challenges they have faced trying to use growers fields for screens. This is an on-going challenge.

Progress towards development virus resistance potato germplasm continues. Dr. Jessica Chitwood-Brown reported on her use of molecular markers to select PVY resistant clones using markers for Rysto, Ryadg, and Rychc. Dr. Max Feldman reported on mapping of a QTL for Tobacco rattle virus resistance (TRV) and application of molecular markers to select germplasm resistant to PVY and TRV.

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**WERA-89 Meeting Minutes**

**March 16th, 2023**

**Potatoes USA, Denver CO**

**8:00 am Meeting started; motion to approve start**

* Welcome remarks
* Motion to approve minutes; Johnathan W. and Alice P.
* Information about registration fees-$50 per person; payment through North Dakota-Thank you Julie for setting up
	+ Payment link was provided
* Introductions of all meeting attendees-in-person and on-line

**8:15-8:30 NIFA Updates**

* Update on the staffing-currently 385 permanent and 8 temporary students/intern
* Strategic Plan 2022-2026
	+ Discussed goals and highlighted programs that are available for individuals; make sure to align proposals with the strategic goals
	+ Budget is appropriated at 1.96 billion
		- 10M increasing AFRI funding
	+ Presented topics covered by NIFA programs
	+ Highlighted the crop protection and pest management program (ARDP-Applied research and development program area)
		- Contacts are provided on the slide if interested in research/extension focused projects; deadline is February
	+ Foundational and applied science, education, and workforce development and sustainable agricultural systems-NIFA AFRI program requests of interest
		- Example of A1112: Pest and beneficial species in Ag production systems
	+ Provided an example of AFRI 1181 Agricultural Biosecurity program is still open until August 10th if interested
* Recommend visiting the NIFA website-sign up for the newsletter so you can learn about upcoming events
* Encourage individuals at the meeting to be involved on the NIFA panels and foster new collaborations

**8:30 State Certification Reports**

* **Oregon State, Tami Brown**
	+ The Certification program in Oregon is overwhelmingly not potatoes. We certify mostly grasses, for example we certified 101,000 acres of tall fescue and only 3082 acres of potatoes. We used 3 inspectors to look at the potato acres. Oregon has 10 growers, 4 counties (6 if California acres are included) and 2 states. Clearwater Russet was the biggest variety last year with Gala coming in 2nd. Our production has been stable over the last 5 years.
	+ I also presented a slide show explaining our greenhouse post harvest grow-outs. We accept potatoes Oct 1 through December 1. Tubers are dipped in GA, then spend 2 weeks in a warming room (82-85 degrees, with high humidity) and then melon ballers are used to plant into trays. We average 96% germination. PVY testing is visual with kits to confirm. Growers can choose to have their lots lab tested.
	+ We did not reject any lots this year, though some were labeled ‘not eligible for recertification’ due to PVY.
	+ Several questions were asked about the post-harvest grow-out-see answers below
		- They tested approximately 100 lots, used a mixture of 66 ml of 4% ProGibb to 80 gallons of water to break dormancy, melon ball are taken from the bud end and Physan 20 is used to sanitize
* **Idaho Report, Lisa Tran**
	+ Idaho crop year 2022: 30,342.7 acres were planted and a total of 779 seed lots were entered for seed certification. From this, 30,164.5 acres were accepted. During summer field inspection: No PLRV was found. 39 Lots (5% of total lots) were found to have mosaic. A small proportion of acres had Blackleg (0.2% of total acres). 643 lots were required for BRR testing and 279,700 tubers have been tested. No BRR was found. BRR has not been detected since 2016. Winter Grow Out went excellent. 29% of samples were tested before Jan 1st and 71% was tested after Jan 1st. Out of 557 lots, the average stand was 79% with 3 lots exhibiting < 50% stand and 3 lots that were not picked.
	+ Did encounter emergence issues due to dormancy, primarily with varieties that have dormancy issues like Clearwater, Alpine, and Ivory Russet. PHT PVY Results. In terms of % Lots: 38% of the lots entered for seed certification tested 0% PVY and 21% of the lots tested equal to or less than 1% PVY. Idaho’s recertification tolerance is 1.00% or less. 59% of the lots entered for seed certification are eligible for recertification. 41% of the seed lots are NOT eligible for recertification (tested greater than 1%). 34% of the lots tested between over 1% to 10%. 7% of the lots tested greater than 10% PVY.
	+ In terms of % Acres: 26% of the acres tested 0% PVY and 27% of the acres tested equal to or less than 1% PVY. 53% of the acres entered for seed certification are eligible for recertification. 47% of the acres are NOT eligible for recertification. 41% of the acres tested between over 1% to 10%. 7% of the acres tested greater than 10% PVY. The average PVY incidence for 2022 per Lot and per Acre is a little over 3% which is higher than averages from 2008 to 2020 but lower than 2021.
* **Montana Report, Emma Tracy**
	+ Started in processing samples for winter test mid-November
	+ Saw an increase in certification acres entered into the Montana program
	+ Lab testing for winter testing occurred between Dec 9 and Jan 23-dealt with some shipping issues this past season that hope will not be an issue moving forward
	+ All visual calls in the field were confirmed with ELISA
		- PVY incidence was higher this year at 6.7% than last years at 1.6%
		- Growers let field crops go 7-10 days past traditional harvest dates which likely lead to increased PVY infection
		- Saw quite a bit of PVY in Russet Norkotah, Russet Burbank, and Umatilla Russet
		- They had in over 100 lots submitted for dormant tuber testing
			* Were some differences between dormant tuber testing and ELISA-difficult to explain why this occurred this past season.
* **Wisconsin Report, Brooke Babler**
* **Colorado State, Andrew Houser**
	+ Introduced the team!
	+ A brief overview of Colorado’s Post Harvest Test was presented. The reason for requiring a Post Harvest Test (or Winter Grow-out) is because PVY infected potato plants will not be detected if the infection occurred late in the growing season. In 2022, nearly 30% of the Colorado seed crop had greater than 5% PVY (this equaled about 2,000 acres) at the Post Harvest Test. This PVY level was similar to the 2021 crop. Nearly 60% of the 2022 G1 acreage (first year in the field) was also >5% at the post-harvest test, which is an incredibly high percentage.
	+ Over the last 11 years, Colorado’s certified acreage has been reduced by about ½ (from 16,000 in 2012 to 8,000 acres in 2022), resulting from seed growers not being able to keep their seed free of PVY. The Nwilga strain of PVY is currently the most dominant strain of PVY in Colorado and about 15-20% of the PVY population is still made up of PVYo.
	+ In addition, the Colorado Potato Certification Service Disease Testing lab compared two testing methods to determine PVY levels in a seed lot in the fall/winter of 2022/23: 1. direct tuber testing using immunocapture PCR and 2. sprout testing using ELISA. The results showed there was a 90% mean correlation between the two testing methods when the same tubers & composite samples were compared. Potato varieties used for this evaluation were Centennial Russet, Reveille Russet, Russet Norkotah sel. 296, 3, & 8.
	+ The PVY/aphid disease complex currently has a very detrimental effect on the seed potato industry across the United States and Canada. A different level of thinking & action is needed if we want to minimize the effect this disease has across North America.
	+ Question: Were tubers warmed before direct tuber testing? No they were not about it the tubers
	+ Question: Were tubers tested right after harvest or later? It was a mix across varieties
	+ Question: Where does seed lots with certification levels above 5% seed go if not allowed to grow? It goes into commercial table stock while a variance can be issued in select cases

**\*\*\*At this point, we are at break time and have three more certification reports to go; there is a need to allow more time for state reports in future meetings.**

* **Nebraska Certification; Adam Winchester**
	+ They made some changes to their dormancy breaking procedure
		- Built a humidity chamber for less than $500 and kept tubers in there until the day before the Rindite treatment
			* Lots left in the chamber the longest had the best emergence
		- Added an outside control panel, air flow system and stationary heating/fan unit to remove need to enter
		- Tested 420 samples, were dipped in GA prior to planting
		- They had emergence around 73%; improvement from years past but vigor was less this year
	+ No lots were rejected for PVY and only one lot had PVY (FY3) in it-they are seeing a huge decrease in PVY in Nebraska
		- 0.6% acres had PVY this year
	+ Did not see any chemical carryover, but did catch two lots with varietal mixtures (this is down from their typical ~10 lots with mixture)
	+ Question: Which variety was positive? Prospect
	+ Question: Level of Isolation of seed potato field? -yes, very isolated
	+ Question: What percentage of acreage is seed versus commercial? 30%
* **North Dakota, Kent Sather**
	+ Acres accepted and rejected are similar to years passed
	+ ND farms are very spread out and early generations are isolated
		- Location graph showed how isolated FY1 and 2 had less virus pressure and mosaic increased as you move across the state
	+ Had 15% lots that were downgraded; 5 lots rejected (most of this was due to mosaic but did see serious wilt (Verticillium and Blackleg) and chemical drift)
	+ Lost their winter test; moving to dormant tuber testing with plans to finish by end of March
	+ Alger Farms will be selling out so ND is looking to change up their winter test-looking at options in FL, HI and lab testing

**Gave Kent a great round of applause for all his hard work and dedication in the seed industry as it will likely be his last WERA 89 meeting**

* **New Brunswick, Mathure Shingh**
	+ An increase in PVY was seen this year
	+ 370 samples tested for PVY via PCR and sprout testing
		- Had an influx of green leaf peach aphid which was very unusual; they grow later variety Russet Burbank looking to improve control methods
			* September vine kill lead to a huge increase in PVY infection across lots
	+ They are seeing a lot of growers moving from processing to seed production or hybrid systems on their farms; this has lead to not well managed lots and increase in PVY
	+ Question-What are they doing for aphid management? Most growers lacked maintaining a constant spray schedules; however if they were successful PVY levels were reduced

**Took a 20 min break until 11 am and then proposed to move the Research Updates: Potato Virus Y to 11 am and then Research Updates-Diagnostics will be at 1:00pm.**

**Mohamad Chikh-Ali, The dynamics of PVY infection during the growing season of the San Luis Valley, Colorado**

* If the infection of PVY occurs early season, one can see up to a 70% reduction in yield
* Need to have a multiple step process to manage PVY
	+ Certified seed, resistant cultivars, culture practices
* Objective: To study the dynamics of PVY infection during the growing season in the San Louis Valley (SLV)
	+ Experimental setup consisted of utilizing tobacco plants (15 sets (40 plants each set) that were 4 weeks old next to PVY field lots, then testing 3-4 tobacco leaves from plants weekly
	+ Results: Found the first PVY infection at the June 14 testing date, saw an increase in infection around July 4 and infection peaked first of August
		- Identified PVY strains N-Wi, O and NTN
		- They did not see any recombination for PVY-O, 2 events for N-Wi and 40 events for NTN
* Question: Was the first infection on June 15 seed born or infection spread? Unsure
* Question: Where is the testing material collected from? Collected from a location centralized with more PVY present…would not see symptoms such as these in outlier locations
* Question: Does this correlate across the state? Not all seed is planted at the same time in the valley
* Question: Do you have any idea if different aphid species are driving the infection across the season? There is some data out there but not sure the details
* Question: Did you test the tobacco plants before putting them into the field? No, but the growth chamber was kept relatively clean; assumed that the tobacco seed was healthy
	+ Note, In Nebraska they find PVY positive aphids around June 5th
	+ Suggested correlating aphid populations with the PVY data; there is data that could be matched
* Question: Would you say the growing season was average? It was maybe a bit cooler season but overall standard; they hope to collect data another year

**Jennifer Rushton, Potato Virus Y strain characterization in the San Luis Valley Colorado**

* Sample collection in 2021 and 2022 season, collected mid to late-season
	+ In 2021, collected 200 field samples and 100 winter test samples (tried to send samples that looked positive) and then in 2022, the same collection method but tested 400 samples; random sampling with various cultivars; a total of 700 samples
* Utilized ELISA and PCR multiplex to detect strains
	+ Had some primers that didn’t detect correctly-Why? N-Wi and O
		- They went ahead and did Next Gen seq (NGS) to see examine oddball samples
			* Seeing single band at 441 bp-it could be different strains so NGS is needed
		- Saw the most N-wi, then O, and then inclusive strains off the multiplex testing
	+ Took 32 of 179 positive samples for sequencing-and then worked to build a PVY strain sequence and then blasted the results and aligned accession numbers
* 18 of 32 samples had 9Kb sequences and could be aligned properly, 6 had mixed infections and 2 samples needed further investigation
	+ N-Wi was primary find; saw mixed infections of PVY-O/NTN and PVY O/N-Wi
	+ Was a challenge to read the mixed samples as they small pieces of sequence didn’t come together well
* Overall, two accessions of PVY-N-Wi that are not priming correctly to the primers currently being used to detect (KY847950.1 and FJ204164.1)
* Next steps are to develop new primers to detect all accessions; also do a complete virome analysis
	+ Currently no PLRV detected; some PVS
* Question: What was the starting material for this project? Total RNA
* Question: What is the step for sequencing? Next Gen
* Question: At separate locations in the valley, did strains differ? Will analyze next
* Question: What is the meaning of other contigs? In all samples but using strong requirements to ensure that contigs are indeed PVY; confident if 100K to 1 million reads indicate PVY
* Question: Interesting that Colorado is still seeing PVY-O? Will those low strain disappear over time as N-Wi takes over? Not sure the exact answer but few varieties grown in CO have resistance

**Rabecka Hendricks, PVY and Yield-How much impact?**

* In Idaho, seeing the transition of PVY-O to PVY-NT and N-Wi
	+ Also note that PVY is not always the only cause of yield loss
* This study is focused on seedborne PVY infection and looked at yield and size
	+ Looked at three varieties: Russet Burbank, Russet Norkotah, and Ranger Russet
	+ Examined low med and high infection rates but had grower and storage location variability
	+ Saw yield reductions at low to high ratio of infection but really couldn’t see differences between low and medium infection rates
	+ In Ranger Russet, minimal yield impact but size profile and grade were impacted
	+ In Russet Norkotah, total yield was impacted but no impact on quality or grade
	+ In Russet Burbank, total yield, size profile and grade were impacted
* Question: Is the yield significant when you have a mix of healthy and infected plants in a field? The adjacent healthy plants do compensate but if infection is to high yield loss is increased
* Question: What exactly is total year? It is looking at all plants in the plot
* Question: Will size profile affect commercial growers? Yes, size profile is very important to commercial growers; desire potatoes over 6 ounces
* Question: What test did you use to measure significant differences? Basic ANOVA across 5 reps

**Lunch was from 12:00 pm to 1:15pm**

**Kelie Yoho, Utilizing crop oils and age related resistance for managing in-season spread of PVY**

* Mineral crop oils are well known for disrupting the *Potato virus Y* disease cycle, but incorporation into IPM programs in major potato growing areas (i.e. Idaho, Washingtion, and Oregon) has been slow. One reason for this delay is grower concerns regarding the efficacy of these oils under aggressive overhead irrigation practices.
* Four spray treatment programs (untreated check, weekly mineral crop oil spray, fortnightly insecticide sprays, and weekly crop oils in combination with fortnightly insecticide sprays) were evaluated on two parameters under overhead irrigated potato growing conditions: 1) reduction of in-season PVY spread, and 2) impact on beneficial insect communities. Weekly mineral crop oil applications consistently reduced PVY incidence compared to the untreated check, with the combination oil/insecticide treatment offering the greatest decline in PVY infection rates.
* No significant differences between the beneficial insect communities has been detected at the moment, though differences may arise as insects are identified to more specific taxonomic levels. These results suggest that
* Question: what rate of oil is being used? It is the label rate
* Question: Did you collect samples of beneficial? Yes, they are frozen and ready to be ID
* Question: Do you know the pressure of the sprayer? It is a bicycle sprayer so it needs to be adjusted each spray time. It was at 25 psi
* Question: How was the oil applied? Limited consistency of when the oil sprayed-it could be before or after irrigation but if before it was at least 24 beforehand
* Question: How expensive, and is it feasible to spray mineral oil? It is not expensive and feasible to spray but the labor is limited

**Dr. Chakradhar Mattupaulli, Mail-away tuber testing: opportunities and Challenges**

* The talk focused on the field application of direct tuber testing approach for detection of viruses causing tuber necrosis, primarily potato virus Y. Studies from 2020 and 2021 indicated how grower cooperators compensated initial sample procurement costs by providing their farm labor thereby facilitating onsite seed potato sample collection and subsequent downstream sample processing at an offsite laboratory using molecular approaches.
* Various opportunities and challenges generated in this project were also discussed.
	+ Estimated labor cost for grower cooperators to sample 8 seed lots: 5 people worked 14 hours with $20/hr wages equals a cost of $175 labor cost/seed lot)
	+ Processing speed increased with experience
	+ In 2021, PVY research project consisted of 6.2 samplers, who sampled 37 lots across 4 states using sampling kits; found it to be 84% accuracy when following the sample kit directions
		- On average it takes 8.3 personnel hours per lot and testing took 7-13 days to complete
		- Compared the qPCR and ELISA results and found a 95% agreement
	+ In 2022, PVY research project was upgraded to 12 states, 103 seed lots and Bode Technologies completed testing
		- The 2022 project challenges were: sending out 19 weekly updates (Jason Ingram), keeping participants confidentiality and navigating labor shortage
		- There is a need for tuber sampling automation-planning to work with an ag engineer to automate
* Question: Can accurately detect PVY, TRV and PMTV from tubers? Research is foscused on collecting a reliable sample, testing 25 tuber sub samples and how accurate are the testing methods
* Question: What specific pathogen are you testing for in this project? Focused only on PVY at this point but will be going back to test for other pathogens off the collected FTA cards
* Question: What primers when testing? Combination of the duplex and singleplex
* Question: What approach are you taking to get seed growers on board with these new methods? Working with growers that submitted samples as part of the 2022 project
* Question: What is the end goal of the project? Goal to provide diagnostic tool for certification programs
* Question: Do you have challenges to determine when to cut off your PCR Cq? Currently using a Cq of 33; determined by data across two labs and variance calculations
* Amy C. made a comment that this test is not only for seed growers but also for commercial or to growers who want information before traditional tests-although this particular test needs to be able to implement faster

Trade publications:

* **Mattupalli, C.**Charkowski, A. O., Ingram, J. T., and Filiatrault, M. J. 2022. Rethinking seed potato certification: Moving toward a grower-focused system. [Spudman 60(1):25-28](https://spudman.com/article/rethinking-seed-potato-certification-moving-toward-a-grower-focused-system/).
* **Mattupalli, C.**, Charkowski, A. O., Ingram, J. T., Filiatrault, M., Sklarczyk, D., Ebe, G. D. 2022. COVID-19 tech provides lessons for seed potato certification improvements. [Spudman 60(3):14-19](https://spudman.com/article/covid-19-tech-provides-lessons-for-seed-potato-certification-improvements/).

**Nathan Gelles, Breaking tuber dormancy to support the seed certification process**

* Goal is to alter tuber physiology with post-harvest treatment; focused on rapid sprouting
	+ Rindite is currently used to overcome dormancy for the winter grow-out; it is toxic and questionable if will continue to be available in the USA
* Looking at other options to break the dormancy such as alternate temps, GA and/or smoke
	+ Found that temperature fluctuations actually slowed or did not affect dormancy break
	+ Found that smoke increase sprout development
	+ Found that GA and smoke together seem to be the best method for sprout development
* They set up a new study that has a GA, smoke, smoke/GA, smoke/GA/Rindite and GA/Rindite; work done by PCAN and Idaho
	+ Smoke was applied a day before the rindite treatment and temps maintained around 65-70F
	+ The smoke/GA dip (Idaho) had the best sprout development; it did vary across varieties with Norkotahs having smaller sprouts whereas Lamoka had beautiful sprouts
	+ Emergence was the strongest with smoke/GA but even GA and the Rindite/GA also performed well; plants also looked better with the smoke/GA treatment
		- Found some outlier varieties like Vanguard; performance was bad; treatment didn’t matter
		- They found that Norkotah had the best results with Rindite/GA
* The take home point is that smoke and GA actually performed better than rindite in all varieties expect Norkotah; more research needed
* Second take home that rindite alone doesn’t do as well as rindite plus the GA dip
* Future studies will be focused on using smoke to facilitate early and accurate PVY testing, getting tubers to sprout sooner after harvest, and to help plant breeders look at dormancy issues across varieties
* Question: What type of smoke are they using? Cold smoke, but looking into liquid smoke
* Question: How did you navigate moving wet potatoes? They were dried before transport
* Question: Did you try a rindite and smoke treatment on some of the challenging varieties? It is interesting thought and Nathan asked for anyone interested in working with him to reach out.

**Jonathan Whitworth, PMTV: Phenotyping is a Pain**

* Mop-top is vectored by Spongspora subterranean; known as sprange
* Problems with PMTV is that it can be symptomless
* Two varieties that are resistant: Castle Russet and Pomerelle Russet
* Field map presented no correlation between Spongospora and PMTV
	+ All testing on site found that symptoms can vary from flecks to necrotic arcs and not specific to variety
* They went back to the same field the following year and looked at more varieties and included a second location
* Issues they faced when trying to diagnosis PMTV
	+ Where do you sample from? Need to look more at localization
	+ Is PMTV evenly distributed throughout the tuber?
	+ What is the best method for detection? qPCR versus traditional RT-PCR and where is the appropriate cutoff-how do we navigate false versus weak positives
	+ How do you navigate carry over contamination?
* Question: Why don’t you move the PCR to longer cycles and what about digital droplet PCR? Discussion of using QPCR and then backing up with digital droplet PCR-they are going to move to this testing method in the future
* Question: How do you navigation variation within the fields? Challenging to navigate
* Question: Does Castle have true resistance? Not true but it is highly resistant
* Question: Where are you sampling? Sampling from the bud and stem end.
* Question: Do you let the samplesset before coring? They are cored immediately upon arrival. They did get the opportunity to collect samples from material at a later date and working to process
* Question: When you cut the tubers was it after storage or harvest? The tubers were cut after storage; the idea was to look into the discussion of whether tuber symptoms progress in storage.
* Question: How do you go about pheynotyping to match up genotyping? To get the original data they looked at the two halves of the tubers to try and match. They found that some tubers collected at various times and from different locations have the same Cq stays while others have varied Cq values
* Question: Mexico started testing for PMTV-what test are they using? It is unknown at this time
* It was suggested that Pitt Moss (Grower Grade Brown) can be used as an alternative to Peat; it is 1.5 times the cost of peat

**Break from 3:05 to 3:25**

**Kylie Swisher-Grimm, Understanding Tobacco rattle virus epidemiology in potato through basic and applied assays**

* Discuss transmission of TRV and PMTV from infected seed
* You cannot visually detect these two viruses; need molecular diagnostics
* Does planting seed with TRV/CRS (Corky ringspot) affect sprouting, daughter yield and subsequent infection ?
	+ Looked at four categories of infection: mild, moderate and high along with asymptomatic
	+ They samples from half the tuber and then planted the other half tuber in a nematode free field to evaluate internal movement; it is a two year trial
	+ Emergence and daughter tuber yields (lbs. and tubers produced) was comparable between susceptible varieties, uninfected, and infected with TRV
	+ The percent of daughter tuber with CRS symptoms was increased in TRV-infected susceptible varieties; it was the same case with internal disease symptom severity
	+ Saw a range of internal symptoms levels in daughter tubers in comparison to parent tuber in the absence of SRN (Stubby knot nematode)
* Overall, the presence of TRV (and not CRS symptoms) in the seed pieces leads to increased CRS symptoms in daughter tubers
* Does planting PMTV-infected seed affect daughter tuber yields, symptoms development or viral expression in daughter tubers?
	+ Looked at three cultivars (Galena, Red LaSoda, Modoc) and combination of negative/positive material that were symptomatic or asymptomatic; looked at two locations with ‘clean soil’ and had 4 reps
	+ One year of data but plans to continue project in 2023
	+ Saw PMTV affect daughter tubers yield but cultivar and location dependent (Modac)
	+ No significant differences between infected and non-infected in terms of yield, tuber number or symptom development in daughter tuber
	+ Daughter detection of PMTV was significantly greater in PMTV infected seed pieces regardless of location
* Overall, the presence of PMTV in the seed piece did not affect tuber sprouting or yield in daughter tubers
* Overall, presence of PMTV in seed pieces leads to increased detection of PMTV in the daughter tubers but no significant effect on daughter tuber development
* Question: Do you have any research on in-season infection for PMTV? No
* Question: Did you do any additional techniques to induce spread? Just typical growing environment
* Question: have strains and/or species variation been detected? To the best of their knowledge there is not; but they hope to explore this more

**Jessica Chitwood, Breeding for virus resistance at Colorado State University**

* They target all markets for breeding ; but they are mostly focused on fresh market russets and yellows
* Viruses focused on in the breeding program are PVY, PMTV and TRV
* How do we approach these challenges as a breeder? Disease resistance genes, consistent and reliable phenotype and need to meet or exceed market standards are required
* Do we focus on Ry-sto, Ry-adg, and/or Ry-chc genes but some limitations due to male sterility and chc is very new
* Program is focused on Ry-adg and Ry-sto
* Asking other breeding programs to share any russet breeding material with Ry-adg
* Like to look inot powdery scab and PMTV resistance by screening wild potato species
* Hoping to screen much earlier when there is still genetic variation available to breed with
* Explained the product profile concept from excellence in breeding platform
	+ It is broken down into basic traits and then looking at comparison to popular varieties to create targets and determine if new lines meet the acceptable range. If the growers are pleased with the basic traits, then you can work toward the value-added traits which are the most important part of a breeder when bringing new varieties forward
* Overall goal, is to create product profiles that can be shared between all breeding programs and have programs help each other-doesn’t have to just be breeders to move this forward
* Comment: Russ Novey and Jonathan Whitworth have some russet with Ry-adg
* Question: What makes phenotyping so expensive? Labor (time) is a huge cost, there is also no reliable source of infection so can lose an entire field year inoculum if not present
* Question: Is there an option for PMTV infection at a greenhouse level to look for resistance? Yes, and it will be talked about tomorrow

**Max Feldman, Germplasm enhancement activities focused on virus resistance**

* Breeding program is at the top of the tri-state breeding program-does a lot of single hill testing
* Have a really good screening field for Corky ringspot; they plant out in 5-hill plots and look at severity but have had some trouble getting extreme resistant; Payette and Castle russet have been strong selections
* Focus on bringing traits to the market, advancement of these trains and genetic mapping
	+ Focus on genetic mapping-Castle russet is an example of the success of the Tri-state breeding program but it took 20 years; want to focus on more high-throughput breeding
	+ Looking into marker-assisted breeding; focused on PVadb, chc, sto and HC1 and tying together phenotyping and genotyping
	+ Broke down a three-year growout for phenotyping and hope for two good years
		- Utilize computer vision measurement methods to find gather large data sets
* Variety Barbara is ugly but has great resistance across so many pathogens so can it be used in breeding with varieties presenting with more desirable traits
* Working to improve their phenotyping process more efficient by creating a system that detect needed information on a conveyor belt system

**Meeting Wrap-up**

* Reminder to register for the meeting today and tomorrow
* Election of Secretary: Dr. Chakradhar Mattupaulli was selected; Mark Pavek nominated and then Max Feldman seconded
	+ Julie Pasche will become chair and Brooke Babler vice chair
* Phoenix and Tucson are nominated for next year’s meeting; San Antonio was also nominated by Jonathan Whitworth
	+ Attendees would like warmer weather, more restaurant options
* 2024 meeting will be first or second week of March

Journal Publications

Chikh-Ali, M. and Karasev, A.V. 2023. Chapter 11. Virus diseases of potato and their control. In: Potato Production Worldwide (Eds., Caliskan, M.E., Bakhsh, A., and Jabran, K.), Elsevier, Inc.: London, San Diego, Cambridge, Oxford; pp. 199-211.

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Gelles, N., Olsen, N., Thornton, M., Karasev, A., Hendricks, R., and Woodell, L. 2023. Novel methods to induce sprouting in dormant potato tubers. Abstracts of the 106th Annual Meeting of The Potato Association of America. American Journal of Potato Research 100 (2): 121.

Hendricks, R.L., N. Olsen, M. Thornton and P. Hatzenbuehler. 2022. Susceptibility of potato cultivars to blackspot and shatter bruise at three impact heights. American Journal of Potato Research 99:358-368.

Kud, J., Dahan, J., Orellana, G.E., Dandurand, L.-M., and Karasev, A.V. 2022. A novel rhabdovirus associated with the Idaho population of potato cyst nematode Globodera pallida. Viruses 14 (12): 2718 ([https://doi.org/10.3390/v14122718](https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fdoi.org%2F10.3390%2Fv14122718&data=05%7C01%7C%7C52b664a18fe3469760c908db68372135%7Ced5b36e701ee4ebc867ee03cfa0d4697%7C0%7C0%7C638218358214345045%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=CnKjVJGu860T1U8fu4p0YdId4jdylSwwH2u%2BbJTiBkc%3D&reserved=0)).

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Mora, V., M. Ramasamy, M. B. Damaj, S. Irigoyen, V. Ancona, C. A. Avila, M. I. Vales, F. Ibanez, and K. K. Mandadi. 2022. Identification and characterization of new sources of zebra chip disease resistance among wild Solanum species. Frontiers in Microbiology. https://doi.org/10.3389/fmicb.2022.857493.

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Conference Abstracts

da Silva, J., N. Gracia, I. Vales, S. Gautam, and K. Mandadi. Applications of bioreactors to plant breeding. 76th Annual Meeting of the Subtropical Agriculture and Environments Society. February 11, 2022, Weslaco, TX. (oral presentation)

Duellman, K.M., Lent, M.A., Liu, C., McKinney, L.F., and Wenninger, E.J. 2023. Timing of in-season plant-to-plant spread of Potato virus Y in potato in Idaho, United States. 12th International Congress of Plant Pathology, Lyon, France, August 20-25, 2023 (poster).

Gelles, N., Olsen, N., Thornton, M., Karasev, A., Hendricks, R., and Woodell, L. 2023. Novel methods to induce sprouting in dormant potato tubers. Abstracts of the 106th Annual Meeting of The Potato Association of America. American Journal of Potato Research 100 (2): 121.

Ifeduba, A.M., S. Zhen, and M.I. Vales. Global warming-ready potatoes: Understanding heat tolerance in potato clones from the Texas A&M breeding program. National Association of Plant Breeders 2022 Annual Meeting. August 8-11, 2022, Ames, IA. Poster.

Jiao, A., S. Gautam, J. Pandey, D.C. Scheuring, J.W. Koym, M.I. Vales. 2022. Genome-wide association studies for tuber dormancy in tetraploid potatoes. American Society for Horticultural Sciences. 2022 Annual Conference. Chicago, IL, July 30 - August 3, 2022. Poster.

Jiao, A., S. Gautam, J. Pandey, D.C. Scheuring, J.W. Koym, M.I. Vales. Investigating the genetic background of potato tuber dormancy. Plant and Animal Genome Conference XXIX. January 8-12, 2022. Online. Digital poster.

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Press

Duellman, K. 2022. Border crops for Potato virus Y management in seed potato production. Potato Grower, December 2022, pp. 24-25.

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