Minutes Summary: WERA89 Annual Meeting

AC Hotel Tucson Downtown

Tucson, AZ on March 7-8, 2018

Chair: Ken Frost

Vice Chair: Matthew Blua

Secretary: Kylie Swisher Grimm

In attendance: Ken Frost, Kylie Swisher Grimm, Andrew Houser, Stewart Gray, Paul Bethke, Mary Kreitenger, Hanu Pappu, Chuck Brown, Neil Gudmestad, Aymeric Goyer, Erin Weber, Judy Brown, Alan Westra, Alex Karasev, Carrie Wohleb, Jonathan Whitworth, Nina Zidak, Chris Benedict, Kasia Duellman Kinzer, Keith Schuetz, Lynn Woodell, Mark Pavek, Sarah Noller, Guiping Yan, Andrei Alyokhin, Chris McIntosh, Alice Pilgeram, Tina Brandt, John Mzicko, Kent Sather, Dawn Musil, Ana Fuladosa, Aaron Buzza, Teresa Almeida, Amy Charkowski, James Dwyer, Russ Groves (by video conference), Amanda Cummings

Ken Frost called to order at 8:00 AM

Welcome and Introductions

No changes to current agenda.

The minutes of the WERA-89 Annual Meeting of March 8-9, 2017 were unanimously approved. Stewart Gray moved to approve, Paul Bethke seconded.

Discussed registration online for WERA-89 membership.

Administrative Advisor Report: Mark McGuire couldn’t make it, Chris McIntosh reported.

**State Certification Reports:**

**CA-** No one to report

**CO-** **Andrew Houser** discussed staff updates in CO. Loss of Greg Hess as supervisor, gained two full time positions, Sarah Noller (in attendance) and Jeff Showcroft.

Post-harvest test of seed lot planted Nov 1- 8, in north shore in Hawaii. Dirt is red, sticky when wet. Inspection Dec 12- 23 for visual inspections and lab testing. Leaf roll was present (not many plants though). Russet Norkotah symptoms great in Hawaii. Mosaic group based on visual symptoms: majority of seed lots fell in 3% or less in the acres represented. Mosaic grouping of 3.1 - 5% is the cap for what can be planted in CO. Over 70% of acres were in 3% or less group in 2016, down to 70% of acres in 2017. Average of mosaic in 2016 (overall) was 3.3%, in 2017 it was 2.77% based on visual symptoms.

Discussion brought up by Ken Frost on effect of PVY on emergence in specific varieties. With PVYO levels declining, may not see a difference.

Decrease in acreage of rejected seed due to mosaic. Perhaps research talks to growers on management is helping growers manage their PVY spread. Winter tests are mostly visual, not all ELISA. Shift in CO to recombinant strains of PVY. In certain varieties (Centennial for example) may be missing visual symptoms. In 2016 and 2017, most seed lot rejections were done in the post-harvest testing. This is a shift from the two years prior. In 2017, less overall acreage was entered, but fewer acres were rejected compared to previous years. Overall, level of rejected acreage is going down. Have lost a few growers, perhaps ones with poorer seed lots.

Since 2015, required to test for PVYNTN. ­Overall NTN in population tested is 7% out of all PVY population. This is up from 3.5% in 2016. A total of 68% of seed lots were tested, compared to 51% last year. Percent of acres with PVYNTN is increasing from 20% in 2016 to 44% in 2017. Stewart Gray indicated that CO seems to have a higher population of PVYO sticking around compared to other states.

Canela Russet emergence: doesn’t appear to break dormancy well. Did well in Hawaii in 2017. Had about 57 – 58% stand, compared to less than 30% in 2016 and 52% in 2014. Dormancy break was done by coring each tuber, soak and gas twice, keep warm.

2017 SLV *Dickeya* sp. survey working with Amy Charkowski. Tolerance for blackleg is 4%. In 2016, under 200 acres rejected, and in 2017, not many acres rejected. 31 symptomatic stems with blackleg symptoms, 3 had *Dickeya*. These three samples were found early in the season (last week of June, first week of July), as opposed to others found later in summer (August).

**ID: Alan Westra** described acreage summary in 2017. Decline rate in 2017 were 1.23% (withdraw or decline). Rejections that they had were due to PVY. In 2017, a total of 74 lots had some detectable level of mosaic based on visual symptoms. All visuals are confirmed by ELISA. Mosaic in 9.4% in 2017, up from 6.4% in 2016 at conclusion of 2nd field inspections (1st week of September). Likely because growers were growing in alternate areas.

Blackleg incidence has been consistent. Percent blackleg (incidence) were 0.01-0.16 at 2nd inspection and 0.01 – 0.32 at 1st inspection. Not planning to start screening program for blackleg (*Dickeya*).

Have issue with bacterial ring rot in seed lots. Had a bad year with in 533 lots tested. In 2016, 1400 total acres were rejected from field and lab testing (150 from field tests, 1250 acres from lab testing). Lack of management on commercial side may be affecting seed lot production. Can’t test their way out of this problem. In 2017, tested 431,600 tubers for BRR, and still ongoing for what lots are required under certification program (compliance agreements). Training seed growers on proper sampling technique.

PVY post-harvest test results: 43% clean lots, 32% infected lots, and 26% >2.0%. Similar to previous years. Average PVY per lot in PHT in Idaho in 2017 is 2.5%, per acre it was ~2.4%. Moved from CA to HI in 2013 and saw increase in PVY detection; HI better location for winter test. PVY levels have been flat for the last 4-5 years. Believes growers are ignoring proper management practices. Ken Frost: perhaps we have added predictability to percent that will show up due to assessments over the past 10 years. Current season spread is a clear issue in ID, frustrating growers, as they don’t know how to manage. Need another strategy for the grower besides just planting clean seed. Growers on verge of going out of business because of this.

Discussion on education required for growers. It is not just a seed grower issue, it is also a commercial grower issue. How can information provided from testing be “less direct” or less damaging to seed growers?

Standards changes in ID: PVY recertification tolerance lowered to 1% (from winter tests, seed that seed growers plant back for further seed production). Will re-examine in a couple years to see if need to move lower. Corky ring spot (TRV harmonized with Necrotic Virus Management Plan, 0.5), 2% tolerance for necrosis caused by PVY, TRV, and PMTV, and pre-clearance of seed lots/shipping point inspections.

Certification program changes in ID: Post-harvest tests: had low emergence samples (<50% emergence) so now have submission of extra tubers as optional, full sample is required. Also changing to field year system. Will no longer have nuclear G1 generation. Hope to improve transparency of the program.

**ME: Jim Dwyer** spoke that PVY levels were up slightly. Gap in oil spray applications from growers, perhaps causing the increase.

**MT: Nina Zidak** talked about growing season; good year, good temps, so crop health was great. Had record yields this year, so seed supply was high.

Post-harvest test summary from Hawaii. Every seed lot was dipped with GA before planting, which improved performance of all seed lots. May have caused some stem elongation, so some plants were fairly large when the visual symptoms were read. Had a reduction in 0% PVY from 53 in 2016 to 41% in 2017, but acceptable lots were still improved. PVYO went from 31% in 2011 to 0.9% in 2017. PVYN-Wi was very dominant in MT seed lot, at 81% in 2017.

For G1, 100% of families are tested. In 2014, 82% had 0% PVY, this was 77% in 2017, so not a big difference. Identifying PVY in these summer tests, so growers have a chance to remove these seed. But still have a significant chance that you will see this in winter tests, especially for over 0.5% virus. For G2, 200 leaves per acre are tested randomly. Can’t trace back to plant, as it is random. 76% in 2014 were free of PVY, but significant drop to 46% in 2017. In PHT, 19% were over 0.5% PVY symptoms in 2017, up from 7% in 2014. In season movement is likely a big issue. Part of this could be because PVYN-Wi is the dominant strain, so possibly missing infection in Umatilla. Possible that environmental conditions are influence symptom expression/ visibility. G3 data is voluntary for random leaf sampling. Not as many lots in sample size. About a 50% chance of being 0% PVY in PHT if started off with 0%.

Question asked: What percentage of PVY isolates show symptoms? We are moving away from a disease that was a big issue (PVYO), but if there isn’t a big issue on tuber yield and tuber quality with the current dominant PVY strains, do we care? There was a shift from a disease issue to a non-disease issue. But some varieties are still showing big loss in yield with new recombinant PVY strains. Is it something industry cares about?

In MT, Norkotah lines, Classic and Yukon gold are latent/susceptible varieties. Very difficult to see symptoms in these plants. In MT they see a shift to PVYWi, so possibly having changes in susceptibility? Overall levels of inoculum is creeping up (percent of PVY is creeping up each year). MT cares about more stringency on plant back, and strategic placement of early generation plantings (especially nuclear (FY1)), perhaps moving outside of potato areas. Another goal is to provide better information from PHT by re-allocating PHT sample sizes to emphasize earlier generations. Old rules stated 400 tuber samples per 40 acres, but not providing enough information for recertification process. Change in tubers sampled for each of G1 – G5 lots. Will also be doing optional lab testing option for G1 and G2, allowing rapid results for recertification decisions and giving a guaranteed sample count.

Break at 10:18 for 30 minutes.

Meeting started at 10:52.

**ND- Kent Sather** cooperating with Alger Farms in Homestead, FL. Planted in November, in FL. In 2017 crop recertification eligibility, there were 364 lots, 8,000 acres, 5,711 eligible acres and 2,287 ineligible acres. G2 and G3 had most ineligible acres (719 and 951, respectively). There were 3,027 and 1,833 G2 and G3 eligible acres, respectively. In 2017, acres submitted in the summer test were lower than previous 10 years. Total in winter grow out lower as well from the past 10 years. 2011 and 2012 had 50% ineligible and 50% eligible, and were worst years in past decade. Had high aphid counts in red river valley, and lower % eligible acres in 2017 compared to 2016 were likely attributed to this. Had 47% of % 0 PVY in 2017, down from 58% in 2016. Had 71% eligible acres in 2017, down from 82% in 2016.

ND PVY strain history: Higher PVYN-Wi in 2017, similar trend in 2016. Could have been present in 2010 and 2011, where there is a higher percent of PVYN:O, but tests were not being done for PVYN-Wi at that time. Had higher levels of PVYO in 2011, but this had dropped off in 2014, 2016 and 2017, similar to other states.

PMTV-positive dark Red Norland, submitted by grower for testing. Concern about having PMTV showing up.

**NE- Amanda Cummings** mentioned that NE acreage was increased from5,300 to 5,600 in 2017. 2% of the lots submitted for testing showed visual symptoms. Utilized the University of Hawaii for ELISA testing of leaf tissue, allowing them to focus on visual symptoms. 10 lots that expressed visual virus, and 14 with ELSA testing. 6 lots were rejected after winter test. Had trouble with one variety (Revilles?) emerging.

**NY- Stewart Gray** found virus in 2 of the lots tested. Nothing else to report.

**OR-Ken Frost** mentioned they did find virus in OR. Nothing else to report.

**WA- Chris Benedict** mentioned they have about 3500 acres in WA. Chris speaking on western WA. March and May was wettest on record in WA in 2017, but then it didn’t rain after that. Aphid pressure was very high, even on crops they typically aren’t on. About 1% of seed lots showed mosaic. Grow-out is done in a greenhouse in WA. A total of 44 plants tested positive (visually), with a foliar test with field kit to confirm. Two seed lots were about 50% of these positive plants.

Organic seed growers in WA. Some of these organic farms have 90% PVY. Growers in Central Washington due a good job of managing, but this is still an issue. According to Carrie Wohleb, central WA acreage of organic potato are really bad with PVY. Perhaps this is a seed issue, and not just an in-season movement issue.

**Research Talks:**

**Lynn Woodell (Nora Olsen): Impact of Seed borne PVY on yield and quality**

2015 commercial grower with 25% PVY, mostly PVYN-Wi, end of June, so likely no in-season movement of PVY. Flagged plants in field and sampled. Went back and dug under the plants that were identified as positive and sent tubers to Alex Karasev’s lab. Specific gravity, fry color, mottling and sugar end percentage. Huge reduction in yield (70%) and huge impact on specific gravities, but no impact on fry quality at harvest. 2017 commercial grower with Alturas. Flagged 20 plants with visual PVY infection. At harvest had a 60% reduction in yield and a negative impact on specific gravity. Again, there was no impact on fry quality at harvest. Alturas with PVYN-Wi fried are often not different from negative tubers. In Hermiston, looked at Russet Burbank and Clearwater Russet lots. Yield differences between Russet Burbank and Clearwater, as well as specific gravity, but no difference on fry quality. Statistics not completed yet. There were no symptomatic PVYN-Wi tubers, but these were flagged with mosaic in the leaves. For fry quality, unless there is a symptom at cutting, there will not be a symptom at frying. Presence of PVYN-Wi doesn’t appear to affect fry color.

Ken Frost suggested looking at yield loss in the big PVY isolate x variety trial, as growers seem to be asking for this information. May require too much replication, too complicated of experimental design to determine this information on yield. This trial will be replicated at four different location, so it is possible to look at yield. Jonathan Whitworth brought up that there will always be a potential for current-season movement between plants inoculated with different strains. Would have to be done in a screen house to avoid this in-season movement.

**Alex Karasev: Genetic diversity of Potato virus Y (US potato PVY status versus outside of US)**

PVY genetic determinant responsible for the PTNRD induction is unknown so far. PVY found everywhere potato is grown. Leaf-drop induced by PVYO in Ranger, but PVYN-Wi shows chlorotic mosaic. Only 6 recombinant strains found in the US potato, only three of these are associated with PTNRD. Of these 3 PTNRD recombinant strains, only PVYNTN is prevalent in the US. Other recombinant strains found in Europe and China, for example. We do have a couple of PVYC recombinants, but only in the lab setting (Gray). They cannot infect potato. In Othello seed lot from 2011 – 2017, NTN hovering around 15 – 20%, N-wilga is now predominant strain, with O levels declining. PTNRD is caused by only some recombinants. Current RT-PCR typing identifies recombinant structure, not PTNRD potential. Presence of non-recombinant strains are found in North America and Japan. Everywhere else, different form of recombinants have taken over. According to Stewart Gray, it is possible that N-wilga is replacing NTN in Europe, but all countries use different diagnostic strategies so it is difficult to know for sure what is happening.

Jonathan Whitworth brought up the issue that N-Wilga isolates can cause some tuber defects, circles on the outside of tuber surfaces. It is not just NTN. Stewart Gray brought up that the majority of O isolates don’t cause PTNRD, but some can. Same for Wilga. This is different than NTN isolates.

Break for lunch at 12:05.

Meeting resumed at 1:30 PM

**Diagnostics:**

**Hanu Pappu: Update on the genetic diversity of PMTV and TRV**

Received isolates from ND (Gudmestad) and ID (Whitworth). A total of 15 USA isolates of TRV analyzed. Initially, known sequences were utilized to develop primers that are good for diagnostics of TRV, also allowing for whole genome sequencing. Overall, the outcomes of this project seek to improve diagnostics for TRV. Sequence analysis was conducted for both RNA1 and RNA2. RNA2 of TRV shows North American isolates very conserved, and distinct from European isolates. Different RNA2 genes segregated differently between North American isolates and European isolates. Did haplotype analyses to see what correlation existed for each gene in TRV. In software prediction models, TRV RNA1 has higher likelihood of recombination, than for RNA2. Certain genes are more subject, or prone to change compared to others, so genes can vary within a single viral genome. Waiting to see how the WA and ND isolates of TRV compare. For PMTV, sequenced 15 isolates from several different states. Verify little variation was seen on RNA1, RNA2, and RNA3. Coat protein read through (CPRT) showed slightly more variation. Could be used to develop isolate-specific tests. Compared all PMTV genes across isolates and developed distance maps for each across all isolates and others available online. Hanu’s lab now has a good set of primers for PMTV diagnostics.

**Nina Zidak: A four state comparison of PVY detection using immunocapture-RT-qPCR detection of dormant tubers and field grow out**

Looking for alternative to field-based PHT, and improving diagnostic procedures. Worked to detect PVY consistently in dormant tubers using different qPCR methods (TaqMan and SYBR), with the goal to optimize the technique. Goal of project was to conduct tuber testing workshop for participants in 4-state study. Here, each state chose one variety with low, medium, and high PVY based on summer inspections. Tubers were sampled in lab and same tubers were sent to HI for grow outs. Also tried utilizing FTA cards as a sampling method (analysis is ongoing). Utilize biopsy probe to take a core from stem and bud ends, bulking tubers prior to immunocapture. Utilized TaqMan probe analysis for real time PCR. Results between visual, ELISA, and IC-RT-PCR were consistent for two varieties (Alturas and Rio Grande). For Russet Burbank, the IC-RT-PCR overestimated the level of infection compared to ELISA. Atlantic was variable. IC-RT-PCR was able to identify lots that were within re-certification tolerances and lots that were high. IC-RT-PCR is time saving and cost-effective. Results are much quicker than a grow out, and can be done locally.

**Alice Pilgeram: Trouble shooting realtime-PCR**

In same trial (as above for Nina), struggled with understanding realtime results. Some amplifications were easier to interpret for samples, some were more difficult to interpret. Negative controls also amplified at later cycles, though at a different slope. Question that resulted: What is PVY positive and what is PVY negative. An attempt was made to correlate realtime results with HI grow out results. Results were subjective for the realtime PCR. Alice chose a CQ of 32 to compile the results. IC tends to underestimate ELISA and PHT visual. PHT visual is nearly equal with PHT ELISA at low PVY positives. This project will be repeated next year to duplicate results, with an attempt to refine the IC-RT-PCR assay. It is hard to detect PVY in dormant tubers when using the different methods (dellaporta, ELISA, IC-RT-PCR), though there is variation between methods.

**Stewart Gray: FTA cards for sampling all different viruses**

Found that most of the virus is in the skin, as opposed to tuber flesh. Skin on developing tubers is a sink tissue for the virus. Virus will move from source (mature) tissue to sink (growing) tissue through the phloem. Later season infection will end up with virus in the tuber because the virus moves to the growing tissue of the plant. 25 samples can be put onto each card, and then put card with skin samples in a press. Put skin side down to push the nucleic acids through to the FTA card. The FTA card is good for freezing and can be stored for months or perhaps even years. Could these FTA cards be used for sampling on the farms? Multiple assays are possible from each card, using a punch. Works for RT-PCR for PVY, PVS, PVX, PVA, PLRV, TRV, PMTV, as well as an RNA control (EF1alpha). Looking to adapt this technique for other pathogens, not just virus. Samples can be stored this way for long periods of time.

**Dawn Musil (PathSensors, Inc): From weapons of mass destruction to potatoes**

Baltimore-based Biotech Company that used CANARY: Cellular analysis and notification of antigen risks and yields. This technology has been used in pentagon since 2007 for biodefense. Biosensor (engineer B cell) has pathogen-specific antibodies expressed on outside. When the cells are cloned, they continue to express the antibody. Right now individual cells types express individual antibodies. When pathogens bind, it causes the biosensor to emit light. The sensitivity of the assay is greater than other methods (IMASS, ENVI, Smart, RAMP, Bio Threat Alert). Platforms for this technology are Zephyr (single sample format) and the Navigator (High throughput platform, for 92 samples plus controls). Original applications were for biodefense, but work in food safety and agriculture realm. Currently doing multiplex assays, so this would be a possibility for various pathogens in potato. Dawn is looking for comments/ concerns, as well as suggestions. Could this work for PVY and other viruses? Cost per sample is $5 – 10 per assay. Finished developing an HLB assay.

**Discussion/Presentation leaders: Neil Gudmestad, Nina Zidak, Alex Karasev**

Nina Zidak: Looking for ways to improve IC-RT-PCR method.

Ken Frost: Possibly clone target and put known concentrations on each plate so there is no variation from plate to plate. Will need to find out titer that is a yes or a no, so need to have controls of known titer on each plate.

Stewart Gray: Need to have assay set up in situation where you know what it should be doing. Optimize the assay with known samples before tackling unknowns. Perhaps over-concentrating sample, so detection is too sensitive.

Alex Karasev: technology is deceiving, as even known negative will eventually be amplified. Went through steps of protocol.

Stewart suggested increasing temperature to help break open virus to expose RNA.

Stewart Gray: Always need to keep in mind how to make these methods high-throughput.

Break at 3:02PM

Meeting resumed at 3:30PM

**Cultivar Development and Evaluation:**

**Chuck Brown: Corky Ringspot Resistance from Castle Russet**

Association of genotype with phenotype for Castle Russet resistance to TRV. Castle Russet has extreme resistance to PVY and carries *Rysto* gene done by mechanically inoculating Castle and Russet Burbank. Castle is an important management strategy for PVY. In an attempt for segregation of TRV resistance in Castle Russet, 48 seedlings from a Castle cross were assayed. Castle Russet interestingly cleanses the stubby root nematode of TRV, as does alfalfa. Of the progeny from Castle Russet (48), there were four groups that separated out in disease severity index (Extreme insensitivity, insensitivity, moderate susceptibility, susceptibility). Considering the two groups as insensitive and susceptible, there is a QTL single marker for resistance. All samples were SNP genotyped, and QTL single marker analysis identified one major peak and one minor peak. The more sensitive progeny also show infection with the virus. In extreme insensitive group, had 0 virus infection by RT-PCR. Only had 4.2% virus infection by RT-PCR in insensitive. Overall, 21 of 48 progeny were TRV insensitive.

Judy Brown: suggestion to look at virus titer by quantitative PCR. It is possible that you can weed out some more of insensitive lines.

**Aymeric Goyer: Vitamins as plant immunity inducers and PVY-potato interaction**

Recent data that vitamins can be sprayed on crops to control pathogens. Goal was to test effect of thiamin applications on resistance to PVY in a greenhouse experiment. Thiamin sprayed on plants at different concentrations (and different days of application). Sampled leaves each week to determine if vitamin treatment could stop spread of virus within the plant. At 14 dpi, no thiamin treatment and 1mM showed virus detection. By 26 dpi, 100mM thiamin concentration showed no PVY detection, same for 35 dpi. At 43 dpi, saw minimal PVY detection in 100mM treatment. At 50 dpi, 100mM thiamin treatment was still best treatment, though low levels of PVY were appearing. So thiamin application of 100mM significantly reduced PVY titer throughout the plant. Two application at 100mM (one at 1 day before inoculation and one 28 dpi) decreased the level of PVY below detection limit.

Seeking to understand how the potato plant responds to PVY. Found differential response to PVY depending upon variety and PVY strain. Developing potato lines with knockouts to specific genes that are differentially expressed based on resistance to specific PVY strains.

Stewart Gray: Could other viruses induce same response?

**Kylie Swisher Grimm: Virus contamination issues: Tobacco rattle virus**

In the storage experiment with Nora Olsen and Chuck Brown, questioned initial results that showed Castle Russet and Payette Russet having 41 and 50% TRV infection rates at the harvest time point, respectively. In Brown lab previously, Castle Russet never showed symptoms, let alone RT-PCR-positives. Sampling of 90 different Castle Russet tubers from the Brown lab cold storage, grown in same field/project as tubers sent to Nora, did not show any TRV infection. Question of contamination became real. Swirling knife in 1.6% Dawn dish detergent or 5% bleach solutions, followed by drying the blade with cloth or paper towel, was successful at cleansing the knife and preventing contamination of TRV-infected Russet Burbank on TRV-free Castle Russet tubers. Use of D128 disinfectant to cleanse required a 6% solution with a 10 minute soak of the knife for complete cleanse. An attempt to cleanse the vegetable slicer using D128 disinfectant failed. The Dawn method of cleansing the knife was reported to Nora Olsen’s lab, who agree to change the order of sampling method. Now sampling for Brown lab RT-PCR prior to completing the next steps to determine tuber infection and fry quality. In the storage analysis 4 month time point (2nd sampling), TRV infection rates for Castle Russet and Payette Russet decreased to 1.3%, each. Russet Burbank TRV infection rate decreased for 90% to 49%, suggesting that contamination was happening.

Stewart Gray suggested using an internal RNA control to be able to assess quality of nucleic acid extractions. Will use a multiplex to detect EF1alpha with TRV.

Hanu Pappu suggested to sequence the TRV PCR product (faint band and strong band) to verify that the correct target is being amplified.

**Discussion/Presentation leaders: Jonathan Whitworth, Kylie Swisher Grimm**

**Jonathan Whitworth:**

Breeding for resistance to PVY: Gene populations and markers

* Waneta x Pike for PTNRD expression
* Rysto Ryadg Rychc being used in breeding programs
* Resistance genes against PVY in a Yukon Gold x Russet Norkotah Cross with a PVYN-Wi  and PVYNE-11 virus challenge
* RYchc development of 4 markers

PVY expression: Genetic diversity of PVY- change in strains

Outcomes and impacts- PVY:

* Prevalence of PVY strains in potato in Columbia Basin
* Role of strain-specific resistance to PVY in selection of recombinants

Final grant activities:

* Post-harvest monitoring of PVY diversity
* Development real-time RT-PCR for PVY
* Further characterize 1F5 epitope
* Population work for R genes
* Screen-house work for strain x variety for tuber quality
* SNP genotyping/mapping for R genes based on *S chacoense*

Needs: marker associated with QTLs for PVY resistance.

Stewart Gray: We are very far away from developing a marker, 10-20 years down the road. Data analysis is really difficult.

Change in PVY over the years (2011-2016):

Ken Frost: 2017 would be similar to 2016 trend

**Kylie Swisher Grimm:**

Whitworth/Novy: Evaluated breeding clones in ID – found 8 clones showing promise

Douches: Established mapping population. Whitworth: For PMTV they are seeing SNPS in chromosome 2 & chromosome 9. Looked at manhattan plots of results.

Gudmestad: Looking on cultivar resistance. Significant difference found in PMTV-induced tuber necrosis. 43 cultivars classified as insensitive to PMTV necrosis, 10 of the varieties overlapped with TRV resistance. Talked at little about the A15001 population: Work has all been done in the field by Gudmestad.

Pappu: PMTV is highly conserved among US.

Gray/Dejong did work on multiplex for TRV, PMTV, and PVY and FTA card work

Karasev developing immunocapture RT-PCR for PMTV assays.

Gray et al.: doing some FTA card work

Gudmestad: S. subterranea detection from soil and peat moss.

Storage work on tubers from PMTV infected tubers (Olson, Gudmestad, Karasev) – looked for processing quality. Internal tuber symptoms increased with time – processing quality only affected if symptoms are present.

Charkowski: in CO collecting S. subterranea and PMTV

Seed lot testing for PMTV and TRV in WA, and OR.

A lot of overlap between PMTV and TRV – evaluations need to be extended from just visual to also checking tubers using RT-PCR.

Castle russet insensitivity – is it geographically/environmental variable?

Yan: Lots of soils collected from 8 different states. Looked at stubby root nematode composition. Develop detection and ID protocols from soils using PCR and barcoding.

Gudmestad commented that PMTV that tubers that are wet late in the season enhances infection by PMTV.

Adjourn at 5:15PM for dinner

Wednesday Meeting began at 8:08AM

Carrie Wohleb Announcement: Abstracts Due for PAA meeting Monday, March 12, 2018

Ken Frost: Thanks for registering

**Diagnostics:**

**Guiping Yan: Stubby root nematode diversity and diagnostics:**

Milva variety in ND shows pronounced TRV symptoms on the outside of the tuber. Yukon Gold in ND doesn’t show great symptoms on the surface of the tuber, but can find right under skin. Use of PCR, sequencing, and morphological analysis to differentiate species of stubby root nematodes from eight different states. Sequenced D2-D3 region of 28S rDNA gene, 18S rDNA and ITS rDNA regions for comparison. Intra- and inter-species variations were higher in ITS rDNA than 18S rDNA and D2-D3 regions. Indel variations in ITS2 rDNA were found in *P. allius* populations. Even within the same state (i.e. ND and ID), there are variations in ITS2 rDNA region. Perhaps slight variation between ND and a single isolate from WA State. With nematode morphology, it is easy to differentiate to genus level by microscope, but difficult to differentiate species level. Developed conventional PCR protocol specific for *P. allius*. Also developed realtime PCR protocol for quantifying nematodes using TaqMan probe and SYBR green assay. Both methods can be used, but SYBR green method is preferred. Guiping believes that the TaqMan probe method overestimates the number of nematodes. Ready to transfer this protocol to certification labs and other potato labs. Currently developing multiplex real-time PCR for four different stubby root nematodes found in the eight states across the country. Working to optimize RT-PCR assays to detect TRV from a single stubby root nematode.

Neil Gudmestad: Likes idea of transmission studies to understand nematode-potato feeding relationship in virus transmission

Chuck Brown: Suggested increasing number of stubby root nematode samples from WA (only has one right now coming from Chuck Brown’s research plot in Prosser). Ken Frost will look to send additional nematode soil samples from OR as well.

Chuck Brown: A “zero” detection of stubby root nematode in a known CRS field, it will still be recommended to control for stubby root nematode.

Guiping: Able to maintain a population of stubby root nematode in the lab, though it has been difficult.

**Administrative Issues:**

Vice Chair is Matthew Blua. Not in attendance for past couple of years. Postpone his appointment, so he will stay Vice Chair. Kylie Swisher Grimm will be promoted to Chair.

Motion by Neil Gudmestad, Stewart Gray seconded. Motion passed by group.

Secretary nominated: Kasia Kinzer. Motion passed by group.

Planning for next year: Will fall on Kylie Swisher Grimm

Location thoughts: San Diego, San Antonio

Ken Frost requests help with impact statements for the SCRI grant; one or two sentences from each person. Email Ken Frost or Kylie Swisher Grimm statements and list of publications and talks related. Stewart: Mary is looking for lists of publications, published abstracts, extension articles, etc. This information needs to get to advisory committee.

Carrie Wohleb questioned whether zebra chip should be included in WERA89 meeting. Some suggested that it should continue, others suggest it is not virus-related enough.

Email sent out to WERA89 members about impact of meeting/group for a potential brochure. Not sure who initiated this.

**Seed Certification:**

**Discussion/Presentation leaders: Stewart Gray, Ken Frost**

**Stewart Gray:**

Agdia has a new PVY strip test for PVYN, and it works quite well. It detects all the PVY strains and then N strain.

PTNRD: O and O5 isolates on Yukon Gold shows variability in what people call PTNRD. We need to think about what we call PTNRD. Often see symptoms right around stem end. Need to put more thought into PTNRD designation.

Seed certification: Why start this conversation?

We haven’t made much progress at really reducing PVY. Seed certification is not to blame for this. Mother Nature and industry practices contribute: change in viruses, visual assessment of growing crop not ideal, tuber quality is now an issue, and lack of effective on-farm virus management options.

Visual assessment of the PHT is no longer ideal. Soil-borne pathogens will become much more important if left unchecked. Can’t ignore the problem. Opportunities are present to improve technology. Tuber testing is an option, but there are still downsides to this.

Currently, 400 tuber sample for seed lot assessment, which allows to determine with 95% probability that you can detect down to 1% disease in the sample. Need to base sample size on desired level of disease incidence detection and on risk tolerance. Committee at seed certification meeting to discuss this issue with 5-year vision to determine opportunities available.

To get to 0.5% virus detection, you would have to test nearly 10,000 tubers. Not feasible. The testing assumes that samples are random and the disease is randomly distributed in the field.

Idea: One size shouldn’t fit all. Figure out the end-use of your product to determine what you need to sample, and how precise you need to be. Early generation seed need to have no/low disease. Late generation seed destined for commercial production can have more disease. So, decide what disease incidence levels are acceptable. i.e. Shoot for 100 tubers for seed lot testing per lot; this will get you ~5% level as a target (73 tubers gives you 5% disease confidence). So, test certain number of tubers and depending upon what you find, test more.

Alex Karasev: above the target (5%)/ below the target. It is a +/- test.

Kent Sather: Wondering practical aspect of this. What would be acceptable by state certification standards?

Alan Westra: Growers want to know precise information. Stewart thinks this is a matter of education, and getting seed laws changed. Stewart is just trying to start the conversation.

Amy Charkowski: Growers are wondering how to sample the field to get lower number of disease incidence. Getting a random sample is not trivial. How do you sample to get the best population for testing? Ken Frost: May have to do some simulation to determine how to randomly sample tubers.

Stewart Gray’s suggestion: Current numbers are deceiving. Jonathan Whitworth: it would be a start to change testing protocol for seed production vs. commercial growers.

To consider:

1. Sampling. Industry has to determine tolerances and precision of estimates. Fit sampling and testing scheme to end use. On farm sampling and storage of tubers (sampling done on the farm?).

Neil Gudmestad: seed is pre-contracted, but then winter tests come out… what is industry really going to do?

1. Lab testing: FTA cards vs. tuber cores. Composite sample size? Multiplex or individual pathogen tests. Development of real-time assays and other technologies (CANARY)? Digital PCR to give you a better estimate of virus in the tuber?

Alex Karasev: Virus distribution, when/where do you sample the tuber? Research issues need to continue to be addressed.

1. Research. How much virus it too much? Validation of diagnostics.

Neil Gudmestad: for PMTV, Neil needs contacted soon.

Break scheduled at 9:27AM

Meeting started at 9:45

**Chris McIntosh: Montana disease test database**

Comparison of PHT to growing season PVY virus. Very difficult to predict. PHT data is typically lower than growing season data of PVY incidence. Goal to predict winter PVY as a function of summer PVY. Depends on what type of model, whether use some or all of data, and what else is controlled for. Spread factor is 4.1, which means that if quit testing/screening, in six years, all seed would be 100% PVY infected. What is the optimal virus levels in seed from an economic standpoint? Winter grow-out tests are the best indicator of how much virus is present. For the analysis: Assume seed potato marked and potato market are perfectly competitive. Assume seed certification will determine how many seed potatoes can be sold, and the commercial yield. The PVY calculator: Taken all information and put together a web-based calculator currently under beta testing. For Russet Norkotah and Russet Burbank potatoes, you can enter assumed level of the virus and the calculator should predict revenue loss per acre, total revenue loss, and adjusted seed price. This calculator does not include any tuber necrosis that may occur in storage; wasn’t factored in. Google phrase PVY calculator and you can find it at Montana State University (msuextension.org/econtools/pvy\_calc/index.html). Taken from webpage: “Calculator estimates end-of season loss from PVY for a grower selling to either process or fresh marker depending upon beginning of season PVY incidence.” This tool will tell a grower how much you should pay for the seed to be economically unharmed.

Nina Zidak: Keep being requested to do more and more testing, but this is not being economically supported.

Kasia Kinzer: How does environment effect the data? What does relationship look like between winter grow-outs and summer grow-outs at the low levels? Chris McIntosh does not think this would change the calculator.

Andrei Alyokhin: What about in-season movement?

Kasia Kinzer: What is more important: seed source or in-season movement? Chris says both. Chris will get data from Kasia from her commercial field plots with increase from 5% to 50% PVY infection during a season.

**Stewart Gray discussion:**

Start with known amounts of virus and follow it through the season and figure out what the end season amounts of virus. Give it to Chris and better validate the model. So, 3 cultivars, 5 starting incidences of PVY (0,1,2,5,10%) and four row of 25 plants. Need 108 infected tubers for each cultivar, 2892 healthy tubers for each cultivar, for each location. Tubers generated in a hydroponic system and stored in the same manner. This allows starting incidence to be controlled. Tubers planted in MT and ID (Kasia Kinzer). Cultivars: Norkotah 296, dark Red Norland and blue. All three are in the top 10% of tuber production and grown in ID and MT. Infected plants would be tested when they emerge to verify. Plants would be sampled after flowering (to see in-season spread). At harvest, collect tubers to be grown out in the greenhouse or winter grow-outs, and tubers would be tested. This gives starting percentage, in-season percentage, and at harvest percentage.

Stewart wants guard rows to minimize interplot interference, and he wants aphids to be able to move in, so need bare ground separation between plots (aphids are attracted to the bare ground first). Be realistic with cultivation practices. Want aphids, but may have to control for other insects.

Amy Charkowski: Will get an edge effect from growth; yield effect.

Gudmestad: What are your objectives?

Stewart Gray: Get an accurate dataset on how much virus can you plant and not see an impact at the end of the season, based on yield data and quality data.

Neil Gudmestad: need to have a split plot design. Making the whole plot cultivars and the subplot virus levels. Neil is not sure 6 reps is enough because he thinks there will be very large experimental error. Concentrate on the most important cultivars, cut 3 down to 2 so you can increase reps.

Stewart: How big can we get the experiment and still be able to do it?

Nina Zidak: Need to have at least one of the Norkotah variety in it. Nolte only had one Norkotah variety in his previous trial.

Kasia Kinzer: What is the optimal virus level, what can you drop and what needs to be kept in order to decrease the size of trial.

Stewart: want low level because early experiments (Nolte) were all with higher levels, and the lower ones are what seed certification wants to deal with. Want infection at the start, as well.

Ken Frost: Need outer rows, harvesting the inner two rows only for yield.

Paul Bethke: Dark Red Norland and Norkotah are going to die earlier in the season.

Neil Gudmestad: Early blight will be an issue (depending upon location). Should drop Dark Red Norland because it will invite an Early Blight issue.

Stewart: What other seed can we use?

Nina Zidak: Do we really need to use hydroponic seed if they are not super robust in adverse environmental conditions?

Neil Gudmestad: Source of tubers need to be the same.

Alex Karasev: Screen houses are not the place for generating good tubers.

Jonathan Whitworth: Use Burbank seed. It is still used at 50% in Idaho, and 30% in the basin.

Stewart would like this kind of discussion for every experiment put forth in this grant.

Lynn Woodell: What PVY strain to be used? PVYN-Wi. What strain did Nolte use in his experiment back in 2010? Could have been a mixture. So possibly, could retest Russet Burbank again.

Amy Charkowski: Goldrush is the easiest russet for seed or dormancy issues. Will grow well east of the Mississippi. Norkotah and Burbank would not be great for WI.

Lynn Woodell: What about Ranger Russet?

Neil Gudmestad: Ranger Russet does pretty well.

Jonathan Whitworth: Bannock Russet? Clearwater?

Neil Gudmestad/Kent: Emergence is slow, has a dormancy issue for both Bannock and Clearwater.

Stewart: Don’t want all same type of russet.

Neil Gudmestad: Lamoka as a non-russet variety

Tina Brandt: focus all different market varieties.

Nina Zidak: Would like to see a Norkotah

Gudmestad/Charkowski: Not good yields for Norkotahs. Not a good option.

Stewart: Goldrush, Ranger and Lamoka.

Stewart: Going back to focus on plot design. How should it be changed?

Stewart: Budget for this is close to $100,000 mainly for testing costs. Limited on dollars and people available to do this.

Neil Gudmestad: Detecting 1, 2 and 5% is very hard because they are such small differences. That’s why he suggest having increased replications. Reduce from 3 cultivars x 5 inoculum levels to 2x4, with increased replications.

Stewart: What about 0, 2, 5 and 10?

Stewart: So Ranger and Lamoka to decrease cultivars, and decrease to 4 inoculum levels, with 9 replications. 2 x 4 x 9 = 72 plots.

Ana Fuladosa: Yield and grade will be influenced by starting from minitubers. Will it be translatable to commercial production?

Stewart: Trying to look at relative yields. Would like to do that, but difficult given the constraints.

Alan Westra: What about PCR of tuber or sprout test?

Nina Zidak: Perhaps the 2018/2019 project should just be getting the right seed produced for this experiment.

Stewart: Is it useful to have relative yield and quality (rating) data?

Jonathan Whitworth: use field seed using FTA card for initial testing.

Amy Charkowski: What is yield loss is the ultimate question. A lot of things could go wrong with minitubers.

Stewart: Need suggestion on where to get good seed.

Alex Karasev: Inoculation, etc. works well in the screen house.

Jonathan Whitworth: Need a good seed potato growing field that is not in a seed production area.

Kasia Kinzer: Could you rely on natural infection?

Neil Gudmestad: Areas in ND where they could produce this seed (clean and infected). Use sudan grass to create a barrier between zero infection and infected potato to minimize cross-over.

Stewart: We need to continue to design experiments as a group to take advantage of everyone’s background. Especially given the fact that we need another grant funded. It will be due next Fall 2018. Need to start talking about the next project. Need to be looking at vertical transmission as well. What is the impact on the next crop?

Stewart: Advisory council for the grant (seed growers, large potato farms, scientists)

* PMTV and TRV are sleeping giant.
* Producers need to stop moving infected seed around
* PMTV is big issue for export to MX
* Payette is PVY resistant, but not being bought. (Tina Brandt: also have to have cultivar that meets processing standards)
* Buyers were likely an influence in some state’s reluctance to test and get more involved
* Powdery scab is everywhere, but PMTV is spreading. Why is PMTV spreading?
* Advisory council needs to step in and be involved in research direction to make sure what industry wants is actually being done.

Next grant proposal is due Fall 2018.

Neil Gudmestad: SCRI budget will get funded.

Stewart’s suggestion:

* Budget tops out at 10 million dollars: submit for this
* Find project director (finds 2-3 people for support)
* Find grant manager who is very capable
* Limit number of people to manageable number, can add cooperators (32 people is too many)
* Advisory council- no more than 10 members, make sure there are scientists on there, outside of potato industry.
* Get yearly renewable budgets for each participant
* Align progress report with NIFA requirements (REE and Annual CRIS reports)
* Have face to face meeting once a year (required)
* Require meeting attendance from each participating lab
* Have periodic webinars for each team (individual projects)
* Academic pursuits must be grounded in economics and potato production constraints (need to have definitive outcomes that will help the industry)
* Hand out money on a yearly basis
* Budget a lot of money for travel because of meetings, perhaps even budget for Advisory Council to come to meeting
* Academic management is not ideal for generating products to solve problems (need to be non-academic minded, corporate management style)
* Hybrid approach: form teams to address each objective, develop the subobjectives and experiments around definable outputs and milestones
* Review and adjust projects each year based on progress, outputs and shifting sands of industry
* Project Director must be willing to terminate projects that are not moving forward or that have become irrelevant (Advisory council will help with this)
* Project Director must be willing to shift funds to support projects in need or to cover new directions

Neil Gudmestad: Adds:

* Institution that is the lead needs to be a large institution that has a capable grant manager.
* Have to find leader capable of writing/speaking
* Need to start working on this today

Break for lunch at 12:01PM

Return from lunch 1:42PM

Jonathan Whitworth: Sarah Delheimer as impact writer potentially for WERA89 meeting

**Jonathan Whitworth: Coordinating PVY trial**

Jonathan and Stewart have seed ready to be shipped out.

Mark Pavek wondered about putting PVY training session on Othello Potato Field Day. Give a general outline of what is going on and then let people walk through, Thursday June 21st. If people want to talk, contact Mark.

Jim Dwyer, last week of June or week before/after July 4th. Could put together video/picture slides with viral symptoms and interviews.

Last year the big impact was pictures taken at time of reading and when plants were older at about three weeks older. This has big impact for industry, with several presentations to industry and even field men. Want to have good pictures at time of reading with labels, and then perhaps three weeks later again. Last year Stewart took leaf samples from everything that was infected but didn’t show infection to verify infection.

**SCRI Current and Future Projects:**

Discussion/Presentation leaders: Stewart Gray, Amy Charkowski

Stewart: Identify people who will step up and lead. Have major objectives sketched out.

Stewart’s notes out of Wednesday’s meeting:

* Seed certification- NPC committee making recommendations to industry. There will likely be research opportunities connected to these recommendations.
* % emergence vs. % infection. Is there a connection?
* % incidence in seed vs. % final disease, yield, and quality
* Efficacy of oil/insecticide under irrigation. Growers always want to know how to manage.
* Disease management options (aerial insect vectors, soil-borne vectors, soil persistence, storage, resistance, etc.)
* Education of growers on what seed certification can do (financial, regulatory, scientific constraints)
* Develop the mechanism to provide accurate estimates of disease incidence
* Montana vs other states as field laboratories. Summer/PHT levels going in the ground vs. final disease incidence being harvested- differences in FY generations (susceptibility of early vs. late generation)
* Yield studies- different strains/isolates, cultivars, locations
* Linkage between Ry (PVY resistant genes) and PMTV/TRV resistance (Castle, Ciklamen, Payette) Rysto- chromosome XI: Chuck pointed out something on Chromosome X1, which is where Rysto is located, could this be gene conferring insensitivity of these varieties to PMTV/TRV?
* Standardize some aspects of seed certification (e.g. field generation labeling)- trade issues
* Induction of tuber symptoms (seed borne vs. current season). Fundamental biology issues.
* Virus detection in tubers over time- harvest vs. storage times
* PMTV/TRV incidence in seed lots. Are these seed issues?
* Vertical transmission of PMTV/TRV, mother tuber to daughter tuber.
* Corporate partners (diagnostics, testing, pesticide). This could add dimension to project that was not there before. Bring in corporate partners that you can’t get in academia.
* Jonathan Whitworth: Standard charts when presenting seed certification data between states.

Planning grant with Pathsensors, Alex Karasev, Stewart Gray. Meeting in the future, perhaps August, or piggyback onto the PAA, about this planning grant, but people could be a part of this grant as well. This would be support in from the industry side. Deadline with USA Potatoes is first week of December, but like the grant in early October.

Stewart Gray: PMTV and TRV infected material is hard to come by for experimental analysis. Need material to test.

Seed lot increase can be done this year. Chuck Brown’s lab and Ken Frost’s lab. Mark get roughly 300 tuber samples. Want to take peels or cores before Mark plants the seed. Could you test 100 tubers (for 5% detection level)?

Alex Karasev: Test for the presence of Powdery Scab and stubby root nematode.

Ken Frost: Mark collects tare dirt, could that soil be tested for these vectors? Could stick the skin sample on FTA cards and ship them to Stewart.

Stewart: Want to look at testing samples after harvest. What is capability?

Stewart: Storage project: tuber incidence over time. Make sure we are moving forward with this test in the appropriate way. Want to get good data this year, as they need information this year. This was part of the grant, so this is critical data to have.

Lynn Woodell: We have PMTV data and TRV data with exception of virus data for first “harvest’ time point.

Stewart: Revisit Lynn Woodell’s data: meant to be an extension project not a research project, but is there a way to get the data to get presented in literature?

Alex Karasev: Identified PVY-infected seed lots in HI.

Planning for grant next year:

Need a large institution that can handle this large grant, and PD coming from there.

Amy Charkowski is up for helping and knows the process

Hanu Pappu is suggesting WSU as large university that can head this up

Russ Groves as possible PD?

Question raised: Could Potatoes USA want a say in who is the PD?

Need a working set of objectives

Neil Gudmestad’s suggestions:

1. Develop improved disease management strategies and tactics for tuber necrosis viruses, PVY, PMTV, and TRV (incorporate improvements in vector management, risk assessment, varietal resistance/sensitivity)

Stewart: Industry will be interested in this, but what is the new projects?

Gudmestad: Guiping’s work to detect TRV in its vector, from the soil sample. Same thing from PMTV and vector. This gives you a risk assessment analysis to help grower identify infection on farm. Vector management.

Russ Groves: What to do differently moving forward. Learning about periods of greatest risk or greatest inoculation. Up regulation of plant defense at timing of high rate of transmission. Hoping for spatial/temporal outcomes. Risk assessment based on vector prevalence.

Nina Zidak: Aphid trapping network in Montana. How many years to assess risk in Montana?

Russ Groves: Fitting information from WA, OR and ME. Greater level of data looks more promising. In two – three years you should be able to see reasonable patterns, at least for general species. Other species that are more oddball, specific to an area, may be longer to get a model/risk assessment.

Ken Frost: Look at resistance deployment strategies to reduce evolution of the virus. Ties to deployment of Bt.

Guiping Yan: Need improved detection methods from certified seed and also from vector prior to figuring out transmission mechanism. Need to figure out how to clean up the virus from the nematode.

Stewart: Russ Groves/Aphid management may need to be careful moving forward because the industry has been supporting this for past decade, and unless there is an outcome (short-term) then there may not be support.

Amy Charkowski: Industry spends a lot of money on seed certification. Can we pull anything from the data without putting certain groups at risk to show the value of this to the industry? Potential objective: How to report the value of this data.

Paul Bethke: Is it know if you have TRV-infected seed and you plant it in a field (with stubby root) would you get infection? Audience suggests the answer is yes. If the tubers you plant have powdery scab, or the field, and your tuber has the virus, you could be transmitting. Stewart: but this may not get to a detectable level for even 10 years. Paul: How do you convince that a problem is developing with a long latency period? Stewart: need to be looking for this now (powdery scab and stubby root nematode). We don’t know how to layer PMTV on the ubiquitous layer of powdery scab. If you introduce PMTV in a powdery scab soil, now you have PMTV-infected powdery scab, but would you detect it for a while? You will rotate to a different crop, and population will go down some. Depending upon soil collection method and quantity, you may not detect it.

Neil Gudmestad: It is always a sampling issue.

Stewart: What we don’t know is if this is a seed issue. Europe doesn’t care about PMTV because they think it is self-limiting. Don’t grow potatoes in infected soil. And they have been selecting for those that don’t show tuber necrosis.

Alex Karasev: It is also climate-dependent.

Stewart: Need to be ready for the “who cares?” question. Be ready to defend your position.

Amy Charkowski: What is the viadate situation? Once these options disappear, TRV will be an issue.

Neil Gudmestad: severe restriction have been put in place.

Keith Schuetz: Need to work with industry (AgDia) to figure out best method of testing, if testing by PCR is not ideal, then what can we move to?

1. Determine yield quality and economic impact of PVY strains among cultivars representing each market class across the US
2. Develop improved virus detection methodology in certified seed and the vectors (?)
3. Determine and identify the basis of PMTV and TRV resistance in potato

Hanu Pappu: Objectives need to align with the stakeholders.

Paul Bethke: What are we actually asking?

Neil Gudmestad: PMTV is a huge problem, and industry is already talking about things we aren’t prepared to answer.

Stewart: Seed guys don’t worry about PMTV/TRV, right now it is a commercial problem. Management practices for PMTV/TRV are not that much different from potato cyst nematode. Cleaning equipment between fields, etc.

**Disease Management Recommendations:**

**Discussion/Presentation leader: Russ Groves via skype:**

Russ Groves has modeled the flight phenology of the principle PVY-vector species of aphids. This has affected the management recommendations: build programs of control around timing of principle vector flights (early grain aphid migration, etc). Next steps are additional aphid identification requirement (state-specific), fitting aphid phenology from other states (underway for year 1 ID’s), identification of the predominate species associated with the greatest PVY movement, and seasonality of vector prevalence- modeling landscape risk. This has not led to modification of management practices. Next step also includes assessment of timing of capture of all species, as species collection timing is different between states. Remaining questions: Create risk indices for local landscapes, for Maine, Oregon, and Washington.

Jim Dwyer: Annual abundance of non-colonizing aphid species and PVY incidence. Primary accomplishments: can forecast the initial yearly occurrence of aphid vectors, see consistent late season aphid pressure, as well as PVY increase later in season which can help with management practices. Can forecast more different species in his area, timing of management need, etc.

Andrei Alyokhin: Relationship of wild hosts to PVY incidence. Major accomplishments: Determining that non-crop vegetation (with the likely exception of plants in the family Solanaceae) does not serve as an important reservoir of PVY. Also, he is obtaining evidence that the notion of PVY’s broad host range needs to be re-evaluated, and confirmed that infected potato tubers are the most important source of initial inoculum (not really coming from outside of the field).

Paul Bethke: Virus effects on tuber quality and storage attributes. Major accomplishments: In-season PVY has not caused a degradation of processing quality, suggesting that initial concerns were not justified, unless you were initially seeing another virus. Industry concerns about PVY and degraded fry processing quality have not been verified, and hyperspectral spectroscopy has demonstrated potential for evaluation of seed lots for PVY.

Debbie Inglis/Chuck Brown: Chuck not working with PVY, but with TRV. This was already discussed. Debbie Inglis not present. Lynn Woodell: Looked at several varieties and found Bannock was promising in 2015/2016, but higher infection of PMTV in 2017. Asymptomatic tubers could have a poor fry quality, but haven’t seen this in ID fry tests. Will take some tubers to Simplot fry processing plant to see what the result is. Lynn will also take a sample to test for virus. If no internal symptoms, there doesn’t seem to be a processing quality issue for TRV- and PMTV-infected tubers. Checking to see if putting tubers at cooler temperatures will help to slow down the virus spread.

Chris McIntosh: Accomplishments for risk and economic analyses of virus incidence in the seed- PVY calculator.

Neil Gudmestad: Asymptomatic tubers don’t seem to cause fry defect issues. If general quality of a bin is poor, it won’t go through processing. They think PMTV in the seed is an emerging problem. Tubers are testing positive, but not causing issue at processing.

Jim Dwyer: Can have no tubers with visual symptoms, but in the same bin over time will see symptoms that have developed.

Neil Gudmestad: Perhaps use survival analysis on various varieties of tubers to forecast.

Nina Zidak: are management practices feasible against PMTV and TRV in seed production areas?

Stewart Gray: We need to develop these experiments to determine if there are any management processes for seed growers. This will take considerable effort and will not be an easy experiment to do.

Kasia Kinzer: Use of a potato line (tuberless potato) as a trap crop in an attempt to decrease the soil population?

Jonathan Whitworth: Growers want to know if it is the seed or if it is the soil that is the issue. We need to have more data on whether this is a seed issue or not.

Russ Groves:

Nina Zidak: Working in the testing laboratories to achieve a level of readiness to begin testing a portion of their samples using dormant tubers, dormant tuber tests can augment visual data (PHT), and results for critical lots can be obtained earlier than for the grow out.

Jonathan Whitworth: Accomplishments include inspector training help in 2016 Othello field lot trial with ~43 varieties infected with 3 PVY strains. PVY demo plots made the industry aware of the difficulties in removing PVY from seed lots. Will be requesting additional plots in 3 region in 2018.

Neil Gudmestad: Need to do survival analysis for all three viruses (PVY, PMTV, TRV) for the growers. Need to be able to detect virus from the soil. May be able to use some primers from Hanu Pappu for the detection of these samples from soil.

Hanu Pappu, Amy Charkowski, Ken Frost and Russ Groves as lead on new grant. Begin moving forward on preproposal in this manner.

Stewart: Send info out in next day or two. Will send notes in next day or two. Want ideas back by end of March. Gives people three weeks. What is interest for each person being part of group, what can they contribute? Want this information sent to new leads. Be thinking about anyone new to be included into the group. Reach out to younger members of the research community. It is hard for them to get funding. Good way to get younger scientists involved.

Motion to adjourn by Paul Bethke, Neil Gudmestad seconded. Meeting voted to adjourn at 4:30PM.