

**Mildew Task Force
Meeting Notes – November 18, 2016**

(Next Meeting – Monday, November 28, 2-4pm, Grower Shipper)

Present

Eric Schwartz	Todd Kodet	Corey Kuchta	Michael Atkins (CPS)
Ramy Colfer	Chris Glynn	Jerry Rava	Paul Fleming
Dirk Gianinni	Mary Zischke	Germaine Rios	Shawn Kuchta
Mike Flynn (phone)			

- Names to consider for a mildew type lead person: Trevor Suslow, Paul Brierly, Richard Michelmore, Lindsay du Toit, Steve Koike, Dr. Dubcovsky, UC Davis, University of Georgia (?).
- Du Toit working on some treatments including post harvest ritamil.
- Eric and Paul talked to Bonnie Fernandez at CPS about transference. She gave us some of the same names (as above) as a starting point. Suggested we focus on a plant pathologist versus a food safety pathogen background. Suggested we also contact: The American Phytopathological Society (APS), 3340 Pilot Knob Road, St. Paul, MN 55121 USA, Phone: +1.651.454.7250, E-mail: aps@scisoc.org
- Group agreed we needed to be inclusive in the organic industry as much as possible. Also need smaller working groups to lead activities. One possibility is just a monthly update for the larger group.

Mary Z Updates:

- Mary Z updated the group on the Lettuce Research Board focus for 2017. They doubled the assessment applied toward DM which is basically where all of their research activity is going. The deadline to apply for project funds from the LRB is the first week of December.
- DM is the number one problem in spinach. Spore trapping is going on in Salinas with the intent of trying to find sources of the inoculant. They are finding spores today but the Salinas crop season is over (not sure where they are coming from). There is no law to break the spinach growing cycle like we have with lettuce. A number of backyard spinach plots still exist throughout the winter in Salinas, like the Hispanic Training Center on Alisal. There is no host free period in Salinas. Conversely, the desert has a long host free period with high heat, but DM is starting even earlier this winter. Points toward seed.
- Finding many of the seed lots have rusting spores on the seed. This could be the primary source of inoculation. If the seed companies have to manage the supply chain with verticillium like they do with Mexico, why not with DM spores? It shouldn't matter if they are dead or alive. We need to assume they are all alive until we prove otherwise.

- The seed companies in Denmark don't have some of the tools the USA has (i.e. Washington industry). However, WA is getting DM also. Seed companies could be moving the inoculant around in the fields if seed isn't clean.
- Most of Denmark fields are old potato fields. Potatoes moved due to DM.
- Plant breeding based on one gene at a time against a pathogen that mutates with multiple spores is ineffective. Breeding single gene resistant plants is not sustainable. The seed companies are running out of material to use in trials.
- Seed companies are taking a substantial hit as well because they have inventory based on past races that they can't sell. Those seeds are dumped back on the conventional market which is artificially holding down those seed costs.
- One long shot is UC Davis working on trying to isolate lots of smaller gene traits, each having a minimal effect on the pathogen. Seed companies funding this research so results aren't public yet, but nothing promising so far.
- J. Correll (Univ of AR) working with bio-fungicides in field trials, but nothing significant so far. In his trials, found so far that copper has little effect. Too much copper and you have a residue the processors cant get off the leaves. Another problem is copper doesn't migrate on a plant as it grows like fungicides do, so timing and coverage is critical to get any benefit at all. EBF did a lot of work with copper and it doesn't solve the problem.
- IR4 Project - Since 1963, the IR-4 Project has been the major resource for supplying pest management tools for specialty crop growers by developing research data to support new EPA tolerances and labeled product uses). <http://ir4.rutgers.edu/>. The EPA has a program for Expedited Review of Conventional Pesticides. The registration is the first step. Then the product would be submitted to OMRI or WSDA for organic approval. <https://www.epa.gov/pesticide-registration/prn-97-3-guidelines-expedited-review-conventional-pesticides-under-reduced>
- Need more growers at their annual meeting (Lettuce Research Board). Last year they had (0) so there is no grower perspective for seed companies and researchers to consider. *Need more participation of field plots to speed up the trials.*
- Key take away - Need to find a way to get clean seed, and disrupt the disease cycle. MZ can put together a training packet for growers so they understand the pathogen and know how to break the disease cycle.
- *Need to put to bed whether spores are alive or dead on the seed, not to place blame but to know where we need to attack it.*
- Michelmore (UC Davis) is a leading expert on DM in wheat. He might be able to assist in building a strategy to attack it. He genetics are the way to go but we can't broadcast one trait into all the fields at once. There is no way to gauge resistance characteristics and learn. He would say to forget tracking races and just focus on genes from the plants that are working.

- The more organic lettuce that's planted, the more DM strains he is seeing. Its hitting spinach first but its becoming a bigger problem on the other lettuce crops already. Lettuce has more variants that are resistant right now. The way the industry does high density planting and quick turns accelerates the pathogens ability to mutate and spread.
- DM is a water mold that needs moisture. It requires dampness for spores to mutate. Fog and dew can't be controlled but overhead irrigation can. Powdery is on top of the leaves, but DM is under the leaves making application difficult. Overhead irrigation splashes soil and could be spreading the inoculant (This is one possible vector. We already know it is airborne).
- Ridomil – if seed companies can apply throughout the seed growth cycle it can build some resistance. Seems like races got worse when the seed companies stopped using it (most seed is not produced organically anyway). It can delay the onset of DM which would help some fields harvest something, versus (0). Michelmore would say that 30% of the DM races are already resistant to Ridomil so that's not the answer either.
- The desert season is a long, dry, host free period. Could it be equipment, people transference? Driving the rigs down the highway should dry out the spores enough to kill them before the equipment gets to Yuma, unless it's in the seed.
- No one has been able to germinate the inoculum in a lab, but that could just mean we don't fully understand how it replicates and transfers. Can't get it to grow on sugar beets or other products either. "O" spores can survive in the soil but shouldn't be able to survive the heat of the desert.
- *Q-Can a quick steam treatment of seed help? EBF tried steam and it hurts the germination cycle so it may fix one problem but create another.*
- The spinach seed surface is corky and rough so there can be different spore counts per seed. This also makes a seed application inconsistent if its not done right.
- *Q-can we collect Best-Ag-Practices so growers know what cultural practices can minimize its spread? Make that part of Google Docs for now.*
- *Q-is there a way to predict DM onset? The wheat companies have a weather based model that predicts best chance of showing up based on weather conditions.*
- Mary will set up a part of the upcoming LRB annual meeting to focus on DM in spinach. The March 2017 meeting is in Pismo Beach.
- *USDA station is working with Ag Bio Science (Ryan Ranch) on a test to confirm whether or not the surface is infected through a DNA molecular process. They need some growers to test with. If it works it could be a confirmation test within 24-hours.*
- Ag Bio test doesn't detect the race, just the infection. If it's infected it doesn't matter what the race is. You just need to know if its time to cut earlier.

Other Comments

- One processor working with a drone company to see if a camera can detect the pathogen or plant health. Challenge is no database exists to compare with. Researchers haven't really studied what the plant gives off or does during various stages of infection to know if a camera or some type of infrared system can even detect it.
- Q- is there a way to take a conventional fungicide and reverse engineer it to remove the non-organic process? Phosphinates work if we can address the process or have an organic source. CPS is searching worldwide for a source that can be commercially harvested. So far its found in snail eggs, sea urchin eggs, and certain bacteria algae.
- Crispier technology shows promise but it may be considered GMO. DM only grows in the host.
- PF asked MZ about sugar beets as a surrogate host. This has already been tested and didn't work.
- Seed milling process - Actigard seems to work if you can combine with copper. Milling process doesn't use water so any treatment would be post milling. <http://www.syngenta-us.com/fungicides/actigard-50wg>. Note: Actigard is not approved for organic by OMRI (Organic Materials Review Institute) or by WSDA (Washington State Department of Agriculture). The only Organic approved product that Syngenta has is Regard Insecticide – with restrictions.
- Celery and Swiss chard seed process uses heat treatment. Very expensive so growers have to request beforehand. It's not a normal part of the seed production process.
- Q-Lettuce Mosaic - we test every lot. Why not for spinach? Growers are going to need to demand it.
- MZ-No way to measure if the spores on the seed are dead or alive. No lab has been able to grow it yet which means we don't understand the full mutation process. Seed industry pushes back on testing for verticilium or "O" spores. We need to find out what their concerns are.
- *Q (CK)-if we only irrigate during the warm part of the day does that help reduce the available moisture at night? (realize this would use more water but this may be the trade off for now)*
- Growers need to approach seed companies as partners versus adversaries if we expect cooperation to get some type of testing done.
- Seed dyes work today and can highlight spores on the seed, but cant tell if they are dead or alive - Klosterman and Koike have done a lot of work on this (*need to put to bed if spores on the seed are dead or alive*).
- Grapes have had success but they have a natural air-drying because of the plants being off the ground. Spinach is a "mat" that traps ground moisture in.
- When we see the yellowing start, the infection (sporulation) was 5-10 days ago, usually around day 6-7.

- Need to knock on doors of growers who have the best fields in the middle of a DM area outbreak to see if we can replicate what they are doing.
- WA has a lower incident rate than Salinas, but they are also relatively new and don't have the high density planting issue yet.
- *Today we spray over the top. Heard someone is working on coming in from the side, blow the leaves around, and then place a vacuum behind the plant to circulate the fungicide underneath versus the old electrostatic method.*
- NV growers working with drip. Feel overhead irrigation splashing soil based spores when the stoma is open moves the infection into the plant.
- Need to focus on curative and preventive steps. Segment our work into seed, applications, and cultural practices.
- Adding organic silicon to the sprays helps the leaves dry off faster. Reduces surface friction so water runs off faster.
- Grape and berry industry use sulfur in the irrigation water.
- We need to stop focusing on the races since we already know single gene breeding cant keep up. If we cant find a way to break the disease cycle new trials will never catch up to see what works. Gnome work is a long shot but based on what we know its out of the box.
- We need some fresh thinking in the industry on the research side so we can blend the years of experience here, with some new sets of eyes.
- Growers said this past season some averaged over 30% loss of the crop for the entire season.
- Group agreed we need to approach this from a plant pathology standpoint.

Next Steps

- MZ will update her training packet for growers. If they can understand the cycle and how to disrupt it maybe we can slow it down.
- Ask growers and processors to share their BMP's so we have a running list of what they are doing.
- Post trails and information we have individually so we don't waste time duplicating something that was already done -ES
- Talk to Steve Koike about genetics before we bring the seed companies in - ES
- Talk to Klosterman about the 24-hour test and how we can help to expedite it? - ES
- How do we bring the freezer spinach growers in? In spite of DM they let it sit in the fields for days spreading the inoculant because they use optical sorters in the processing to take the yellow out – Group Discussion next meeting.
- Google Docs to start collecting what we have. Send Eric anything you want posted for now (in .pdf format).
- Who is the right person to drive the bus (the TSG of DM)? *The group was asked to think about this for the next meeting.*
- Vet the names and pass info back to the group- ES, PF, CK
- Set up a Michelmores call sometime next week (if he is available) so others can listen in – ES, PF, RC

- Start to think about sustainability as another reason this needs addressed. The current path isn't sustainable and wastes tremendous amounts of inputs (water, seed, fungicides, labor) and ground – Group discussion next week.
- Follow up with WGA due to their work with NOSB around sustainability –ES to send Hank G. our notes.

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