

Mildew Task Force – Organic Spinach
Meeting Notes
April 13, 2017

- The overview and objective statements from the original November 7 meeting were briefly reviewed for the new stakeholders. Mildew requires a multi-prong approach to address prescriptive and ultimately curative steps. A secondary challenge for stakeholders is to share data and cultural practices while still honoring proprietary steps.
- The categories requiring focus include cultural practices, early detection, chemicals, breeding/genetics, and seed.
- The industry's only defense today is to plow under, or harvest early and take the hit on yield. The UC Davis organic spinach cost study for 2015 (released in 2016, <https://coststudies.ucdavis.edu/current/>) showed on average growers are disking 15-30% of their acres. This past winter was even higher for many growers, and the concern is the coming Salinas season due to the recent rains. Not only will the incidence of mildew increase, but other leaf spot diseases could increase too.
- Estimated annual industry loss is over \$100mm due to growing costs and out-of-stocks at retail and food service. Spinach accounts for over 50% of the organic salad category.
- Because of grower concentration if 1-2 growers are out of supply due to mildew it affects the entire organic spinach category.
- We need to find more ways to shave time off trials and get access to private data (without crossing the proprietary line).
- MZ – Request local farm advisor to work on effectiveness and trials to speed up research work. She will talk to Steve Koike about resources and follow up with Jim Correll about status of publishing the latest work that Leafy Greens helped fund.
- ES – will accumulate a list of cultural practices for growers to access. MZ mentioned starting a Mildew Website (as opposed to Google Docs or Drop Box) to make all information accessible.
- ES – will look into creating a database of effectiveness of various bio-fungicides with the intent to avoid “recreating the wheel”. Ideally, the chemical companies will help so it is more science based than opinion. In those instances where growers are mixing their own “cocktails” we will be sensitive to what is proprietary. The intent is to find those things that can buy us a few extra days of protection or detection.
- Using highly acidic products might actually do more harm than good.
- There was a discussion about Texas and Mexico now starting to deal with their own mildew issues. TX is coming off 8 years of drought and now two wet years and is at a critical point with mildew and other leafspot diseases in organic and other leafspots in conventional, especially Stemphylium and Anthracnose.
- JS - shared the challenge of collecting new wild spinach species because the origins of spinach are in the Middle East with Iraq, Iran, and Afghanistan being important collection areas. Breeders recognize the need to plant multiple resistance varieties in

the same field when they do not have completely resistant varieties. However, this can result in the possibility of more than 1 race in the field at the same time. Does this lead to maintaining old races and making of new races? Should we caution that mixing new varieties in the same fields before we find ways to break the disease cycle will just contaminate those varieties quicker?

- Breeders need a minimum of 4-6 seed generations to breed a new variety, and a season only offers 2 cycles. It takes 3-5 generations to develop a new parent line. The disease is “out breeding the breeders”. There was a discussion about how single gene breeding is not the answer long term (confirmed by Michelmore and Brummer from UC Davis back in a November call). Some plant pathologists suspect we may already be up to Race 24.
- Denmark had a rough seed production season with drought last year, and they had a large acreage of plantings to keep up with demand. This dry year showed some fusarium in some fields which is the reason for long rotations in the Northwest. They are trying a year five rotation while the Northwest is 8-12 years depending on the tolerance level of parental lines for fusarium.
- Cultural practices – Should we look at going back to 40” beds for more airflow?
- Mary’s group is looking into obtaining more data for the newer varieties to see if mildew is affecting them at the same rate.
- Average yield for seed production in Denmark is 1,200 kilos per hectare (2.471 acres). The CA produce industry is planting up to 60 kilos per acre which does not allow for poor seed production years.
- NOSB – we discussed the comment period for copper, chlorine, etc. The board make up includes small east coast organic farmers (one board member only farms 7-1/2 acres). Terms are five years and most board members are early in their terms. In light of what’s transpiring with chlorine and copper, it’s not realistic to expect the NOSB board to approve something like “crisper” technology.
- NOSB is pushing for organic spinach seed. This will kill the industry if approved. WGA is aware of this (Hank Giclas) and monitoring the board’s actions.
- Seed producers are already maxed out on ridomil sprays. Conventional treatments used to give mildew protection for 40 days. Today, it’s closer to 24 days. Even the conventional side is now spraying 5-7 times to knock down mildew.
- UC Davis researchers cautioned that sprays are losing effectiveness on the conventional side as well.
- Oxnard was the primary growing region for years until Race 4 knocked out the area.
- Regrow – some feel that regrows are having fewer issues. Theory is the plant is healthier because the root system is established and can resist mildew longer.
- Seed discussion – some felt some producers are already testing their seed so they know if oospores are coming in or not. However, there is not an accepted industry test for the oospores yet. Some researchers are just looking under a microscope. Some DNA type tests don’t tell if oospores are dead or alive.
- Best way to end a field – ideally undercut then disk. If plant material left at just disked, some plants remain alive longer, which gives the pathogen a source to survive

longer. Under cutting cuts the root supply and kills the leaves faster. Some growers are encouraged from results of undercutting, then burning the field as a final step.

- Ordinance path – would take 2-3 years, after an approved test is developed. Some producers are already testing seed for oospores so should we insist on results and ask all producers to test? Another option is for the growing side to test for oospores. Research showed 16-20% of random seed lots (Correll study was 20%, Klosterman study was 16%) had oospores. Need to ask the producers how they can replicate the 80% clean seed into the other 20%. Correll showed in TX that a 1"x1" square on a leaf can hold 4mm spores, and it only takes two individual spores at the asexual stage to start an infection. Combining race resistance in the same field with high-density plantings is pushing the seed to mutate faster.
- Options to clean: Steam clean with vacuum to get into crevices and get moisture out, but need to add beneficial bacteria back so the germination isn't dropped (Bejo). Some past steam processes only focused on steam which killed the beneficial bacteria that is needed to break down the hull. Hot water has had mixed results. Need min temperature of 122F, (165F for best results to kill all diseases but that can kill germ). Incotec had a process that showed promise, but licensing issues made availability difficult. May be worth revisiting. Not sure of capacity but some recalled the process could only clean 100,000 seeds per hour. Rijk Zwaan has a hot water treatment if the seed is over 5% infected, but it does bring down the germ. The trade off might be a lower germ if more net acres are harvested at the end of the season.
- One suggestion was the possibility of getting a variance on replacing organic spinach with conventional as a component in blended items. Organic processors didn't think that was realistic from a consumer standpoint.
- Testing – USDA just looks under a microscope for now. They are working on a dye to help determine if the oospores are dead or alive. Today they can only count all oospores. Next meeting – how can we move down the path of an industry accepted test?
- Not all seed producers test for the presence of oospores because they already know they are there.
- MZ – LGRB will look into a way to update seed variety trial info. If Richard can set up a protocol we can look into a third party lab to do the testing.
- We don't know the real infection rate for all lots, especially in the newer varieties. If the infection is there in the new varieties then we have to find a way to attack it at the seed growing stage. Need to know the actual infection rate in general. If distributors could send in random samples we could determine this fairly quickly. The problem is that the infection rate is determined by the resistance in the hybrid to the isolate or race present. If the hybrid is resistant to the isolate used, it will have a low infection rate. Planting a hybrid susceptible to race or isolate present may show different infection rates for different isolates or races. Infection rate will be hard to judge.
- Denmark is still producing 75% of the world's spinach seed (14,000 acres), then 21% WA and OR (3-4,000 ac), and very small amounts in Chile, (1,000 acres) New Zealand,

France, and Germany. After coming off a drought year, Denmark fought fusarium for the first time last year.

- Group agreed that a breakdown of the 20% infected lots would be helpful: area grown, producer, and varieties.
- Correll's presentation indicated Metalaxyl and Orondis as seed treatment had benefits. However, Orondis is a new material and not registered in California. Metalaxyl is already used on seed destined for conventional production.
- Growers need to request tested and treated seed when opening up new remote areas, at least until we find a way to break the disease cycle.
- There was still a concern that some infected freezer fields are sitting too long to put on weight. If someone sees that please let Eric know.