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Little Cherry Disease Taskforce priorities 2022

Responding to the Little Cherry Disease crisis in cherries and other stone fruit: Current constraints and paths forward

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Context: The Little Cherry Disease Taskforce was established in 2019 to develop a cross-disciplinary, coordinated plan to address research, Extension, policy and funding needs to meet the goal of slowing progression of X-disease phytoplasma and Little cherry virus 2 in the Pacific Northwest fruit industry. Here, we discuss factors limiting our ability to respond to these urgent and critical threats to the cherry and stone fruit industries in the Pacific Northwest. The group includes growers, crop consultants, government members, members of the research and Extension community, and members of industry supported organizations to support research and policy matters. For Washington and Oregon, the general needs are the same, but in some instances the specific paths to meet those needs sometimes differ by state and/or region, in which case we describe them separately. We have separated the constraints and needs into two categories: improving the efficiency and capacity in our current response, and research that will enable better response in the future.

Due to the equivalent symptoms caused by X-disease phytoplasma and Little cherry viruses 1 and 2, this set of symptoms is often referred to colloquially as “Little cherry disease.” Little cherry virus 2 is transmitted by mealybugs, X-disease phytoplasma is transmitted by leafhoppers, and Little cherry virus 1 vectors are not known. X-disease phytoplasma is currently the most prevalent of the three pathogens. There are a few key characteristics of these pathogens that make them difficult to manage. First, the symptoms caused by X-disease and Little cherry virus 1 and 2 are only present in mature fruit, which makes it impossible to identify disease presence when fruit are not present due to 1) tree immaturity, or 2) seasonal phenology, without a costly molecular test. For other stone fruit (e.g., peach and nectarine) there are leaf symptoms. Second, the patchy occurrence of the virus or phytoplasma within the tree, particularly for X-disease phytoplasma, makes finding pathogens within asymptomatic or pre-symptomatic trees using molecular tests difficult. Third, for each pathogen there is a multi-year lag between tree infection and symptoms in mature fruit, meaning that identifying early infection in trees even at the right life stage or time of year is difficult or even impossible. Initially a small portion of the fruit on an infected tree are unmarketable, with proportion of unmarketable fruit increasing each year. Eventually the tree will die but not until many years after the fruit are unmarketable. Finally, X-disease phytoplasma and its leafhopper vectors have wide host ranges, such that controlling the disease reservoirs and primary infection is extremely difficult. A key theme to the problem of cherry disease caused by X-disease phytoplasma and/or Little cherry virus 1 and 2 is that this is an area wide problem, and pathogens and insects that vector them do not care about state or farm borders. Therefore, we need to work together at local and state levels to prevent spread of pathogens from untreated/unmanaged sites back into areas actively managing for disease. This means engaging with members of the cherry and stone fruit (for X-disease) communities that may not have the means or motivation to respond to the disease crisis caused by X-disease phytoplasma and Little cherry virus.

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Immediate needs to overcome limitations to improve current response

Constraint: *Symptoms are not visible in young trees until the trees are old enough to produce fruit, typically a period of 3-5 years. Possibly with few rare exceptions, no other pathogens have symptoms that are only expressed in fruit. Given the lack of fruit in seedlings and limited fruit in mother blocks, this provides an unprecedented challenge to nursery management and evaluation of nursery stock.*

Path forward A: Current fruit tree certification program screening methods are primarily focused on visual scouting and vector management focused on nematodes. Establish a working group to review current policies and procedures for the current Fruit Tree Certification program 16-350 WAC and explore plant health quarantines. This will be informed by proposed research in the "Needs to improve future responses" section below.

Path forward B: Currently the majority of trees planted are non-certified. Legislation is needed to ensure the use of propagative material sourced from pathogen-tested sources, both in state, or entering the state, and funding is needed to expand the state certification program to ensure that nursery blocks can be tested.

Path forward C: Ensure sufficient supply of pathogen-tested G1 germplasm of cherry and other *Prunus* scion, rootstock and pollinizer cultivars needed by PNW growers from the CPCNW for distribution to nurseries for multiplication. This will require 1) increased funding for the Clean Plant Center Northwest to increase staffing and expand facilities to meet this need, and 2) prioritization of cultivars needed by growers.

Constraint*: Because trees do not show symptoms until they bear fruit, planting and management of young non-bearing trees in orchards, is of particular concern.*

Path forward: Develop and implement tree removal, planting and management strategies to reduce the probability of infection by Little cherry virus and X-disease phytoplasma in new plantings. This should include estimation and reduction of local pathogen pressure to limit re-infection risks, as well as the risk of introduction from infected nursery stock.

Constraint*: It is difficult for growers and managers to keep up with rapidly evolving best management practices designed to reduce the spread of X-disease phytoplasma and Little cherry virus.*

Path forward A: Increase the number of Extension personnel and support to guide the industry's response. **Progress**: An Extension ITT position for X-disease and Little cherry virus was hired in Washington. There is only a single Extension person working to meet the needs of the entire Oregon tree fruit industry.

Path forward B: Educational materials and training to increase effective identification, scouting, sampling, tree removal and vector management. **Progress**: As of May 2022, materials include 2 webpages, 26 newsletter articles, and scouting and vector ID guides at treefruit.wsu.edu, a little cherry scouting App, and 2-6 educational events per year. While adoption is high among participating growers additional efforts and resources are needed to reach all growers.

Constraint*: Plant testing costs are high, reducing the industry-wide response.*

Path forward A: Identifying sources of funding to offset costs, potentially through subsidies that would incentivize testing. This is particularly important for smaller farms with less financial resources to address this need. **Progress:** Specialty Crop Block Grant funds have been allocated through the efforts of the WSTFA to the WSU diagnostic lab, which has allowed them to reduce the per-unit cost of diagnostic tests for PNW growers for a limited time.

Path forward B: Research-informed solutions to reduce costs, turn-around time, and improve detection of recent infection are also needed, and is further described in the "needs for future responses" section below.

***Constraint**: Molecular testing capacity*.

Path forward (Oregon): The recent retirement by Oregon OSU plant pathologist (Robert Spotts) has left a vacancy in the plant testing expertise and capacity in Oregon and needs to be replaced. **Progress**: Robert Martin's position was replaced at USDA Corvallis.

Path forward (Washington): Improve capacity through: i) continued support for commercial labs, and ii) increased support for sustained diagnostic testing capacity at WSU or other publicly funded labs to conduct area-wide surveys. **Progress**: Six labs have current proficiency tests as of May 2022. As of August 2021, capacity for XDP/LCV2 samples from 6 labs was 19,250 samples over 3-month testing period. Funding was leveraged for expanded capacity of the WSU diagnostic lab. Future initiatives focused on testing pre-symptomatic trees or nursery trees would alter this ability to meet the capacity.

***Constraint**: High cost of tree removal, replanting and time to maturity disincentivizes removal, promoting disease spread. Furthermore, infected blocks produce reduced, but potentially financially viable yields for multiple years creating short term disincentives for tree removal.*

Path forward A: The USDA FSA Tree Assistance Program is helpful to encourage the removal of diseased trees. However, this program needs to be streamlined to improve the speed of the response to prevent continued spread of the disease and focused on tree removal, rather than replanting. Lag times and need for extensive evidence of disease infection discourage tree removal, potentially allowing pathogen spread within orchards and to neighboring farms. Furthermore, funding should be used to offset lost income, rather than just the costs of tree removal. Third the current program subsidizes replanting which is not always appropriate after removal of infected trees, as orchard land cannot be immediately replanted with cherries or stone fruit due to disease pressure from surrounding blocks.

Path forward B: Provide cost share for tree removal, which is independent of replanting, and with a quick, streamlined application process. Cost share should be adapted to the particular economic constraints of operations of different sizes and scales, and to ensure programs are accessible to typically underserved communities and/or communities with reduced access to financial resources. **Progress**: WSDA Specialty Crop Block grant is providing approx. $250,000 towards incentivizing tree removal. Additional funds are needed.

Needs to improve future responses.

For updated research progress see:

http://treefruit.wsu.edu/crop-protection/disease-management/western-x/

http://treefruit.wsu.edu/crop-protection/disease-management/little-cherry-disease/

https://treefruitresearch.org/advanced-search/

Constraint: *It is unclear what levels of infection risks threaten delivered nursery stock at each stage: rootstock, budwood, and developing nursery trees.*

Path forward A: A molecular test-based survey of each stage of nursery production will help evaluate infection risks at each stage of production.

Path forward B: Research on management strategies to safeguard plant material will help reduce infection risks identified in "Path forward A."

Path forward C: Following each path forward described above, Extension activities are needed to apply best management practices and reduce infection risk for nursery stock.

Constraint*: Currently the only method of reliable disease detection is at harvest, allowing for transmission to occur not only pre-harvest, but throughout the early stages of the tree's life before it is fully matured.*

Path forward A: Continued research on plant-pathogen interactions to better understand the impacts of the phytoplasma on tree pathogenicity and virulence and relationships to environmental conditions. Identification of these physiological changes may allow for methods to detect the changes and allow for early disease detection, and decision making.

Path forward B: Continued research to study the biotic and abiotic factors that influence phytoplasma tropism and titer during the course of an infection from inoculation to systemic infection and symptom expression.

Path forward C: Development of methods for rapid, reliable identification of infected trees in orchards and nurseries, building on continued research.

Constraint*: Limited knowledge of the leafhopper and pseudococcid insects that vector the X disease phytoplasma and Little cherry virus 2 (leafhoppers for X disease in particular), respectively, limit our ability to control the insects and, for X-disease, identify alternate hosts that may act as disease reservoirs in the orchard landscape.*

Paths forward A: Continued research to identify all vectors of each, X-disease and Little cherry virus 1, and Little cherry virus 2. Information on seasonal acquisition and necessary titers of pathogens for vector acquisition will help determine the timing and application of control methods.

Paths forward B: Continued research on vector biology, behavior, phenology, and host plant use, particularly for leafhopper vectors of X-disease, including impacts of phytoplasma on leafhoppers.

Paths forward C: Better understand ecological interactions between vectors and other species to identify potential biological control agents, with particular emphasis on leafhoppers, given the lack of knowledge.

Paths forward D: Development of an integrated pest management program for X-disease vectors that can be implemented areawide.

Paths forward E: Continued research to better understand X-disease vector genetics to capitalize on genetic-based control methods.

Paths forward F: Recent and historic research suggests that alternative hosts in the ground cover are an important part of the life cycle of each, X-disease vectors and phytoplasma, but more options are needed to control immature vectors in orchard groundcover.

Constraint*: Evaluation of phytoplasma and leafhopper biology suggests that broadleaf weeds are common hosts for both, pathogen and vector. However, it is unclear how best to manage groundcovers to reduce the presence of alternative hosts.*

Path forward A: Research comparing different management regimes, such as (re)planting aggressive grass to outcompete broadleaf weeds, application of selective herbicides, weed mats/reflective ground cover, and bare ground cultivation will inform vector and pathogen management. Effects on tree physiology and economics must be considered in these evaluations.

Constraint*: Currently there are no varieties of cherry or other stone fruit crops resistant to X-disease phytoplasma or Little cherry viruses.*

Path forward A: Continued funding for breeding programs can develop resistant or tolerant varieties to ensure productivity, despite presence or risk of X-disease phytoplasma, Little cherry virus 1 or 2.

Path forward B: Development of treatment protocols for infected trees.

Constraint*: On-farm research may lead to infection of surrounding orchards, particularly, as is often the case, when conducted on commercial orchards*

Path forward: Develop and support designated facilities (ideally a contained, screened-in orchard) to conduct research in realistic scenarios where trees can be infected while limiting pathogen spread to commercial orchards. **Progress**: Experimental blocks have been or are being established by USDA in Wapato, and by WSU in Prosser.

Constraint*: Currently the industry is using many approaches to remove diseased trees and it is unclear which is most effective. Furthermore, methods depending on herbicide treatment are not available for organic farms.*

Path forward: Continued research tree removal techniques and re-establishment will allow for development of standard, effective tree removal techniques. **Progress:** best management practices for tree removal have been developed.

Constraint: *Multiple disease and vector management options are being developed and economic analyses to identify the most economically sustainable management practices are needed.*

Path forward: Conduct economic analyses of multiple management practices and scenarios (e.g., high pressure blocks versus low pressure blocks, different commodities, etc.) so that informed decisions can be made by a wide range of growers.