Organic fire blight control and the NOSB

by David Granatstein, Washington State University. September 2011.

Fire blight is a plant disease caused by the bacterium *Erwinia amylovora*. It is native to North America where it resides in wild hosts such as crabapple and hawthorn. Over the decades, it has spread to other pome fruit producing regions in Europe, the Middle East, and New Zealand. But it is currently absent from South America, South Africa, East Asia, and Australia. Apple and pear orchards in the Pacific Northwest are at risk from this disease, which is even more challenging in other parts of the country. A serious infection does not occur every year in every orchard, but constant vigilance is required. The most common infection route in our region is through the blossom, and thus monitoring and control is generally most critical at bloom. The disease can be vectored in many ways, including honeybees, other insects, birds, rain, wind, and hail. Once a tree is infected, the bacteria travel downward in the tree's vascular system and can kill the entire tree and can rapidly spread to infect an entire block (see Figure 1). Thus the economic consequences can be devastating.

Growers have a number of tools for preventing and controlling fire blight, including: plant genetics, sanitation, removal of diseased limbs, nitrogen and water management, antibiotics, copper, and biocontrol products. Antibiotics have long been key disease control materials for fire blight, one of the few uses of antibiotics in plant agriculture. These materials are natural compounds produced by naturally-occurring soil microorganisms. For the past several decades, the most common control for fire blight has been the use of antibiotic sprays along with a predictive model of disease development. The two antibiotic materials used are oxytetracycline and streptomycin. The former is primarily used in our region, while Midwest and Eastern growers rely on the latter. Streptomycin is now generally ineffective in the Pacific Northwest due to resistant disease strains, while tetracycline can provide 85-95% control if application is timed correctly. These materials have shown the best and most consistent control compared to other options. Biological controls have been researched and developed continuously since the 1980s, but to date, no control has proven equal to antibiotics. For example, Sundin et al. (2009) tested several biocontrols over seven years in Michigan, New York, and Virginia, and found that "the prospects for biological control of fire blight in the eastern United States are currently not high due to the variability in efficacy of existing biological control options." In the Pacific Northwest, oxytetracycline is applied when needed during the bloom period of apples and pears, and no residues have been detected in the fruit at harvest.

When the National Organic Standards were being drafted, the two antibiotics, both considered synthetic products because of their manufacturing process, were ultimately put on the National List of Allowed Synthetics with the specific annotation for use only for fire blight control in organic apples and pears [NOP Subpart G Section 205.601(i)9-10)]. Materials on the List are reviewed every five years as part of the sunset process to determine whether their continued use is justified or whether a suitable organic compliant alternative has become available. Given that these are the only allowed uses of antibiotics on organic foods, there has been pressure to phase them out. Various interests have put forward justification over the years, while growers have cited the lack of effective alternatives.

In 2006, the National Organic Standards Board (NOSB) cast a mixed vote (7 yes, 4 no) to renew the two antibiotics until the next sunset review. Then the NOSB received a petition in October 2007 to change the annotation to the use of oxytetracycline by adding another chemical form of it. This triggered a review independent of the sunset process (slated for 2011) and would have reset the sunset clock for another five

years. On November 19, 2008, the NOSB changed the annotation to include both forms of tetracycline, but also added the expiration date of October 21, 2012, thus removing it from the normal sunset process. The USDA accepted this recommendation as a final rule in 2010. The majority of NOSB members appeared to support phase-out as soon as possible. Streptomycin was slated for sunset review in 2011 and a similar phase out date was envisioned.

Washington State organic orchardists were surveyed in February 2010 regarding their likely response to this regulatory change. Eighty-two percent of the respondents said they would not be able to control fire blight in a high infection risk year (CougarBlight model >700-800) without antibiotics (Figure 2), given the available alternatives. Many growers anticipated reducing their organic apple and pear production based on the loss of tetracycline. Organic growers in the Upper Midwest and Pennsylvania were also polled and generally said that antibiotics were a crucial tool of last resort for fire blight control. Since Washington State produces the vast majority of organic fresh market apples and pears in the U.S., the loss of tetracycline would likely diminish the supply of these products at the same time that demand is still growing in domestic and international markets. And since the disease is not present in South America, a decrease in domestic supply would likely be replaced with imported fruit. In response, the Washington State Horticulture Association submitted a petition to the NOSB to remove the annotation regarding the phase-out out date for oxytetracycline. The petition was put on the docket for the April 2011 NOSB meeting in Seattle, which also included the sunset review of streptomycin. The meeting location was fortuitous, as many affected growers were able to testify in person.

The testimony and discussions at the Seattle meeting were lengthy and illustrated the complexity of the fire blight disease. Most NOSB members had little understanding of the nature of the fire blight disease, the effective control options available, and the levels of risk and loss grower face with the disease. A significant part of the justification for the phase-out was based on presumed availability of alternative controls and resistant varieties and rootstocks. Alternative controls are registered for use, but have not performed consistently or with the same efficacy as antibiotics, as stated above. According to Tim Smith, WSU Extension and a world expert on fire blight, all pears are considered quite susceptible. Apples have a wider range of susceptibility, but none are truly resistant. 'Red Delicious' apple is one of the less susceptible varieties, but it is also one of the least desired by organic consumers. 'Gala' and 'Fuji' are produced on the most organic acres in Washington, and 'Gala' is more susceptible. So do growers choose a variety principally on the basis of consumer demand or a disease trait? An extension bulletin from Colorado State University states that "Cultivars of apple, crabapple, and pear differ in their degree of susceptibility to the bacterium … although some cultivars are less susceptible than others, no cultivar is immune to infection when the pathogen is abundant and conditions are favorable for infection." Thus full resistance, or immunity, is NOT currently available for growers to utilize. There is a new project using marker-assisted breeding to find sources of resistance from *Malus sieversii*, a wild apple relative that could lead to NOP compliant resistant varieties in the future. The NOSB repeatedly referred to resistant rootstocks, especially the 'Geneva' series from New York, as a reason to phase out antibiotics. These look very promising, but are not yet commercially available due to propagation problems. The major tree fruit nursery companies were interviewed during December 2011 as asked about what resistant varieties they would recommend for commercial growers, and the availability of 'Geneva' rootstocks. They said they had no good suggestion for a resistant variety for commercial growers, as none were known or accepted in the marketplace. And they could not provide any trees with 'Geneva' rootstock before 2014 due to propagation challenges. Additionally, a resistant rootstock does not confer resistance to the scion (top) of the tree, which is where infections occur (primarily through the blossoms). And you don't switch

a rootstock in an orchard like you change a wheat variety in a seed drill. Replanting an orchard is a $15-20,000 per acre expense. Introducing a new variety into commercial channels is a multi-million dollar proposal that can take years. The discussion around resistant germplasm pointed out how complex this entire issue is and the challenge posed to members of the NOSB who typically do not have the technical background to understand it. This leaves organic growers quite vulnerable to the particular expertise and biases of the Board members whose decisions can have a dramatic impact down on the farm. It suggests that growers need a better mechanism to ensure that their voices and concerns are heard by NOSB, something that the Organic Tree Fruit Industry Work Group hopes to provide.

After much debate and numerous revisions to the committee recommendations, the NOSB voted to extend the expiration date for oxytetracycline to October 21, 2014. The same expiration was voted for streptomycin under the sunset review. You can read the statements at http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5091701 and http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5091714 . The Board asked the industry to set up a task force to monitor progress towards alternatives, which has been initiated by Washington State University and Michigan State University, with support from the Organic Trade Association. The Organic Tree Fruit Industry Working Group will provide updates to the NOSB and try to help them objectively assess whether suitable alternatives to antibiotics are ready by October 2014. An update was provided at the November/December NOSB meeting in Savannah, along with a series of fact sheets developed by the group. Unfortunately, any change to the decision already made will require a new petition to NOSB, a lengthy and potentially costly process.

In the meantime, research on non-antibiotic fire blight control continues. Dr. Ken Johnson, Oregon State University, was awarded a USDA OREI grant to continue his work on fire blight control in organic fruit. He will collaborate with colleagues in Washington and California and test both new products as well as integration of existing tools and management practices. Several growers have tried a non-antibiotic regime and report success so far. A new yeast product from Germany called Blossom Protect® shows promise in initial trials in western states, but not in Michigan. Ironically, this yeast, naturally occurring in Washington orchards, was screened for its potential use a number of years ago by Dr. Larry Pusey, USDA-ARS fire blight researcher in Wenatchee. He has plans to investigate it, other biocontrol agents he has worked on (such as *Pantoea agglomerans* or Bloomtime Biological®), as well as the potential to use bacteriophages (a virus that attacks bacteria) against the fire blight organism. Interestingly, some of the biocontrol agents available or being developed themselves produce antibiotics to control the fire blight bacterium which work similarly to the antibiotics being phased out by NOSB. Tim Smith has recently upgraded the CougarBlight predictive model for fire blight that is routinely used in Washington to decide if and when to treat for the disease based on the weather (http://county.wsu.edu/chelan-douglas/agriculture/treefruit/Pages/Fire_Blight.aspx). And new diagnostic tests are becoming available, such as the LAMP test developed by Ken Johnson to determine the presence/absence of active fire blight bacteria in an orchard.

The story of fire blight, antibiotics, and the NOSB illustrates some of the challenges of the organic standards process. The Board members, all volunteer, are confronted with huge work loads that seem to continually grow larger. They generally do not have the technical expertise to evaluate many of the issues they are deciding on and must rely on expert input, stakeholder testimony, and fellow Board member

recommendations. They are trying to balance often conflicting interests of different stakeholders and not do harm to the organic sector. However, it is apparent that the biases of an individual or two on the Board can shape recommendations to the Board without there being adequate checks and balances from potentially affected parties. Given the recent fire blight experience, the interests of growers need to be better represented in the process and the Board should be more pro-active in soliciting representative grower input regarding decisions that could have large negative consequences. The realities of production and the market must be considered by the NOSB and their decisions should allow for growers to make an orderly change of practice without undue disruption of their efforts to provide organic foods. Several Board members themselves described how their own children will not eat the organic 'Red Delicious' apples that they bring home, while the 'Galas' are quickly devoured, confirming that less disease susceptible varieties that no one wants to buy are not a solution to the fire blight problem. While getting involved in the NOSB process is extremely time consuming, the more members of the organic community that do so will definitely help improve the process over time.

References

Sundin, G.W., Werner, N.A., Yoder, K.S., and Aldwinckle, H.S. 2009. Field evaluation of biological control of fire blight in the eastern United States. Plant Disease 93:386-394.

Figure 1. Fire blight risk: "Under optimal conditions, it can destroy an entire orchard in a single growing season" (Wikipedia). An infected 'Pink Lady' apple block in Washington State. (Photo: Tim Smith)

Figure 2. Washington organic grower response to the loss of oxytetracycline. Results from surveys at winter meetings, 2010 and 2011. D. Granatstein, unpublished.