Antibiotics in Fruit Production

Support the Crops Committee recommendation to discontinue streptomycin and tetracycline use in organic fruit production by allowing streptomycin to sunset and rejecting the petition to repeal the 2012 phase-out of tetracycline.

Summary

Antibiotic resistance is an important threat to human health, and the use of antibiotics in agriculture contributes to the problem.

Organic consumers do not want antibiotics used on their food.

Organic growers have a responsibility to choose varieties that are resistant to diseases before adopting a chemical response to the disease.

Support the committee recommendations to allow streptomycin to sunset and to deny the petition to remove the expiration date on tetracycline.

More Details

There has been controversy over the use of the antibiotics streptomycin and tetracycline in organic fruit production since they were first approved by a split vote in 1995. As laid out in the committee decision for streptomycin, many issues have been raised. Foremost among these have been:

1. The potential for promoting resistance to the antibiotics in human pathogens by spraying them in the orchard environment,
2. Inconsistency with the position on antibiotic use in animals, and
3. Incompatibility with organic and sustainable agriculture.

1. Resistance

We all recognize that resistance to antibiotics among human pathogens is a huge problem. The Centers for Disease Control (CDC) call it, "one of the world's most pressing public health problems."[1] Many bacterial infections are becoming resistant to the most commonly prescribed antibiotics, resulting in longer-lasting infections, higher medical expenses, and the need for more expensive or hazardous medications. Tetracycline is used for many common infections of the respiratory tract, sinuses, middle ear, and urinary tract, as well as for anthrax, plague, cholera, and Legionnaire's disease, though it is used less frequently because of resistance.[2]

[1] CDC, "Get Smart: Know When Antibiotics Work." http://www.cdc.gov/getsmart/antibiotic-use/fast-facts.html Accessed 3/20/2011.

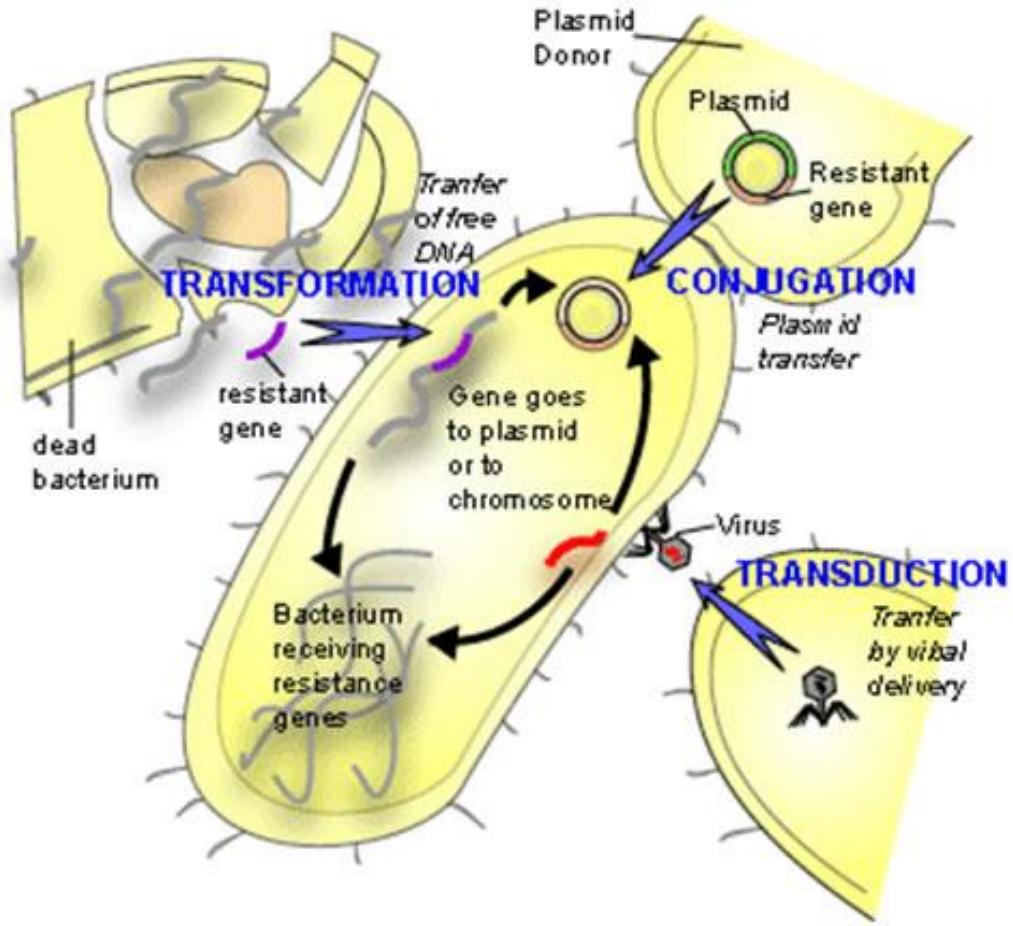
[2] Tetracycline TR, 2006. Lines 68-71.

Streptomycin is used for tuberculosis, tularemia, plague, bacterial endocarditis, brucellosis, and other diseases, but its usefulness is limited by widespread resistance.[3]

It has not been so well appreciated by this board that use of antibiotics on fruit trees can contribute to resistance to the antibiotic in human pathogens. The human pathogenic organisms themselves do not need to be sprayed by the antibiotic because movement of genes in bacteria is not solely "vertical"—that is from parent to progeny—but can be "horizontal"—from one bacterial species to another. So, a pool of resistant soil bacteria can provide the genetic material for resistance in human pathogens.

The basic mechanism is as follows. If bacteria on the plants and in the soil are sprayed with an antibiotic, those with genes for resistance to the chemical increase compared to those susceptible to the antibiotic. We know that resistance genes exist for both streptomycin and tetracycline, and spraying with these chemicals increases the frequency of resistant genotypes by killing those susceptible to the antibiotic and leaving the others. Those genes may be taken up by other bacteria by a number of mechanisms, collectively known as "horizontal gene transfer." They include *transformation*, in which bacteria pick up DNA that is free in the environment—for example, from dead and degraded bacteria, *conjugation*—from direct cell-to-cell contact, which may involve unrelated bacteria and is mediated by plasmids or transposons, and *transduction*—the transfer of DNA via phage. These are illustrated below.

[3] NLM (U.S. National Library of Medicine). 2006. Streptomycin sulfate injection, solution. DailyMed website. National Institutes of Health. http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?id=2250



Once resistance genes are present in *any* bacteria, they increase the pool of resistance genes and the likelihood that human pathogens will acquire that resistance. See the paper "Emergence, Spread, and Environmental Effect of Antimicrobial Resistance: How Use of an Antimicrobial Anywhere Can Increase Resistance to Any Antimicrobial Anywhere Else" by Thomas F. O'Brien for further clarification.

The contribution of antibiotic use in fruit trees to resistance may not be nearly as important as the use of non-therapeutic antibiotics in livestock, but it does have an impact on the pool of antibiotic-resistant bacteria, and organic agriculture should not be contributing to the problem. Furthermore, antibiotics may be taken up by plants and affect bacteria.

2. Inconsistency with Prohibition of Antibiotics in Organic Animal Husbandry

The organic rule (205.238(c)(1) says organic livestock producers may not "[s]ell, label, or represent as organic any animal or edible product derived from any animal treated with antibiotics." This has contributed to reduced rates of antibiotic resistance in bacteria in animals

on those farms.[4] The intention has been to prevent antibiotic resistance by using good preventive health care that can eliminate most need for antibiotics. Even in an emergency, if animals may be treated with antibiotics, they may not be sold as organic. In the case of fruit production, antibiotic use has been allowed, and as shown below, it has resulted in practices that create more need for the chemicals. The program should be consistent in prohibiting the use of antibiotics.

3. Incompatibility with Organic and Sustainable Agriculture

The use of antibiotics in organic fruit production is incompatible with a system of organic and sustainable agriculture for a number of reasons.

First of all, it does not encourage and enhance preventive techniques, including cultural and biological controls. Almost every publication on fire blight stresses that the first line of defense is the choice of disease-resistant varieties and rootstocks. The following table listing resistant and susceptible varieties of apples, pears, and their rootstocks is from a Purdue Extension publication.[5]

Table 1. Fire Blight Resistance of Apple and Pear Varieties Resistance Varieties

Apples

Highly Resistant	Jonafree, Melrose, Northwestern Greening, Nova EasyGro, Prima, Priscilla, Quinte, RedFree, Sir Prize, Winesap
Resistant	Dutchess, Empire, Red Delicious, Goldrush, Haralson, Honeycrisp, Jonagold, Jonamac, Libery, McIntosh, Northern Spy, Novamac, Spartan
Susceptible	Beacon, Cortland, Fuji, Gala, Golden Delicious, Granny Smith, Honeygold, Idared, Jonathan, Lodi, Monroe, Mutsu (Crispin), Paulared, Rome Beauty, Wayne, Wealthy, Yellow Transparent, Zesta!

Apple Rootstocks

Resistant	B.9,* Geneva 11, Geneva 30, Geneva 65, M.7, M.27,* Novole, Robusta
Susceptible	Alnarp 2, Bemali, Bud. 9*, Bud. 118, Bud. 140, C.6 (interstem) M.9, M.9 (interstem), M.26, M.27,* MM.106, MM.111, Mark, Ottawa 3, P.2, P.16, P.22

Asian Pears

Resistant	Chojuro Kosui, Olympic (Korean Giant), Seuri, Shinko, Shinsui, Singo, Tse Li, Ya Li*
Susceptible	Hosui, Kikusui, Okusankichi, Seigyoku, 20th Century(Nijisseki), New Century

---

4

Schwaiger K, Schmied EM, Bauer J., 2010. Comparative analysis on antibiotic resistance characteristics of Listeria spp. and Enterococcus spp. isolated from laying hens and eggs in conventional and organic keeping systems in Bavaria, Germany. Zoonoses Public Health. 2010 May;57(3):171-80.

[5] J. Beckerman, "Fire Blight on Fruit Trees in the Home Orchard", http://www.extension.purdue.edu/extmedia/BP/BP-30-W.pdf.

	(Shinseiki) Ya Li*

Pears

Highly Resistant	Honeysweet, Kieffer, LaConte, Magness, Moonglow, Old Home
Resistant	Seckel, Maxine
Susceptible	D'Anjou, Aurora, Bartlett, Bosc, Comice, Clapp's Favorite, Dutchess

Pear Rootstocks

Resistant	Old Home (OH) Old Home x Farmingdale (except OHxF 51), *P. calleryana*, *P.betulifolaefolia* seedlings
Susceptible	Bartlett Seedling, Quince seedling

*There are studies that provide contradicting data, suggesting that this cultivar, rootstock, or species is susceptible.

Compatibility with sustainable and organic principles requires that growers first choose varieties that are not susceptible to important diseases in their region. Other preventive techniques should be used, including site selection, careful fertilization, adequate spacing, and proper pruning practices. Use of a material like streptomycin or tetracycline should be a last resort. There are now additional products available for use against fire blight. Serenade Max, Bloomtime Biological FD, BlightBan C9-1 and **Blightban A506 are relatively new biological controls. Surround is a kaolin clay product that has had some success in controlling fire blight.**[6]

We have seen over the past years a trend towards greater dependence on the antibiotics and a greater concentration of susceptible varieties grown in high densities on susceptible rootstocks.[7] See, for example, the trends in apple and pear varieties grown by organic growers in Washington in the Granatstein presentation, cited below, pages 11 and 14, and compare to the list above of resistant and susceptible varieties.

The use of antibiotics is not sustainable, since it inevitably leads to resistance, as has been seen with streptomycin in the Pacific northwest. And in the long run, it leads to health problems for everyone on the farm—from the plants to the humans. For a summary of some of these problems, see the appendix to these comments.

---

[6] Glenn, D. M., van der Zwet, T., Puterka, G., Gundrum, P., Brown. E. 2001. Efficacy of kaolin-based particle films to control apple diseases. Online. Plant Health Progress doi:10.1094/PHP-2001-0823-01-RS. http://ddr.nal.usda.gov/bitstream/10113/12139/1/IND43805958.pdf

[7] PW Steiner, 1998. How Good are Our Options with Copper, Bio-controls and Alliette for Fire Blight Control? WV University Kearneysville Tree Fruit Research and Education Center. http://www.caf.wvu.edu/kearneysville/articles/SteinerHort2.html

M. Longstroth, 2002. The 2000 Fire Blight Epidemic in Southwest Michigan. MSU Extension Horticulture. http://www.canr.msu.edu/vanburen/fb2000.htm

D. Granastein and J. Kirby, 2010. Organic Tree Fruit Production Trends. WSHA Annual Meeting Dec. 6, 2010, Yakima, WA. http://csanr.wsu.edu/publications/presentations/Org_Fruit_Trends_WSHA_2010.pdf

Finally, organic consumers understand these things. They understand the importance of the threat of antibiotic resistance. An important reason that consumers buy organic meat is the absence of antibiotics. Organic consumers do not want antibiotics to be used on their fruit.

More information about tetracycline and streptomycin can be found in the Crops Committee section of the NOSB meeting packet, and under the listings for tetracycline and streptomycin in the NOP Petitioned Substances Database.

You may submit comments at the Regulations.gov website. Please identify your comments with "CC: tetracycline and streptomycin." You will have 20 minutes to type comments of 2000 *characters* or less, or you may upload a file. You may see a list of all comments that have been submitted on all proposals here.