Antibiotics in Fruit Production

A challenge to organic integrity

By Terry Shistar, PhD

Editor's Note: *The vast majority of antibiotics used in food production are given to non-organic livestock. According to Physicians for Social Responsibility, the non-therapeutic use of antibiotics in livestock production accounts for nearly 80% of all antibiotics used in the United States. Typically, low levels of antibiotics are administered to animals through feed and water to prevent disease and promote growth. This is generally done to compensate for overcrowded and unsanitary living conditions, as is common in concentrated animal feeding operations (CAFOs), and to fatten livestock to get them to market sooner. Non-therapeutic antibiotic use is prohibited in the production of all organic animal products, however, as an exception it is allowed for use in organic apple and pear production –a situation the current National Organic Standards Board has sought to correct with its vote in April 2011 to phase out this use by 2014.*

People think of organic agriculture in many ways. Some define it by the things that are lacking –organic production should involve no pesticides, synthetic chemicals, or processing technologies you wouldn't have in your kitchen. Others think about it in terms of food value –organic food should be nutritious and safe to eat without washing. And some think of it as ecologically-based agriculture. Still others think of the economic opportunity provided by a market for a premium product.

For the originators of the organic method, it was all about the soil. They believed that the soil must be regarded as a living organism. Organic gardening and farming literally grew out of the study of composting. As J.I. Rodale and the Rodale staff wrote in *The Complete Book of Composting*:

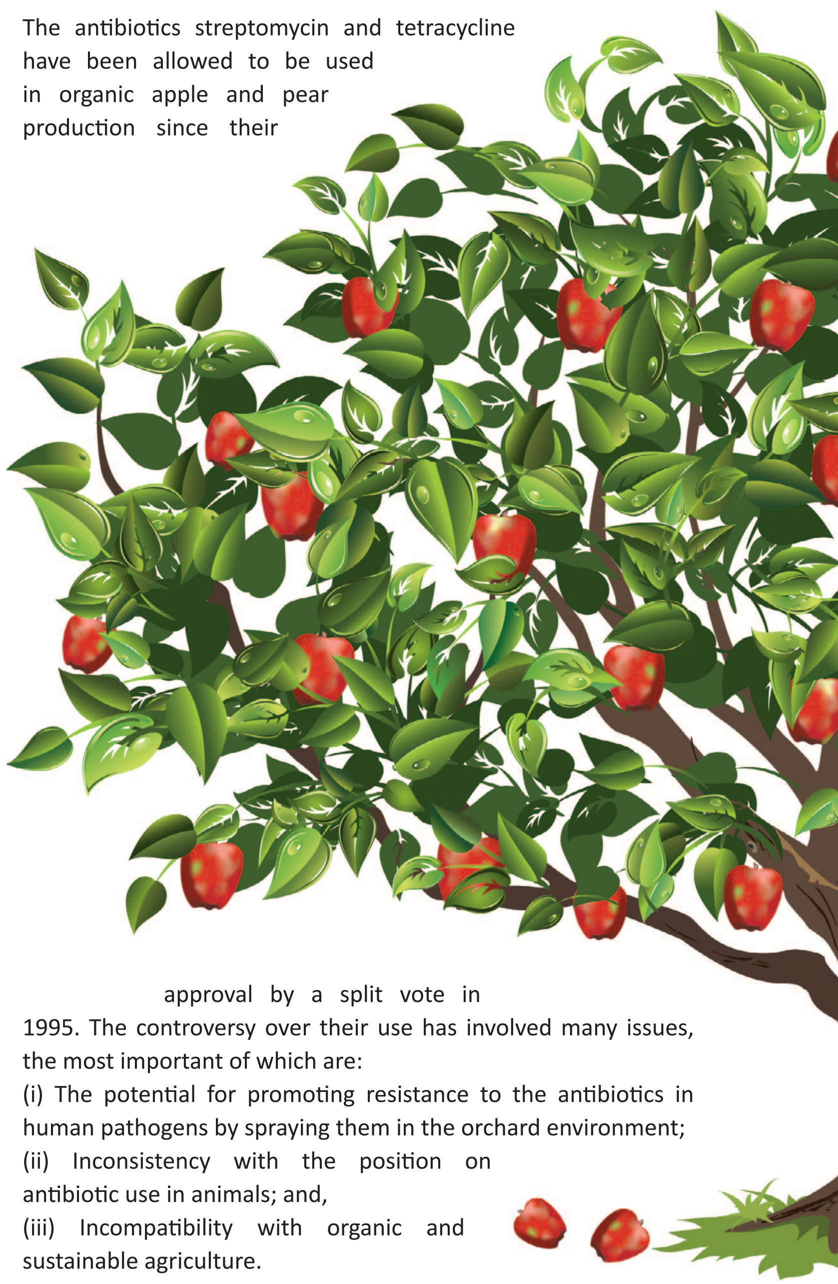
At the very foundation of good nutrition is the soil –soil that is fertile and alive, that is kept in shape to grow plants as nature meant them to be grown. The life and balance in this soil is maintained by returning to it those materials which hold and extend life in a natural cycle, and aid in replenishing the nutrients needed to produce healthy, life-supporting crops. Soils that lack vital plant nutrients cannot give these food values to what is grown in them.

Hence the saying, "Feed the soil to feed the plant."

The *Organic Foods Production Act* (OFPA) was written with the intention of ensuring that organic food meets *all* of these expectations. And it offers opportunities for all of us to engage in protecting our vision of organic food. Protecting the integrity of the organic label depends on our views of what "organic" means to us being repeatedly voiced in response to proposals that might weaken the legal meaning.

The National Organic Standards Board (NOSB) was established by OFPA to "assist in the development of standards for substances to be used in organic production and to advise the Secretary" on implementation of the act. One issue that arose recently before the NOSB –the use of antibiotics in apple and pear production for fire blight, a bacterial disease– illustrates the problems encountered in maintaining organic integrity as organic production expands to meet an increasing demand.

The antibiotics streptomycin and tetracycline have been allowed to be used in organic apple and pear production since their approval by a split vote in 1995. The controversy over their use has involved many issues, the most important of which are:

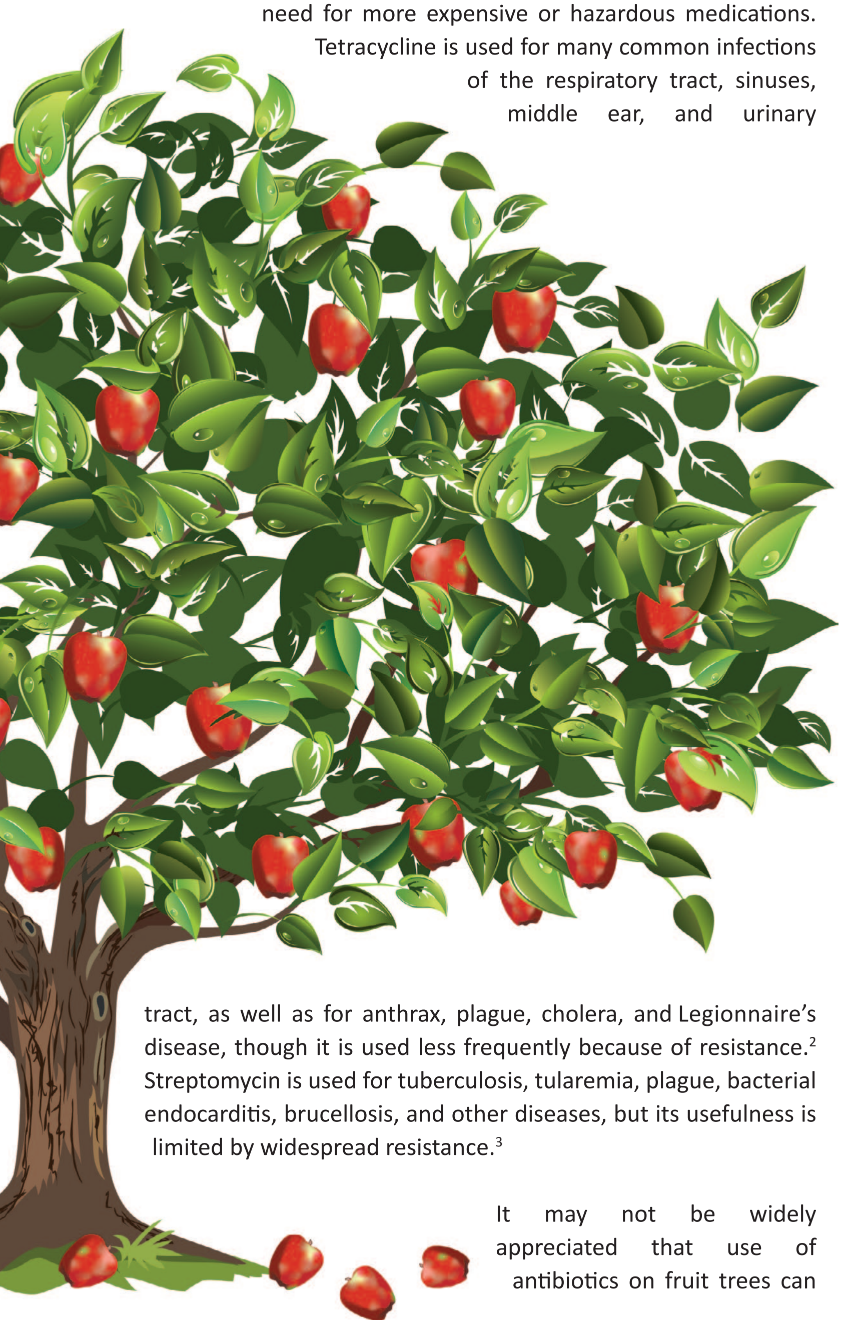


(i) The potential for promoting resistance to the antibiotics in human pathogens by spraying them in the orchard environment;
(ii) Inconsistency with the position on antibiotic use in animals; and,
(iii) Incompatibility with organic and sustainable agriculture.

Definition of Organic Production
A production system that is managed in accordance with the Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity. (7 CFR 205.2)

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



It may not be widely appreciated 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.

"Horizontal gene transfer –the movement of genetic material from one organism to another– is the primary mechanism by which bacteria acquire antibiotic resistance."[4] 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.[5]

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, residues of antibiotics in the soil may be taken up by treated or untreated plants and affect bacteria.[6]

2. Inconsistency with Prohibition of Antibiotics in Organic Animal Husbandry

The organic rule (205.238(c)(1) is clear that 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.[7] 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. Table 1, from a Purdue Extension publication, lists resistant and susceptible varieties of apples, pears, Asian pears, and their rootstocks.[8]

Table 1. Fire Blight Resistance in Apple and Pear Varieties[8]

Organic apple and pear trees may be treated with the antibiotics streptomycin and tetracycline to control fire blight. This can increase the likelihood that bacteria causing human diseases will be resistant to those antibiotics as well. (Apples and pears produced by chemical-intensive agriculture may be treated with these antibiotics as well as other poisons.) You can reduce your exposure to resistant bacteria and give growers an incentive to eliminate antibiotic use by demanding resistant varieties. Take this chart shopping with you, and try some new apples and pears. If you shop at a farmers' market or another place where you can talk with the grower, ask about antibiotic use and the varieties they grow.

Apples	
Highly Resistant	Jonafree, Melrose, Northwestern Greening, Nova EasyGro, Prima, Priscilla, Quinte, RedFree, Sir Prize, Winesap
Resistant	Cameo, Dutchess, Empire, Red Delicious, Goldrush, Haralson, Honeycrisp, Jonagold, Jonamac, Liberty, McIntosh, Northern Spy, Novamac, Spartan
Susceptible	Beacon, Braeburn, Cortland, Fuji, Gala, Gingergold, Golden Delicious, Granny Smith, Honeygold, Idared, Jonathan, Lodi, Monroe, Mutsu (Crispin), Paulared, Pink Lady, 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 (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.

History of NOSB Actions on Antibiotics in Apples and Pears

1995. In a split vote, streptomycin and tetracycline added to National List for fire blight in apples and pears.

1998. The proposed regulations would have allowed "antibiotics as pesticides." In spite of the public's concentration on the "big three" (genetic engineering, sewage sludge, and irradiation), there was public opposition to the use of antibiotics as pesticides.

2000. The next draft rule removed the NOSB recommendations allowing streptomycin and tetracycline in order to be consistent with the prohibition of antibiotics in livestock. Later, in December 2000, the two antibiotics were reinstated in the final rule in response to public comment from growers.

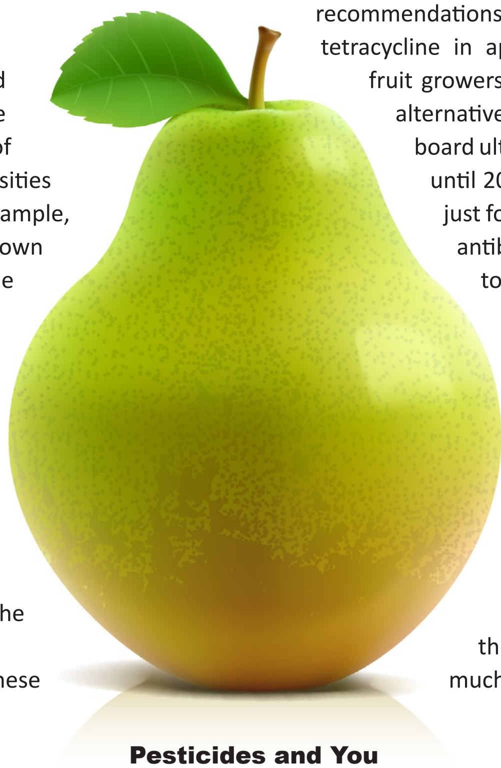
2006. After expressing concern and the wish that someone might petition to remove them sooner than the next sunset review (every five years), the two antibiotics were renewed with a vote of 7 yes, 4 no, 1 abstention, and 2 absent.

2008. A petition to add another form of tetracycline –oxytetracycline hydrochloride– would have reset the clock on tetracycline sunset. NOSB members were not happy with extending the sunset because they wanted it off the list. The Board voted against the proposal with a vote of 1 yes, 13 no, and 1 absent. Later, the Board reconsidered the motion, allowing the hydrochloride to be added ("to level the playing field"), but adding an annotation that turned the sunset date into an expiration date--October 21, 2012.

2011. In response to a petition on streptomycin and sunset of tetracycline, the Crops Committee voted to de-list the antibiotics, and the Board set for both an expiration date of October 21, 2014.

Compatibility with sustainable and organic principles requires growers to 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 of trees, and proper pruning practices. Certifiers should already be requiring that these other measures be used before any synthetic input is used.[9] 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. Even so, the use of resistant varieties virtually eliminates the threat of tree loss to fire blight.[10]

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



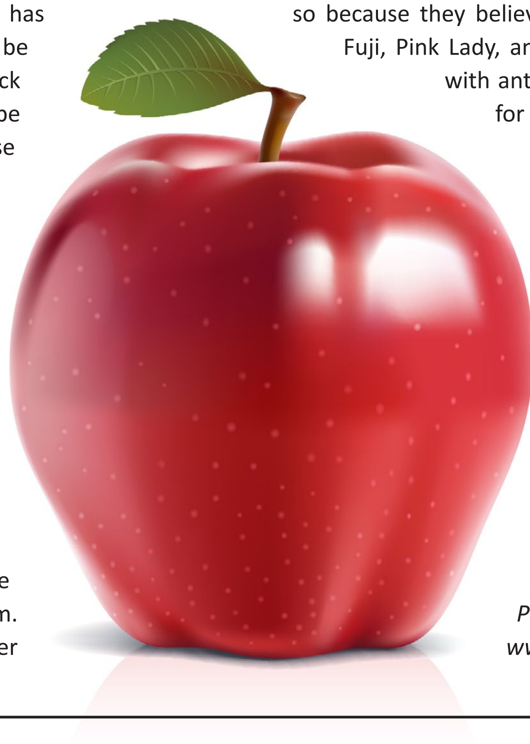
The use of antibiotics is not sustainable, since it inevitably leads to resistance, as has been seen with streptomycin in the Pacific northwest. And in the long run, it leads to health problems for everyone on the farm –from the plants to the humans.
Finally, organic consumers understand these things. 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. Organic apple and pear growers have missed an opportunity to differentiate themselves from conventional growers. Instead of growing susceptible varieties, they should be educating consumers to know that Gala, Fuji, and Granny Smith apples are most likely to be treated with antibiotics, and that certain other varieties are not.

Most Recent NOSB Action

At their April 2011 meeting, the NOSB considered committee recommendations to eliminate the use of streptomycin and tetracycline in apples and pears by October 2012. Some fruit growers argued for more time, saying that certain alternatives are not sufficiently available, and the board ultimately extended the use of both antibiotics until 2014. We need to examine these claims –not just for the sake of eliminating unnecessary use of antibiotics, but also because they reflect threats to the integrity of organic production that arise in other situations as well.

First, these growers argue that the alternative (biological) sprays for fire blight are not always efficacious. Their preferred product is still in development, and it is not known when it will be commercially available. While these products, which are mostly benign microorganisms that compete for space on the flower with the fire blight bacteria, are much less hazardous than antibiotic sprays, their use is only one small part of an organic system –a system that should be promoting healthy trees through site selection, choice of cultivars and rootstocks, soil fertility management, sanitation, and encouraging biodiversity.

Second, it was argued that the dwarfing rootstocks that are resistant to fire blight are not sufficiently available. While there is one particular rootstock that is equivalent to a susceptible rootstock favored by many growers for its dwarfing characteristics that is currently not available in the quantities growers would like, this argument has some hidden assumptions that should be examined. Why is this particular rootstock considered so essential? It appears to be because of the movement towards dense plantings of small trees. While dense plantings of small trees offer a great deal in terms of convenience and concentration of many trees in a smaller acreage, they also offer greater potential for disease to take hold and spread. This is particularly true because such orchards are essentially monocultures.



Third, some fruit growers argue that consumers drive the market, and that they grow varieties susceptible to fire blight because consumers demand them. Some go so far as to claim that other varieties are "inedible." On the other hand, it should be argued that organic growers who make that claim seem to be content to follow the lead of chemical-intensive growers, rather than establishing themselves as growers of antibiotic-free fruit.

What You Can Do

Fire blight management does present a challenge to organic fruit producers. So far, however, they seem to have lacked the incentives to take the first step towards eliminating dependence on antibiotics –planting resistant varieties. They have failed to do so because they believe that organic consumers demand Gala, Fuji, Pink Lady, and Granny Smith, regardless of treatment with antibiotics. We can all help create a demand for the resistant varieties.

Take the lists in the table on page 14 with you when you shop, and ask for the resistant apples and pears. If you belong to a coop, ask to put up a sign listing fire blight-resistant and susceptible varieties and stating that the susceptible varieties are more likely to be treated with antibiotics. Share this information with others.

For more information on organic food and what you can do to protect and strengthen organic integrity, visit Beyond Pesticides' Organic Food program page, www.beyondpesticides.org/organicfood.

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[9] See, for example, Midwest Organic and Sustainable Education Service, "Organic Tree Fruit Certification" at http://www.mosesorganic.org/attachments/productioninfo/fstreefruitcertification.html: "The organic regulation mandates that a specific pest control hierarchy be used. To manage pests and diseases, you must start with cultural controls (i.e planting resistant stock), mechanical controls (i.e screening or netting) or biological controls (i.e. the use of beneficial insects and pheromone disruption). If these methods don't work, document the fact and then natural products can be used. If natural inputs are not effective, then approved synthetics can be used."
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