



# Crop Use of Antibiotics

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**Presidential Advisory Council on  
Combating Antibiotic-Resistant Bacteria  
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# Three antibiotics are permitted by the U. S. Environmental Protection Agency for use in plant agriculture

1. Streptomycin since 1958.
2. Oxytetracycline since 1972.
3. Kasugamycin since Sept. 2014.
  - No clinical use of kasugamycin for humans or animals.
  - No cross-resistance with other aminoglycosides or tetracyclines.

## Antibiotics are registered for specific crops:

Primarily tree fruits (apple, pear, peach, and nectarine).

Antibiotics are not permitted for several crops, such as corn, rice, fibers, grains, grapes, or berries.

# Major use of antibiotics on plants

Bacterial spot of peach and nectarine  
(*Xanthomonas arboricola* pv. *pruni*)



~15% of quantity of antibiotics  
~6,000 kg annually  
Three sprays on 15% of acreage

Fire blight of pear and apple  
(*Erwinia amylovora*)



~85% of quantity of antibiotics  
~29,500 kg annually

Pear: Three sprays on 45% of acreage

Apple: One spray on 18% of acreage

Intervene if fire blight risk high: warm temperatures coincide with open flowers in orchards with recent history of disease.

# Direct exposure of workers to antibiotics limited by regulations

Protective gear required, including respirator and waterproof gloves.

Re-entry into orchards prohibited for 12 hours after application.

Wash hands before eating, drinking, chewing gum, or using tobacco or the toilet.

Cannot apply under conditions that the product may contact people through drift.

Cannot apply directly to water or contaminate water by cleaning of equipment.



GROUP 14 FUNGICIDE

## Kasumin 2L

For Agricultural Use Only  
For Control of Powdery Mildew on Pome Fruit

| INGREDIENTS:                                 | % BY WT. |
|--|----------|
| ACTIVE INGREDIENT:                           |          |
| Kasugamycin hydrochloride hydrate            | 2.26%    |
| OTHER INGREDIENTS:                           | 97.74%   |
| TOTAL:                                       | 100.00%  |
| *Equivalent to 2.0% Kasugamycin              |          |
| Contains 5.168 pounds Kasugamycin per gallon |          |

**KEEP OUT OF REACH OF CHILDREN  
CAUTION / PRECAUCIÓN**

See back panel for additional First Aid, Precautionary Statements, and Directions for Use.  
If you do not understand the label that appears to explain it to you in Spanish, see back panel for additional First Aid, Precautionary Statements, and Directions for Use.

For Product Information Call: 1-800-761-6387

|                                |  |
|--------------------------------|--|
| <b>IF IN EYES:</b>             | <ul style="list-style-type: none"> <li>• Hold eye open and rinse slowly and gently with water for 15-20 minutes.</li> <li>• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.</li> <li>• Call a poison control center or doctor for treatment advice.</li> </ul>  |
| <b>IF ON SKIN OR CLOTHING:</b> | <ul style="list-style-type: none"> <li>• Wash off contaminated clothing.</li> <li>• Remove skin immediately with plenty of water for 15-20 minutes.</li> <li>• Call a poison control center or doctor for treatment advice.</li> </ul>   |
| <b>IF INHALED:</b>             | <ul style="list-style-type: none"> <li>• Move patient to fresh air.</li> <li>• If person is not breathing, call 911 or an ambulance. Then give artificial respiration, preferably by mouth-to-mouth, if trained.</li> <li>• Call a poison control center or doctor for further treatment advice.</li> </ul>  |
| <b>IF SWALLOWED:</b>           | <ul style="list-style-type: none"> <li>• Call poison control center or doctor immediately for treatment advice.</li> <li>• Have person sip a glass of water if able to swallow.</li> <li>• Do not induce vomiting unless told to do so by the poison control center or doctor.</li> <li>• Do not give anything by mouth to an unconscious person.</li> </ul> |

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

**FOR 24-HOUR MEDICAL EMERGENCY ASSISTANCE CALL PROGRAM:**  
1-800-424-9292 (ext. 4) 8:00 A.M. - 5:00 P.M.

**FOR 24-HOUR CHEMICAL EMERGENCY EQUIP. SUPPLY, INFO, RESPONSE OR RECEIVING CALL CENTER:**  
1-800-424-9292 or 1-703-527-5887

**PRECAUTIONARY STATEMENTS**  
**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**  
**CAUTION**

- Causes moderate eye irritation. Avoid contact with eyes.
- If clothing Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

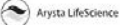
**ENVIRONMENTAL HAZARDS**  
See back panel for use of this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only prohibited handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

**DIRECTIONS FOR USE**  
It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only prohibited handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

**STORAGE AND DISPOSAL**  
Offer for recycling if available. Do not contaminate water, food, or feed by storage or disposal. **PESTICIDE DISPOSAL:** Store in a dry place away from excessive heat. Do not drain into food or feed. Store in original container only. **PRECAUTION:** Remove labeling from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER HANDLING:**  
Rinse, neutralize/combine containers several times enough to shake (i.e., with capacities equal to 1/4 the tank capacity). Wash contents container. Do not reuse or refill the container. Triple rinse container or equivalent promptly after emptying. Triple time as follows: slosh the remaining contents into application equipment or a non-food grade tank for 10 seconds after the tank begins to empty. Fill the container 1/4 full with water and slosh for 10 seconds. Pour this into application equipment or a non-food grade tank for water use or disposal. Slosh for 10 seconds after the tank begins to empty. Repeat this procedure two more times. Then offer for recycling or purchase and disposal of a sanitary landfill, or if allowed by State and local authorities in burning, if allowed. Skip step if empty.

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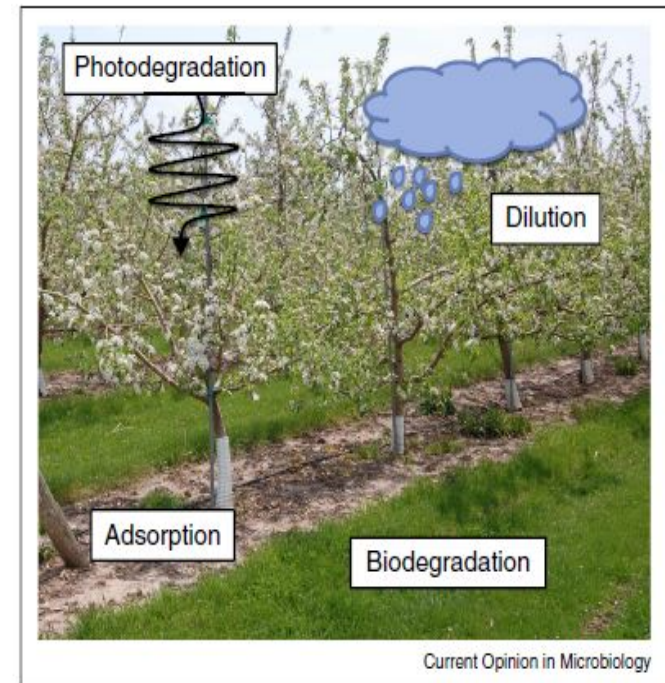
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ADDITIONAL INFO  
10/13/14

NET CONTENTS: 2.5 GALLONS

# Fate of antibiotics applied to plant surfaces

- Antibiotics suppress bacterial growth on flowers and control disease for less than 5 days.
  - Vanneste. 1996. Biocontrol News Inform. 17:67N-78N
  - Stockwell *et al.* 2008. Acta Hort. 793:383-390.
- Rainfall reduces antibiotic concentrations rapidly.
- Sunlight degrades antibiotics on plant surfaces.
  - Christiano *et al.* 2010. Plant Dis. 4:1213-1218.
- Soil inactivates aminoglycosides and tetracyclines.
  - Subbiah *et al.* 2011. Appl. Environ. Microbiol. 77:7255-7260.



Processes that potentially influence the availability, stability, and activity of antibiotics applied to plants.

From: McManus 2014. Curr Opin. Microbiol.19:76-82.

# Impact of antibiotic applications in orchards on bacterial communities and resistance genes

## On streptomycin-treated flowers:

--A minimal temporal community-level response detected.

Shade, McManus, & Handelsman. 2013. mBio 4:e00602-12.

## In streptomycin-treated orchards:

-- No effect on bacterial communities in soil.

Shade et al. 2013. Appl. Environ Microbiol. 79:6617-25

Walsh, et al. 2014. Front Microbiol 4:383.

-- No effect on bacterial communities in soil, leaves, flowers, and fruit.

-- No effect on resistance genes in soil, leaves, flowers, and fruit.

Duffy, Hölliger, and Walsh. 2014. FEMS Microbiol. Lett. 350:180-189.

## Non-treated orchards vs orchards treated for 10 years with streptomycin:

-- No effect on bacterial communities on leaves or their resistance with long-term streptomycin use.

Yashiro & McManus. 2012. PLoS One 7:e37131

## Recommended review:

McManus, P.S. 2014. Does a drop in the bucket make a splash? Assessing the impact of antibiotic use on plants. Curr. Opin. Microbiol. 19:76-82.

# Exposure to consumers: Pre-harvest intervals and maximum residue levels permitted on fruit

## Pre-harvest intervals:

- Streptomycin cannot be applied within 30 days (pear) or 50 days (apple) before harvest.
- Oxytetracycline has a 45 day pre-harvest interval.
- Kasugamycin has a 90 day pre-harvest interval.



Maximum permissible antibiotic residues on fruit range from 0.20 mg/kg to 0.35 mg/kg fruit. No reports of tree fruits exceeding permissible residues.

On apple trees sprayed three times with streptomycin, 0.018 mg/kg was the maximum residue quantified.

-Mayerhofer et al. 2009. J. Antimicrob. Chemother. 63:1076-1077.

# Summary

- Antibiotics have been used for more than 60 years in plant agriculture without detected adverse affects to the environment or human health.
- Antibiotics are important tools for the management of bacterial diseases of tree fruits because they are cost-effective, provide consistent levels of disease control, and do not mar fruit finish.
- Organic tree fruits are antibiotic-free since 2014. Consequently, the 'real world' efficacy of alternatives to antibiotics technology for effective disease control on a commercial scale will be tested in organic orchards.
- Additional research is needed on the impact of oxytetracycline, kasugamycin, and combinations of antibiotics on microbial communities and resistance genes in orchard environments.

