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Copper is an effective bactericide and fungicide, commonly used for many fruit tree diseases and a few vegetable diseases. It is one of a very short list of fungicides available to organic producers.

However, if used over a long period, copper can accumulate in soils and cause toxicity in certain crops. It can also contribute to water quality issues. A copper exceedance has occurred in the PNSNS Subwatershed, so carefully consider any copper use and choose alternatives whenever possible.

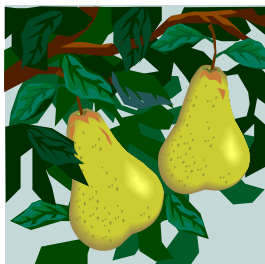
Alternatives to Copper

- ◆ Bordeaux mix, which does contain copper, is more persistent than fixed copper materials. It is less susceptible to being washed off by rain, so it is a better choice for dormant sprays. However, Bordeaux mixture is corrosive, so a pre-mixed material is the safest. If you plan to mix your own, please follow the instructions and precautions at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7481.html>
- ◆ Lime sulfur or sulfur may be other options for organic growers.

- ◆ Newer protectant fungicides such as the strobilurins and sterol inhibitors are absorbed into leaf and fruit tissue. Thus, once the residue has dried, they are not susceptible to rain wash-off.

Alternatives for Specific Diseases

- ◆ **Fireblight:** Effective copper alternatives are Agri-mycin for apples or pears; Mycoshield or Blight Ban for pears, or Bordeaux mix for apples.



- ◆ **Brown rot:** Copper is not very effective for stone fruits; there are many other more effective choices. In citrus, use Bordeaux mix.
- ◆ **Leaf curl:** use Ziram, Bordeaux mix or Bravo/Echo.
- ◆ **Shothole:** choose Pristine, Bordeaux, or Echo/Bravo. A Bordeaux spray after leaf fall but before rains reduces spring disease incidence.

- ◆ **Walnut blight:** use Bordeaux mix. Use forecast models to time sprays effectively.
- ◆ **Bacterial speck and bacterial spot** occur in early plantings of tomato and pepper in wet springs. Delay planting if possible. Good sanitation, including disking in crop residues and culls will reduce incidence, as will rotation to non-host crops. Apply copper sprays before rainfall. Thorough coverage helps minimize the number of sprays needed. Tank mix with Mancozeb to increase effectiveness.

For more information on materials for specific crops, see **UC IPM Pest Management Guidelines**, <http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html>

When copper is used:

- Remember that copper is effective only as a preventive. It will not protect new plant growth from infection nor be effective for a disease that is already established.
- Use copper in the spring when it has a lower probability of being washed off by rain.



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- A commonly-used rule of thumb for fungicide wash-off is:
 <1" of rain since the last spray does not significantly affect residues.
 1-2 inches of rain halves residue. Cut the number of days between sprays by half.
 >2" rain will remove most of the spray residue. Spray as soon as possible after rain.
 - If copper is used, use a spreader/sticker to reduce wash off potential.
 - Time sprays properly so that they will be most effective.
 - For many fruit tree diseases, in dry springs, additional sprays after a dormant copper spray are unnecessary.
 - When spraying, at the least, turn off outward facing nozzles at end of each row before making the turn to avoid depositing copper on the ground.
- Copper can be a valuable tool in managing many fruit and vegetable diseases. However, it must be managed properly to avoid contaminating runoff water or creeks and streams.

References

PNNSSS Subwatershed Coalition
<http://www.cleanwaters.info/>

The Role of Copper in Disease Control. Western Farm Press.
<http://www.pentonag.com/Copper>

UC IPM Pest Management Guidelines. <http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html>

Uses of Copper Compounds: Copper Sulphate's Role in Agriculture. http://www.copper.org/applications/compounds/copper_sulfate02.html

