

# AgBioChem, Inc.

The leader in crown gall control

[www.agbiochem.com](http://www.agbiochem.com)

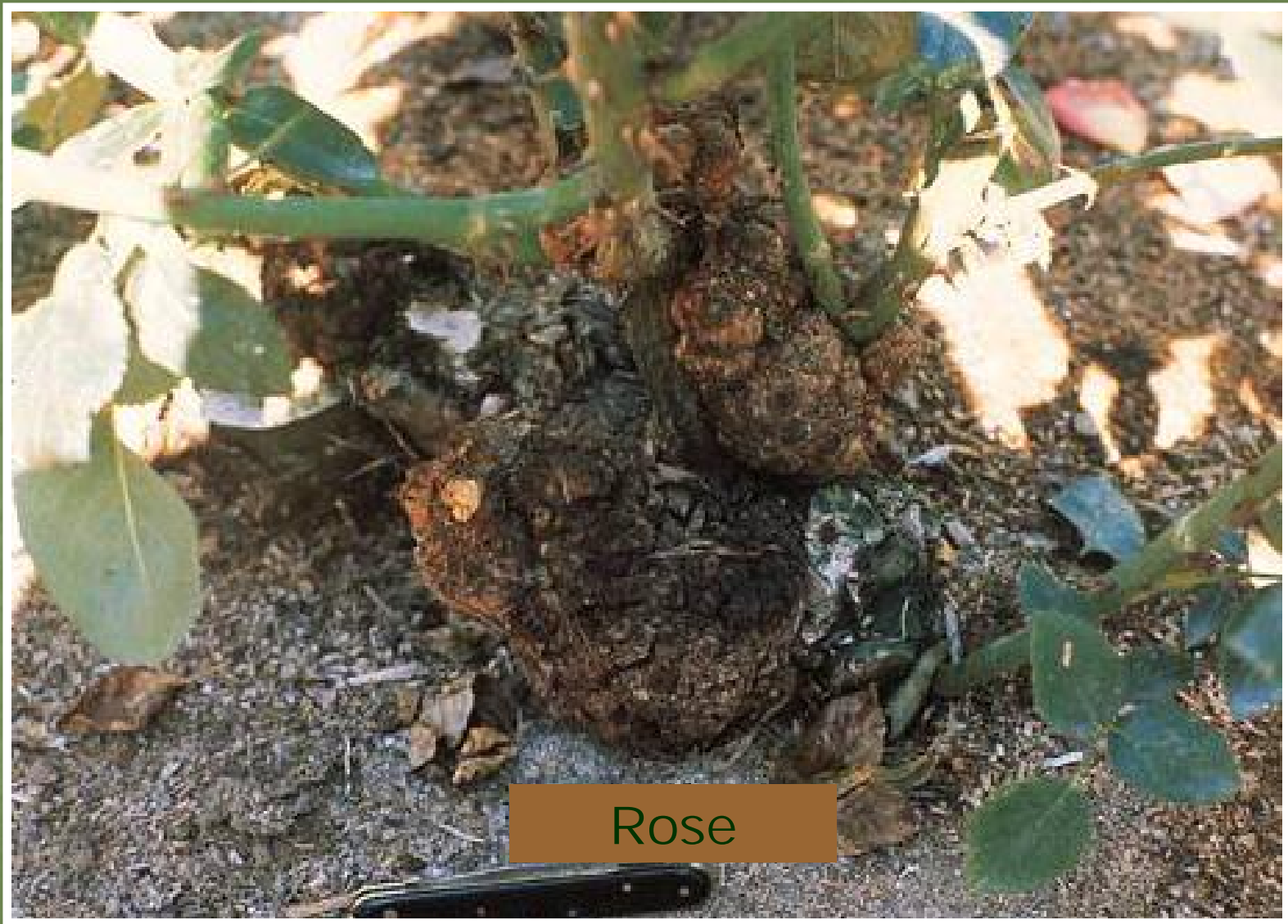
# Crown Gall Disease



Walnut



Almond



Rose



# Susceptible Species:

- 140 genera of more than 60 plant families
- Apple, pear, cherry, almond, walnut, grape, peach, nectarine, apricot, plum, prune, blackberry, raspberry, pecan, blueberry
- Rose, euonymous, willow, poplar

# Stunts Plant Growth



Walnut

# Provides Entry Point for Decay Fungi

## Almond Tree Blow-Over Problems

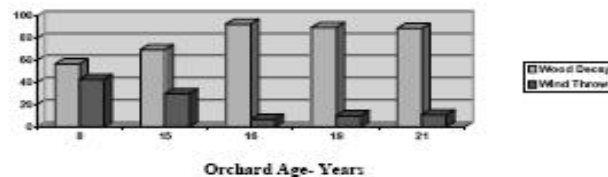
Bill Krueger UCCE Glenn County

Periodically fall winter or spring storms with associated high winds and saturated soil conditions result in high tree losses. As an example, a March 1995 storm brought 6 inches of rain and wind gusts up to 100 mph to the Sacramento Valley and resulted in an estimated loss of 13,000 acres of almonds worth \$210 million. More recently a storm in December of 2002 with wind gusts in up to 70 mph resulted in tree losses of greater than 30% in some orchards.

When trees fall over their failure can usually be classified as windthrow or wood decay related. Windthrow is when trees with sound healthy roots are uprooted as a result of strong winds and wet soil conditions. Wood decay related failures are the result of infection from wood decay fungi, which consume the lignin in the cell walls of the heartwood. Eventually these trees fall, often in wind storms. Wood decay fungi are secondary pathogens and are not capable of penetrating intact plant membranes and must rely on some type of injury to gain access.

Survey work conducted by Joe Connell, Butte County Farm Advisor and Jerry Uyamoto, USDA Plant Pathologist following the March 1995 storm revealed the following. Generally, as trees aged tree losses increased. Windthrow was an important factor in young orchards (Fig. 1). As orchards matured wood decay became more dominant. Wood decay accounted for approximately 90 % of the tree loss in mature orchards. Of 394 downed trees evaluated: 77% had wood decay and 81% had crown gall. Crown galls function as sites of entry for wood decay fungi.

Almond on Lovell Peach  
% Tree Losses to Wood Decay and Windthrow



## Wind Failure of Mature Almond Trees:

- 81% of failed trees had crown gall
- crown gall provided access to decay fungi





Chico, CA  
January 2008





Modesto, CA  
2010





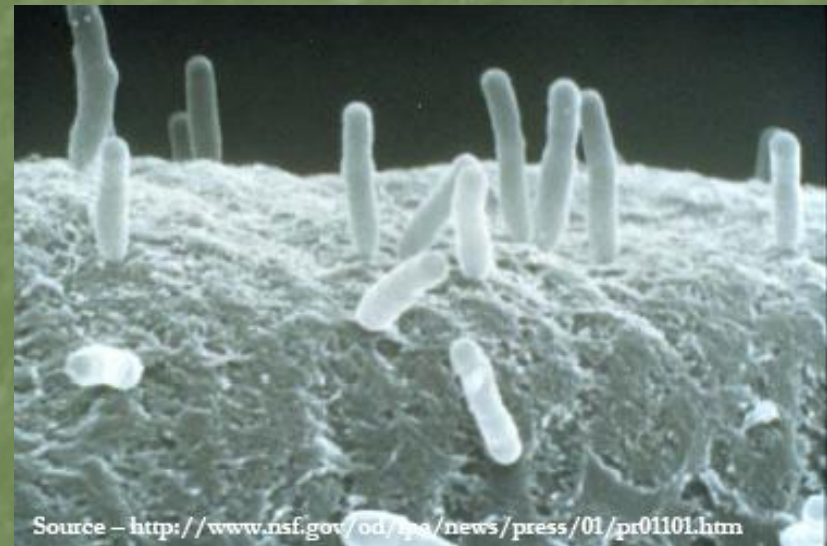
# Crown Gall Caused by: Agrobacterium tumefaciens

Soilborne bacterium:  
occurs everywhere



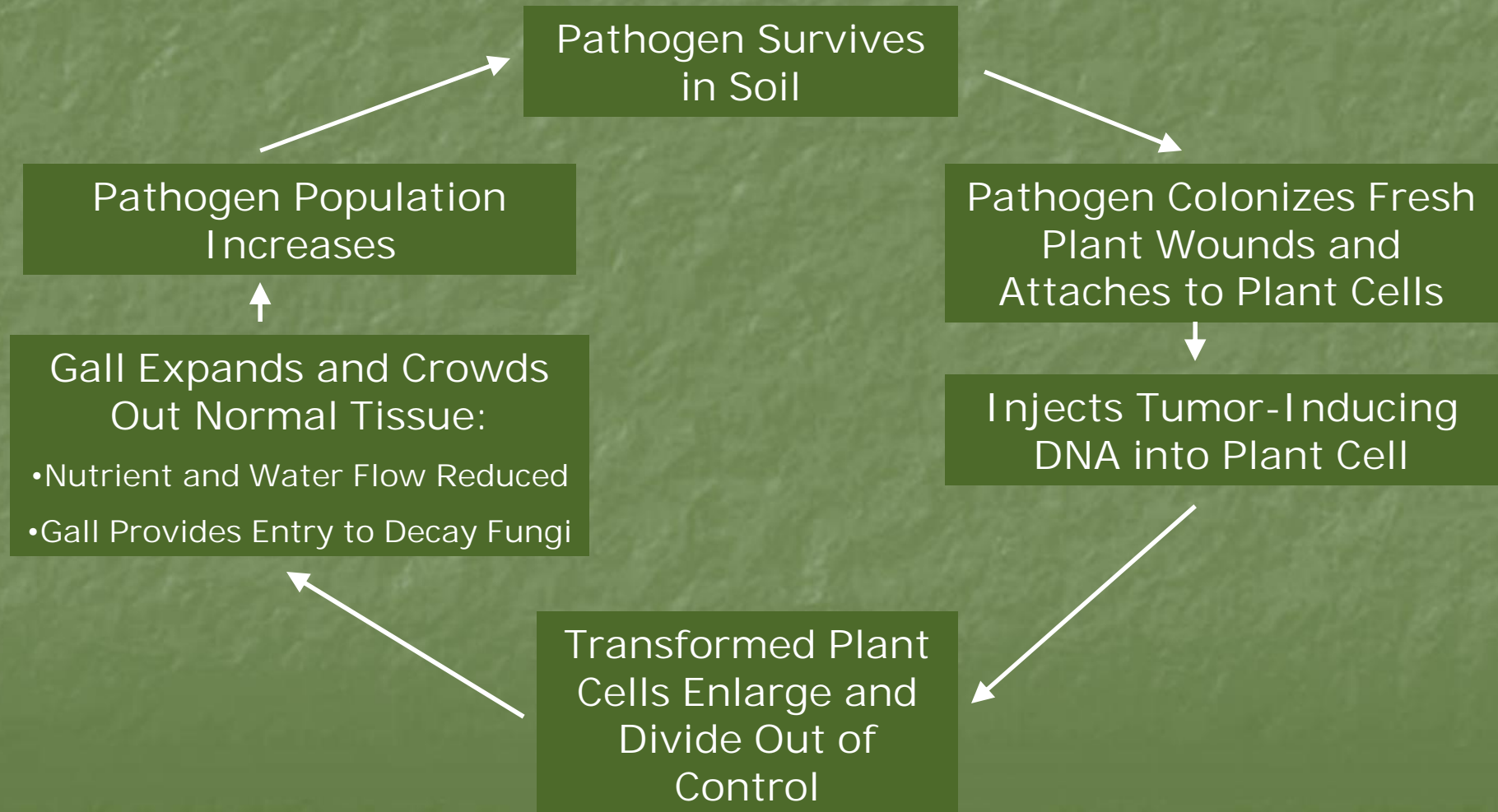
Normal DNA

Tumor-Inducing  
DNA



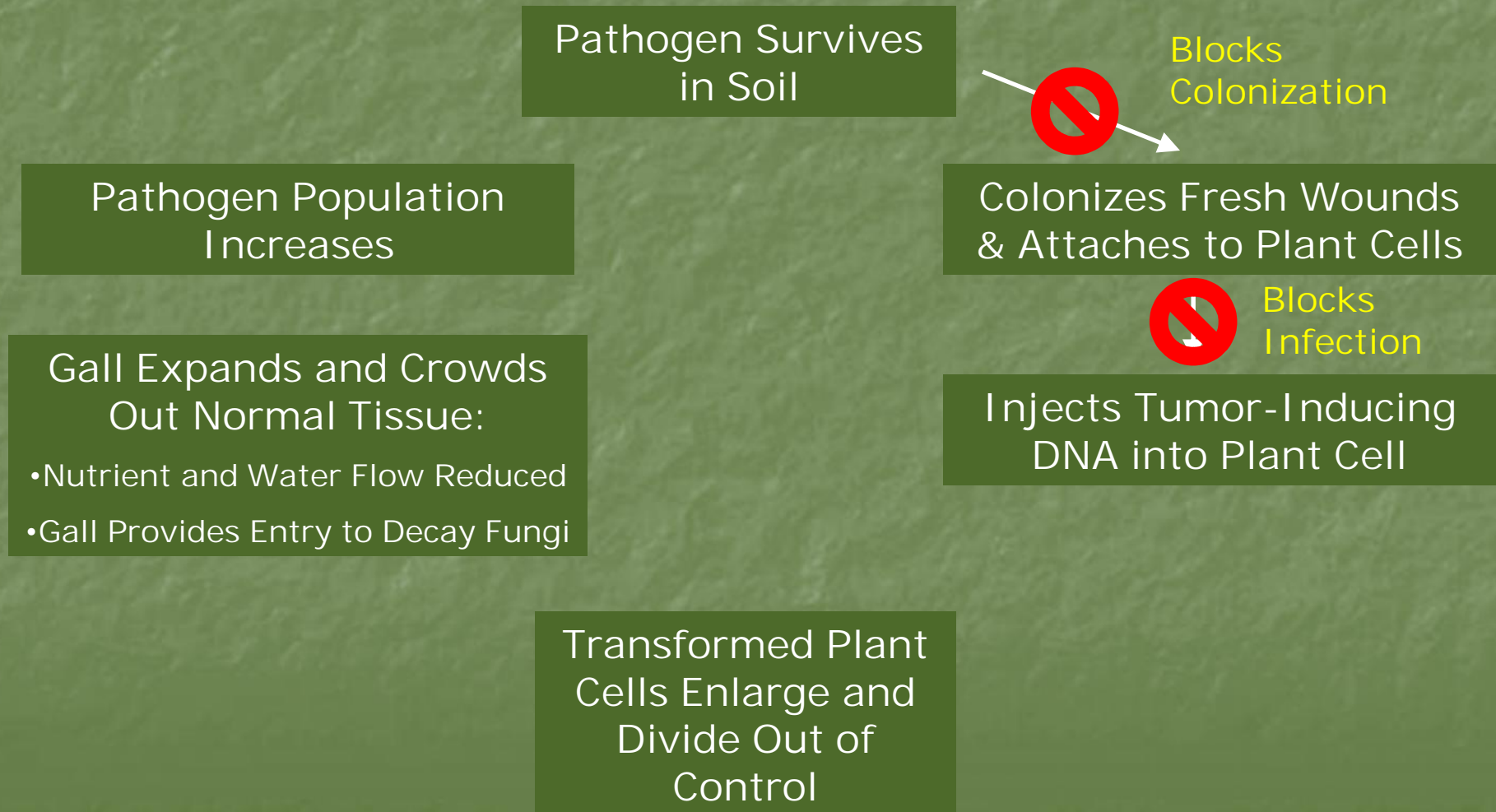
Pathogen attaches to  
plant wound

# Disease Process:





# Galltrol Prevents Disease:



# Galltrol Treatment:

- **Timing:** as soon after wounding (nursery, delivery to grower, pre-planting) as possible (not more than 12 hours)
- **Rate:** bacterial growth from 1 plate in 1 gallon water (non-chlorinated)
- **Application Method:** spray or dip
- **Users:** growers and nurseries
- **User Cost:** \$0.10 to \$0.15 per tree (much less for nursery seeds, cuttings, liners)



**Galltrol:** active ingredient is bacterial growth on agar surface

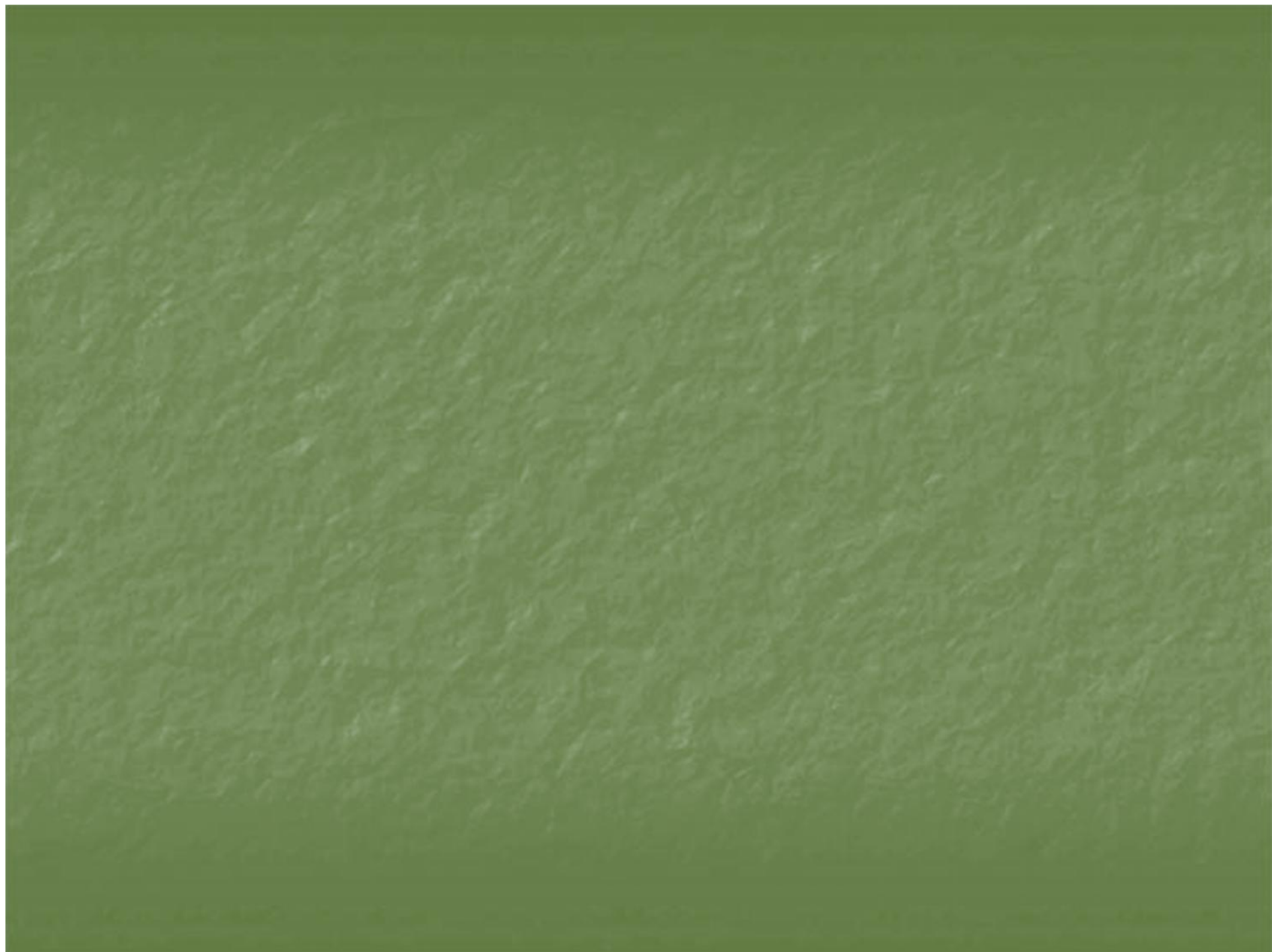




# Galltrol: Mixing



1. Discard lid
2. Submerge dish in water
3. Wipe bacterial growth from agar surface
4. Agitate mix to suspend bacteria
5. Use as spray or dip



# Gallex: Gall Eradicant

- Kills gall tissue
- Doesn't harm healthy cells
- Controls crown gall and apple burr knot





# Galex: Treatment of Existing Galls



1. Expose gall



2. Remove excess gall tissue (chisel, hatchet, knife)





3. Allow tissue to dry 2-3 days





4. Paint Gallex onto cut surface (overlap healthy, intact tissue by 1 inch)



# Gallex: Treatment of Large Galls



Expose galls (compressed air or water, or hand dig)

Gall Eradicated with Gallex



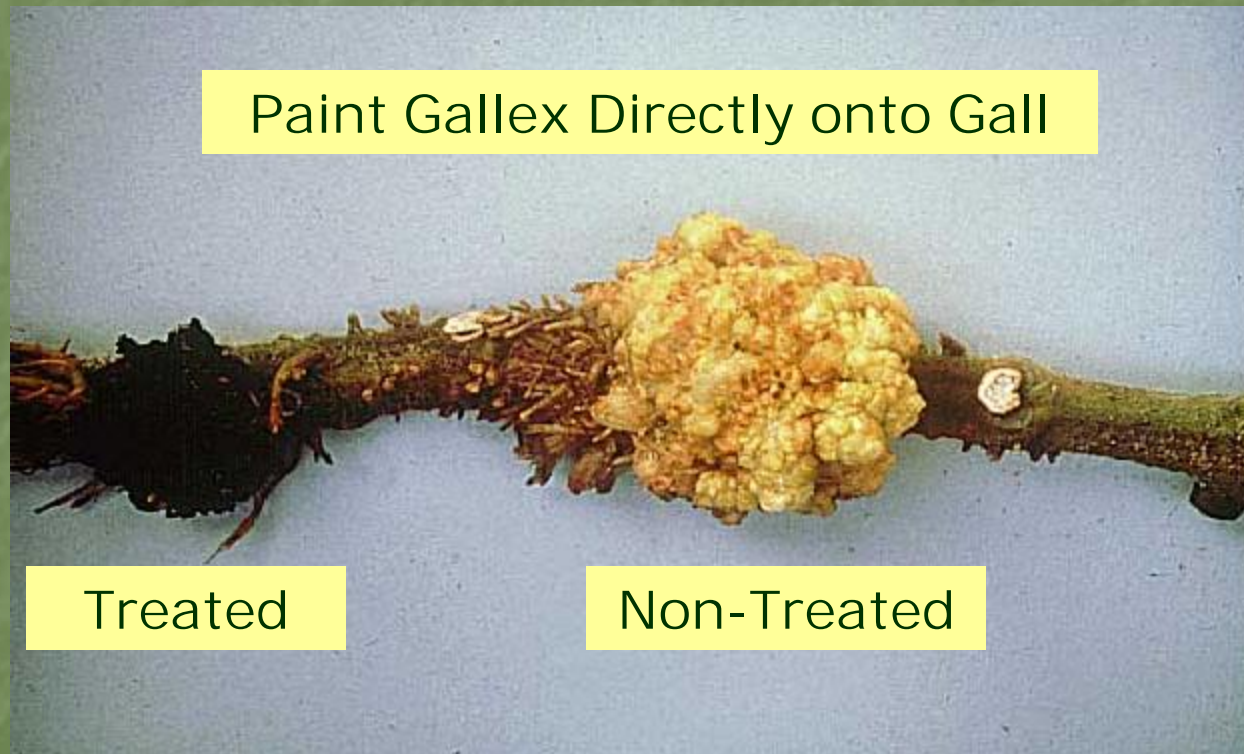


# Gallex: Treatment program for eradicating galls on young trees

- Regularly check trees for evidence of galls (at least twice per growing season) and treat
- Small galls are easier to expose, treat, and control
- Kill galls before significant plant damage is done
- Re-examine treated galls after 3-4 months; treat gall regrowth, if any

# Gallex Treatment: Small Galls

Paint Gallex Directly onto Gall



Treated

Non-Treated

Rose

# Galltrol & Gallex: U.C.-Endorsed

UC IPM: UC Management Guidelines for Crown Gall on Almond - Microsoft Internet Explorer provided by Comcast


File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Mail Print Word Pad

Address <http://www.ipm.ucdavis.edu/PMG/r3100511.html?printpage>

Google G Go 260 blocked Check AutoLink AutoFill Send

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 **UC IPM Online -**  
University of California Statewide Integrated Pest Management Program

**How to Manage Pests**  
**UC Pest Management Guidelines**


[More pests](#) | [More crops](#) | [About guidelines](#)

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**Almond**  
**Crown Gall**  
Pathogen: *Agrobacterium tumefaciens*  
(Reviewed 1/05, updated 1/05)

In this Guideline:

- [Symptoms](#)
- [Comments on the disease](#)
- [Management](#)
- [Publication](#)
- [Glossary](#)



**SYMPTOMS**  
Rough, abnormal galls on roots or trunk. Galls are soft and spongy. The centers of older galls decay. Young trees become stunted; older trees often develop secondary wood rots.

**COMMENTS ON THE DISEASE**  
The bacteria survive in gall tissue and in soil. They enter only through wounds. Crown gall is most damaging to young trees, either in the nursery or new orchard plantings. Peach-almond hybrid rootstocks are more susceptible to crown gall than Nemaguard rootstocks.

**MANAGEMENT**  
Crown gall is best prevented by purchase of trees from a reputable nursery accompanied by careful handling to avoid injury as much as possible, both during planting and during the life of the tree in the orchard. Preplant treatment is for prevention only. Galltrol is a preparation of the biological control agent *Agrobacterium radiobacter*-B4. It is effective only as a preventive treatment and is used as a root dip or spray before heeling in or planting. It does not eradicate existing galls.



# U.C. Pest Management Guidelines:

## MANAGEMENT

Crown gall is best prevented by purchase of trees from a reputable nursery accompanied by careful handling to avoid injury as much as possible, both during planting and during the life of the tree in the orchard. Preplant treatment is for prevention only. Galltrol is a preparation of the biological control agent *Agrobacterium radiobacter*-84. It is effective only as a preventive treatment and is used as a root dip or spray before heeling in or planting. It does not eradicate existing galls.

Strains of *A. tumefaciens* resistant to Galltrol and Norbac have been reported. Their occurrence is not widespread, but failure to control crown gall with these materials should be reported. Eradication involves removal of existing galls and topical application of Gallex. Carefully follow label instructions for exposing crown and roots and removing large galls.

Common name  
(trade name)

Amount/Acre



- A. AGROBACTERIUM TUMEFACIENS (formerly A. RADIOBACTER) K-84#  
(Galltrol) Label rates  
COMMENTS: Preventive preplant treatment only.
- B. GALLEX Label rates  
COMMENTS: For removal of existing galls, apply winter through spring.

# Acceptable for use on organically grown produce.

## PRECAUTIONS

## PUBLICATION



UC IPM Pest Management Guidelines: Almonds

UC ANR Publication 3431

Diseases

W. D. Gubler, Plant Pathology, UC Davis

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Acknowledgment for contributions to the disease section:

B. L. Teviotdale, Kearney Agricultural Center, Parlier

## Crown Gall

Crown gall, a disease of roots and stems, occurs on a large number of plants. In Washington, it is probably most serious on cherries, apples, and a few other tree fruits. It is also a problem on roses and several other ornamental trees and shrubs. Crown gall and the very similar cane gall also affect raspberries and blackberries.

Biological control is available for a number of fruit and ornamental crops. This method involves inoculating newly grafted, recently lifted transplants or cuttings with a bacterium that is closely related to the one causing crown gall. This prevents the crown gall bacterium from infecting wounds on the plant. Cultures of this competing bacterium are marketed under the trade name Galltrol. Galltrol is registered for commercial use in Washington State and can be used on non-food and non-bearing crops.

Painting the galls of tree fruits and nuts with Gallex has helped reduce the incidence of crown gall. Gallex is registered for commercial use in Washington State. Follow manufacturer's directions for use.





# AgBioChem, Inc.

- Galltrol - crown gall preventative
- Gallex – crown gall curative

[www.agbiochem.com](http://www.agbiochem.com)

# Want Healthy Roots Like These?

AgBioChem, Inc. provides the most effective biological and chemical Crown Gall control products available today.



## Galltrol

Prevents Crown Gall, a serious plant disease that reduces yields and shortens the life of your trees, vines, and shrubs.

## Gallex

Eradicates galls on diseased plants. The only product that controls Crown Gall after tumors are formed.



### AgBioChem, Inc.

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# PREVENT CROWN GALL

## GALLTROL®

For over 30 years the most effective prevention of crown gall disease.

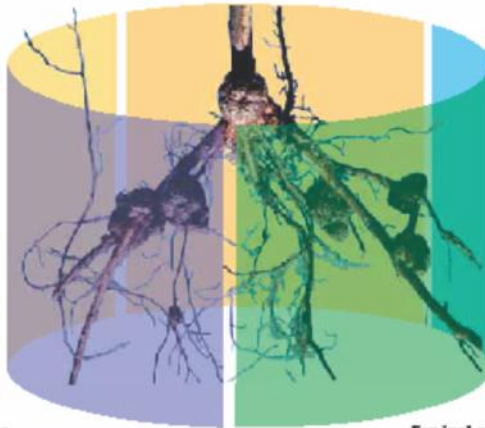
### THE PROBLEM

Crown Gall is a plant "cancer" responsible for significant commercial losses in almonds, walnuts, pecans, hazelnuts, stonefruits (e.g., cherry) and other plants.

Infected plants develop tumors (galls) that damage root systems and trunks resulting in weakened, non-productive plants.

In almond trees, galls provide points of ingress for wood decay fungi that cause the trees to "blow down" during high winds.

The crown gall pathogen is present in almost all soils and infects plants via fresh wounds created during propagation, nursery digging, handling and transplanting.



### THE SOLUTION

Growers have only **ONE** chance to prevent crown gall and that is **BEFORE** trees are planted.

Like all cancers – an ounce of prevention is worth a pound of cure.

Each plate of **GALLTROL** contains **120 BILLION** freshly-grown, active bacterial cells that colonize wounds and block infection.

For just pennies a tree **GALLTROL** protects your plant investment.

### KILL EXISTING GALL CELLS! GALLEX

A ready-to-use flowable emulsion that eradicates existing galls.

Works by selectively penetrating and killing gall cells, but does not harm healthy tissues.



Available from your local agricultural chemical distributor



AgBioChem, Inc. ~ 10795 Byrne Avenue ~ Los Molinos, CA 90655 ~ Phone: 530.586.1561  
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