

Field Treatment of Crown Gall on Walnut

Different Options' Effects on Growth and Productivity

By Bill Olson & Richard Buchner

Due to superior resistance to *Phytophthora* crown and root rot, increased vigor and more adaptability to marginal walnut soils walnut trees on Paradox rootstock are the preference of most California walnut growers even though the paradox rootstock is highly susceptible to the bacteria disease crown gall (*Agrobacterium tumefaciens*).

The California Walnut Board is supporting research on the epidemiology and prevention of this disease while growers that already have the disease on their walnuts are treating it with surgery and chemicals or with a heat treatment.

The surgery and chemical treatment generally consist of:

1. Removing the entire gall as thoroughly as possible with hatchets, chisels, etc.
2. Removing 1-2 inches of bark around the gall margin.
3. Often treating the entire area with a chemical.
4. Sterilizing all tools between each tree with a disinfectant material.
5. Watching for gall regrowth for one year and retreating with surgery and chemical as needed.

With the heat treatment it is advised to:

1. Grossly remove large galls with a hatchet in order to see where to apply the heat and to be able to observe any gall regrowth.
2. Apply heat using a torch fueled by propane (or other gas) to a 1-2 inch margin around the gall area.
3. Watch for gall regrowth for one year and retreat with heat as needed.

Is Crown Gall Present in the Orchard?

Knowing if crown gall is present in the orchard on young trees can be a difficult determination before the pres-



Surgical/chemical treatment must be thorough to be effective.

ence of galls become noticed above ground. Early signs that crown gall may be present on young trees includes:

- tree not growing vigorously
- stunted tree
- excessive ground cracking around the trunk of the tree
- ground "heaving" around the trunk of the tree
- poor leaf color
- early appearance of fall coloration

If any of these signs appear it is recommended that the crown of the tree be exposed and examined for the presence of crown gall.

To Treat or Not to Treat?

Treating for crown gall is expensive. It can easily take one hour and often two hours to remove the soil and treat a single tree. The preferred time to treat is during the growing season when tissue can callus (heal) rapidly. This

Burning the margin is the key to success with the heat treatment.



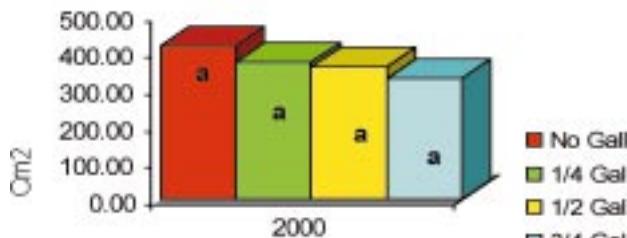
timing interferes with many other important farming operations. Also the surgery preformed to clean up the gall on small trees is often extensive enough to girdle part of the cambium causing restricted flow of nutrients. For these reasons paradox rootstock trees that do not make good growth the first year due to the presence of crown gall are better off being replaced than treating for crown gall.

On second leaf trees it may be advisable to treat the gall depending on its size and any effect it has had on the trees performance. With small galls (less than one-fourth the way around the trunk) it may be economic to treat the gall. While second leaf trees with larger galls it is more economic to replace the tree. Any stunted tree caused by crown gall should be replaced, not treated.

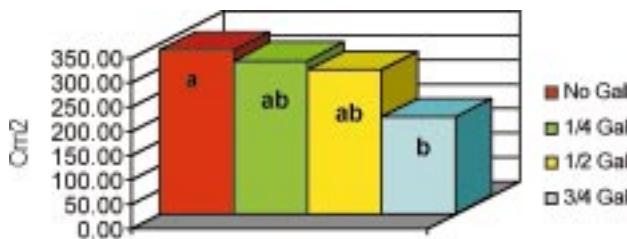
On third through about sixth or seventh leaf trees it is economic and generally a good idea to treat trees with galls of nearly any size except those that have completely girdled the tree. These trees should be replaced, as should any stunted trees.

After the sixth or seventh leaf, or when the trees are nearly full size, gall treatment can end. Trees of this age, that are not stunted, are rarely an economic problem even if crown gall exists.

Early research data through the sixth leaf shows that treating galls on third leaf trees, and continuing to retreat any gall regrowth as needed produces a tree comparable in size and



Graph 1.
Mean Trunk Area 10 cm Below the Union on Gall Treated Trees



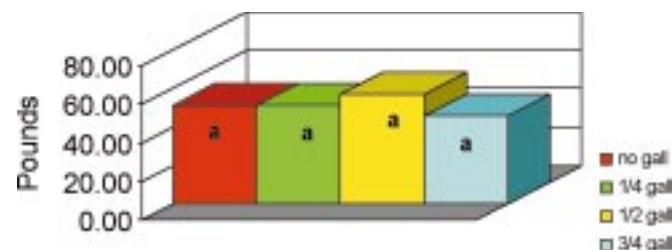
Graph 3
Mean Trunk Area 10 cm Below the Union on Untreated Trees with Galls



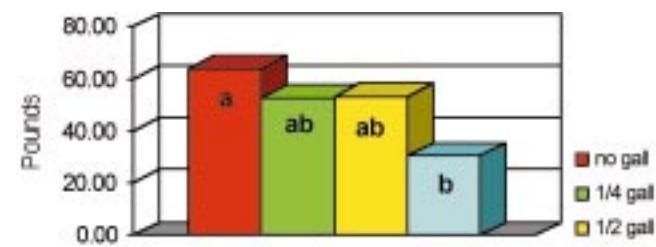
Retreating gall regrowth is simplified with the heat treatment.

with comparable yields of trees that never had a gall (Graphs 1 and 2). This is true of galls one-fourth, one-half, and three-fourths the way around the tree trunk. Comparable trees that were left untreated have decreased tree size and yield where galls were

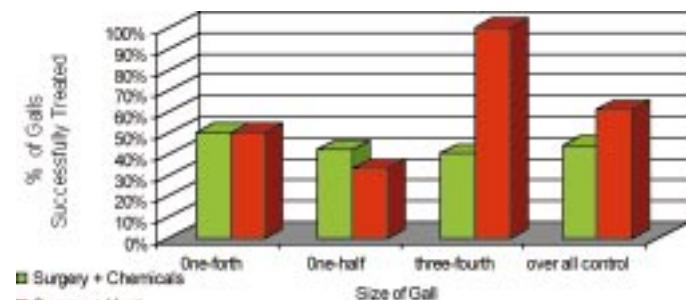
three-fourths the way around the trunk as compared to trees that never had a gall (Graphs 3 and 4.). Additional data collected over the next two years will provide conclusive evidence of the economic impact crown gall has



Graph 2
Mean Accumulated Yield (lbs./tree) on Gall Treated Trees
(1999 - 2000)



Graph 4
Mean Accumulated Yield (lbs./tree) on Untreated Trees with Galls
(1999 - 2000)



Graph 5

and whether treating galls is economically worth while or not.

What Method of Treatment is Best?

Under actual field conditions research efforts have shown little preference in method of treating galls. All methods can work well and no method provided 100 percent control without re-treatment. Surgery alone can work as well as any other method but this method is very time consuming and requires considerable precision. With the heat treatment the amount of heat needed to kill cells and the bacteria is unknown. Early trials have applied heat until the bark is "red hot".

Field research on below ground galls on third leaf trees comparing the surgery/chemical treatment to the heat treatment showed no clear preference in terms of gall control on galls one-fourth or one-half the way around the trunk (Graph 5).

Surprisingly, the heat treatment gave nearly complete control of galls that were three-fourths the way around the trunk while the surgery/chemical treatment resulted in less than 40 percent control. Overall the heat treatment resulted in 16 percent better control of galls than the surgery/chemical treat-

ment (Graph 5).

Success in Treating Galls

Although the heat treatment is still being researched and is not recommended as a general treatment, because the long term effects of applying heat to the cambium of walnut trees are not known, growers are quick to point out the following disadvantages and advantages of the two crown gall treatment procedures.

Treatment Disadvantages

Surgery + Chemicals

- More expensive
- Complete surgery required
- More equipment required
- Slower process
- Treating gall more complex
- **Tool sterilization is more detailed**

Surgery + Heat

- Long term effects are unknown

Treatment Advantages

Surgery + Chemical

- Long standing proven technique

Surgery + Heat

- Less equipment needed

- Slightly faster
- Control is at least as good if not better
- Ease of treating gall regrowth
- "Gross" surgery or no surgery required
- **Simplified sterilization of tools**

Even with crown gall the fact remains that paradox is and will continue to be the most popular walnut rootstock for many years to come. Research on crown gall epidemiology and prevention will hopefully reduce the incidence of crown gall in the future. For now the best course of action, once a gall is present on a second or older leaf tree is to treat it and continue treating it until no more galls appear. Treatment can be discontinued once the tree is near full size. Early data suggest that this procedure can be economic and can result in a tree as large and productive as a tree that never had a gall.

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