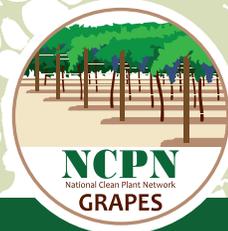


FACT SHEET

National Clean Plant Network



Start clean, stay clean.

Grape Crown Gall

What is the cause and what are symptoms?

Crown gall of grapevines is caused by the bacterium *Agrobacterium vitis*. During infection the bacterium transfers a component of its DNA into the plant which upon expression in the grapevine results in gall formation. Infection and gall formation occur at wound sites, such as those caused by freeze injuries on trunks (Figure 1) and at grafting sites (Figure 2). The pathogen can survive systemically in grapevines and be spread in propagation material. Strains of *A. vitis* that form galls (tumorigenic) and those that are non-tumorigenic both exist in grapevines. All strains have the ability to cause a necrosis on grapevine roots (Figure 3). The disease cycle of crown gall on grape is shown in Figure 4.

How serious is the disease?

Crown gall in nurseries results in losses due to unsaleable symptomatic plants (Figure 5) and may also lead to spread of the pathogen in asymptomatic plants. In young vineyards infected vines may be killed to the graft union, or they may be stunted with reduced growth and production. Economic losses are therefore associated with reduced productivity and costs of vine or trunk replacement. Because the pathogen can survive in infected grapevine roots, even after vine replacement, contaminated soils may remain so for a period of years. Currently a study is underway to document the economic impact of crown gall in vineyards.

Where does the pathogen survive and how does it spread?

The bacterium is present in xylem vessels, and infected, necrotic root tissue. As such it can be spread through infected cuttings, or survive in root tissue or soils for several years where grapes have been previously grown. The recent development

of a highly specific and sensitive method for detection of *A. vitis* has greatly enhanced our knowledge of survival of the pathogen in grapevines. The new method is about 1000-fold more sensitive than previous methods. In addition to detecting the pathogen in asymptomatic dormant cuttings from vineyards we have recently shown that pathogenic *A. vitis* survive in wild grapevines (*V. riparia*) in New York. The new detection method was also used to demonstrate presence of the pathogen on shoot tips in vineyards with crown gall. From 240 shoot tips that were collected, 16 tested positive for the pathogen. We are currently exploring survival on leaf surfaces, in dormant buds, standing water near vineyards and in vineyard soil.

Is it possible to develop grapevines that are free of *A. vitis*?

Before development of the sensitive indexing method it was thought tissue culture from shoot tips was sufficient to rid plants of the pathogen. This has recently been challenged in our NCPN-funded work and over a two year period we have detected in some cases the presence of the pathogen in shoot tips and in meristems. In a 2013 experiment about 20 percent of shoot tips and meristems were *A. vitis* positive. These were collected from vines growing in a greenhouse where other research on grape crown gall was ongoing. In 2014 additional samples of tips and meristems were assayed. Again, shoots were grown from cuttings collected from vines with crown gall. Shoot tips were then collected and the meristem and shoot tip were separated for assays. In this case from 49 samples of meristems and shoot tips minus the meristem, all tested negative for the pathogen. Currently in research funded by NCPN, shoot tips and meristems collected from plants grown from cuttings taken from crown gall infected vines are being propagated. As these plants are generated they will be assayed for the presence of the pathogen. Currently our results indicate that plants free of the crown gall pathogen can be generated and will need to be assayed as they develop to ensure they remain clean.



Figure 1. Gall on trunk



Figure 2. Gall at graft



Figure 3. Grape with root necrosis

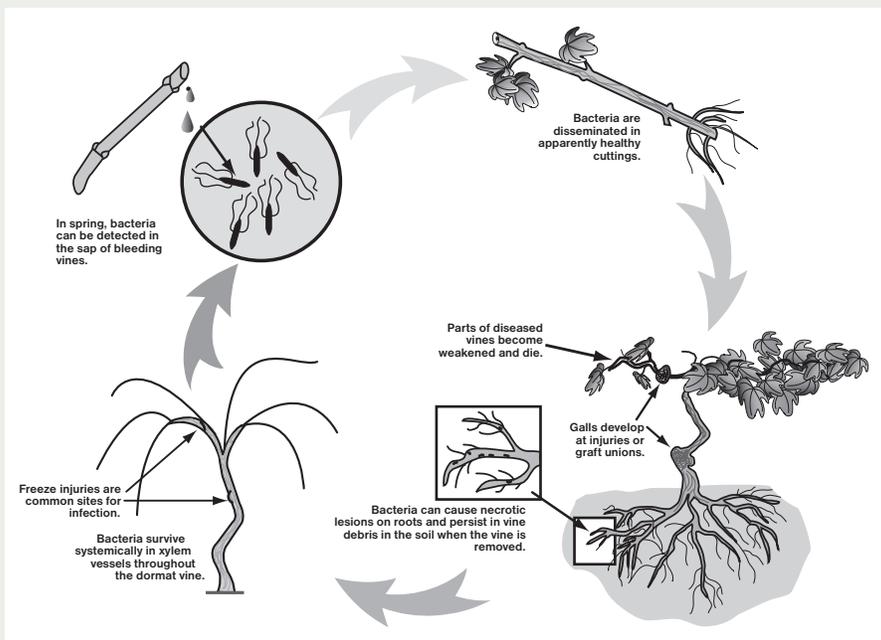


Figure 4. Disease cycle



Figure 5. Crown gall in nursery

Are clean plants important to the overall management of the disease?

If, as proposed above, clean plants can be generated, can they be maintained free of the pathogen after planting in commercial vineyards? Our ongoing research on pathogen biology suggests there are significant sources *A. vitis* in nature, including wild grapevines. A better understanding of important environmental sources of the pathogen is a goal of current NCPN research. Establishing vineyards with clean plants should continue to be a key strategy for crown gall management. Young vineyards are most vulnerable to damage from the disease that will have significant economic impact. If older vines become contaminated with the pathogen and infected with crown gall the significance of the disease will be much less and often manageable with cultural methods.

How can the disease be currently managed and what are future prospects?

Growers should assume that *A. vitis* is likely to be present in at least some nursery stock and in existing vineyard blocks. Yet this does not mean that crown gall disease will be expressed or cause economic injury. Experience in cool climate regions such as New York and Washington has shown that widespread galling occurs relatively infrequently, and often in association with significant cold injury to trunks during the dormant season (In New York, crown gall expression was common after winter injury in 2004 and 2014, but rare in intervening years). Cultural methods – starting with site selection – are the key to minimizing losses from crown gall. Cultural practice recommendations include:

- **Cultivar choice.** Plant varieties and rootstocks that are tolerant of the disease.

- **Site Selection.** Plant vineyards on sites that have good air drainage and well drained soils to minimize freeze injury.
- **Hilling up.** Mounding soil over the graft union in the fall protects it from extreme cold events, and ensures survival of scion buds for trunk renewal.
- **Multiple trunks.** Establishing multiple trunks allows growers to remove and replace galled trunks while maintaining production.
- **Regular monitoring and replacement or renewal.** Evaluate trunk and vine health on a regular basis, mark and replace trunks and vines promptly.
- **Cropping levels and fertility.** Manage cropping levels, irrigation and nutrition such that active vegetative growth ceases or slows by veraison.

As crown gall-tested foundation vines become available and are propagated by nurseries, and if clean vines can be maintained through careful nursery practices, then use of clean planting stock should provide growers with a tool to avoid early problems during vineyard establishment, even if vines acquire *A. vitis* from environmental sources in the field.

There are no available chemical treatments effective for disease control. Biological control of grape crown gall is being studied and shows promise for providing an effective option for protecting graft unions and other wounds on vines.

Authors

T. J. Burr, Cornell University

T. E. Martinson, Cornell University



Start clean, stay clean.

nationalcleanplantnetwork.org
ncpngrapes.org

February 2015