# Figuring Out Stem Gall (Canker)

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The malady commonly called "canker" was found on several different cranberry varieties throughout Wisconsin in 1998. Canker is certainly not new—growers and researchers have reported its sporadic occurrence for many years in Wisconsin and other cranberry growing regions. But in 1998 it was especially widespread and severe in Wisconsin. Only time will tell whether stem canker is an emerging problem that will pose a significant threat to the industry in Wisconsin. In the meantime, however, it is wise to become educated on the cause of canker so that management strategies can be implemented.

## "Canker" is really "stem gall"

Canker symptoms from the dike appear as patches of unthrifty or dead uprights. Upon closer examination, runners and/or uprights are swollen with bumps and galls erupting through the bark. Thus, canker might more appropriately be called "stem gall." The current year's growth is stunted or dead. Symptoms have been noticed in early July, but extensive damage is usually not detected until late July through September. When galls first emerge they are soft, green, and moist. Later they shrink, and become hard and brown to black. The galls appear to originate from outside the vascular cambium, the cell layer from which new food- and water-conducting tissues are born. However, if the galls become large and encircle the stem, they apparently crush the vascular cambium thereby killing tissues above the galled area. Within a few weeks an upright can go from looking healthy with large fruit starting to color, to completely withered with brown leaves and dried-up fruit. Stem tissue below the galled area is green and often sends out new shoots. Thus, even where stem gall has been severe, it has not killed cranberry plantings outright. However, growers suffer significant yield losses as it takes a few years for the new growth to regain full productivity.

## What causes stem gall?

The cause of stem gall has been debated by growers and researchers for several years, but evidence is mounting that a species of the soil-borne bacterium *Agrobacterium* may be the culprit:

> *Agrobacterium* causes "crown gall" or "cane gall" on over 200 different plants, including relatives of cranberry (*e.g.*, blueberry and rhododendron).
>
> Stem gall symptoms on cranberry resemble symptoms caused by *Agrobacterium* on other woody plants such as grape, raspberry, and blueberry.
>
> Bacteria (but not pathogenic fungi) are commonly found in association with the galls, and some of these bacteria have been identified by biochemical,

physiological, and molecular (DNA) tests as *Agrobacterium*.

*Agrobacterium* enters plants through wounds. The pattern of stem gall symptoms in the field often follows tire tracks or appears to have resulted from beater injury.

Some of the putative *Agrobacterium* strains isolated from cranberry, and a known strain of *Agrobacterium*, cause galls when re-inoculated onto cranberry.

We are continuing to inoculate cranberry plants under controlled conditions in the greenhouse so that we can re-isolate *Agrobacterium* and complete the necessary steps to prove that *Agrobacterium* is the cause of stem gall. Also, we will identify our strains of *Agrobacterium* to species to see if the cranberry strains are unique or are common inhabitants of agricultural soils. Knowing this is critical to developing control strategies.

**Cranberry culture and potential for infection by *Agrobacterium***

The life cycle of *Agrobacterium* in a cranberry planting is unknown. However, cranberry culture has some unique features that might influence infection by *Agrobacterium*, the development of galls, and spread of the pathogen. For example, *Agrobacterium* appears to be systemic in cranberry stems. If so, then the pathogen would be readily spread in cuttings used to establish a new planting. Cranberry in Wisconsin is highly susceptible to winter injury which creates wounds through which the pathogen could infect. If the weather is mild following harvest and plants don't harden off well before the first cold snap, injury could occur in November or December. On beds where it's hard to hold a winter flood, exposed vines could be injured. Ironically, the mild winter of 1997-1998 might have resulted in significant winter injury: many beds did not hold a flood and vines were exposed to fluctuating temperatures for several weeks. The harvest process itself can damage vines, and sometimes stem gall is worse near the ends of beds where tractors and beaters turn. *Agrobacterium* is readily dispersed in water. Beater damage, winter injury, and water are all part of cranberry culture. Thus, it's not hard to envision infection of cranberry by *Agrobacterium*.

**Control of crown gall on other plants**

Until we know more about the *Agrobacterium*-cranberry interaction, it makes sense to consider how the crown gall is managed in other systems and apply these strategies to cranberry where appropriate. In other woody plants, integrated control of *Agrobacterium* includes:

*Sanitation*—nurseries inspect and reject suspicious plants.

*Biocontrol*—nurseries treat roots or seedlings with biocontrol bacteria.

*Chemical*—soil is kept free of root-chewing insects.

*Cultural*—root and crown injury is avoided; hardening off encouraged by not applying nitrogen late in season; plants protected during winter.

In general, these measures are preventative. There is no cure for *Agrobacterium*

infections once established, and experiments with bactericides such as copper and antibiotics have not been promising.

**Control of cranberry stem gall**

To a limited extent, cranberry growers can adopt the management strategies outlined above:

> *Sanitation*—do not use cuttings from a planting with any history of stem gall.
>
> *Chemical*—keep soil free of chewing insects.
>
> *Cultural*—do not overfertilize with nitrogen; minimize beater damage; avoid winter injury with timely winter flooding.

As for other crops, there is probably no cure for *Agrobacterium* infection of cranberry. That's the bad news. The (sort of) good news is that even severely affected plantings have recovered fully after 2-3 years.

In summary, the cause of cranberry stem gall is not fully understood, but appears to be caused by the soil-borne bacterium, *Agrobacterium*. Developing management strategies requires that growers share their observations and experiences with one another, with crop consultants, and with university researchers. Each group sees this problem from a different angle and will make essential contributions to solving the problem.