

Crown Gall and Ethylene Content of Rose Plants¹

D. R. Paterson², E. W. Lyle³, and D. R. Earhart²
*Texas Agricultural Experiment Station and
 Texas Rose Research Foundation, Inc., Tyler*

Abstract. Ethylene (C₂H₄) was higher in the internal atmosphere of crown gall infected rose bushes than in healthy plants. C₂H₄ was higher in the crown and root tissues than in the top of normal as well as crown gall infected plants.

Crown gall is a nonself-limiting neoplastic disease that affects more than 60 dicotyledonous plant families including Rosaceae (2). Tumors grow just beneath the soil surface at or near the root crown. Galls may vary from about 1-4 cm in diam. This disease is initiated by a tumor-inducing principle (TIP) elaborated by *Agrobacterium tumefaciens* (Smith & Town.) Conn. The TIP produced by the bacteria possesses the ability to transform normal plant cells to tumor cells. Once this change has taken place, the continued abnormal autonomous proliferation of the tumor cell becomes an autocatalytic process that is entirely independent of the bacterium.

In this study we investigated the ethylene content of crown gall infected

and normal rose plants. Ten 'Condesa de Sastoga', 8 'Blaze', 2 'Mirandy', 2 'Konigin Luise' and 2 'Eclipse' crown gall infected rose bushes all on *Rosa multiflora* (Thunb.) understock were harvested in Jan. The 24 crown gall infected plants along with an equal number of appropriate controls harvested from the same field were analyzed for C₂H₄ by gas chromatography. The tops and roots of both control and crown gall plants of the 5 cultivar multiflora combinations were trimmed to approx 10 cm from the plant crown and each plant placed beneath a large inverted funnel with a serum cup fitted over the spout. The funnel was filled with and submerged in tap water in a beaker. Control and crown gall plants from each cultivar were extracted simultaneously for 10 min at 185 mm Hg inside a vacuum chamber. C₂H₄ levels were determined on a F&M Model 5750 gas chromatograph using flame ionization and an activated alumina column. C₂H₄ was identified by retention time, co-chromatography with commercial C₂H₄, and removal from gas samples by a saturated mercuric perchlorate solution (2).

C₂H₄ levels in the crown gall infected plants were higher than the controls in each cultivar but there was considerable variability between both diseased and control plants of the 5 rose cultivar rootstock combinations. 'Blaze', 'Konigin Luise' and 'Condesa de

Table 1. Effect of crown gall on the internal atmosphere of rose bushes [crown + 10 cm of shoot (cultivar) + 10 cm of root (*Rosa multiflora*)].

Scion cultivar	ppb C ₂ H ₄ /100 g fresh wt	
	Control	Crown gall
Eclipse	102ab	185ab
Mirandy	118ab	613bc
Condesa de Sastoga	275ab	653c
Konigin Luise	53a ^z	1450d
Blaze	334ab	1451d

^zMean separation by Duncan's modified multiple range test, 5% level.

Sastoga' were higher in C₂H₄ than the 'Mirandy' and 'Eclipse'.

C₂H₄ content was determined from tissues from top, crown, and roots of 3 control and 3 crown gall infected 'Konigin Luise' plants. The ratio of C₂H₄ of tops:crown:root was approx 1.0:3.3:1.6 in both healthy and infected plants.

The higher ethylene content of the crown gall infected plants may be due to ethylene production directly by the bacterium or may represent a wound response of the infected tissue. Ethylene is produced by *Pseudomonas solanacearum* (E. F. Smith), a bacterium that infects banana (3). These results suggest that ethylene may be implicated as a possible factor in the etiology of crown gall.

Literature Cited

1. Braun, A. C. 1962. Tumor inception and development in the crown gall disease. *Ann. Rev. Plant Physiol.* 13:533-558.
2. Maxie, E. C., I. I. Eaks, N. F. Somer, H. L. Rae, and S. El-Batal. 1965. Effect of gamma radiation on role of ethylene and carbon dioxide evolution by lemon fruit. *Plant Physiol.* 40:407-409.
3. Pratt, H. K., and J. D. Goeschl. 1967. Physiological roles of ethylene in plants. *Ann. Rev. Plant Physiol.* 20:541-584.

Chilling Injury and Decay of Grapefruit as Affected by Thiabendazole, Benomyl, and CO₂¹

W. F. Wardowski, L. G. Albrigo, W. Grierson,
 C. R. Barmore, and T. A. Wheaton²
*Agricultural Research and Education Center,
 University of Florida, Lake Alfred*

Abstract. Chilling injury (CI) of 'Marsh Seedless' grapefruit was reduced by a preharvest spray of benomyl (Benlate) but not of Vapor Gard (VG) pinolene antitranspirant. Postharvest treatments with benomyl and thiabendazole (TBZ) also reduced CI. The effect of high CO₂ atmospheres (up to 20%) induced under

0.0254 mm (1 mil) PVC film varied sharply with picking date. CI was almost eliminated in such atmospheres in early and midseason pickings but accentuated in the late (postbloom) picking. Modified atmospheres tended to increase decay regardless of picking date.

Chilling injury (CI) has limited the marketing of grapefruit for many years (3, 6). Postharvest applications of TBZ have been shown to reduce the incidence or severity of CI of grapefruit (11, 12, 15). Preharvest applications of

Benlate³ (like TBZ³, a benzimidazole fungicide) can provide considerable postharvest decay control (4), but it was not known whether this affected CI. High CO₂ (up to 30%) has also drastically, but often inconsistently, reduced CI (2, 5, 8, 10, 14). Postharvest waxing reduced CI of grapefruit (8). Preharvest application of Vapor Gard³ (VG) alleviated certain peel injuries of oranges and increased the persistence of Benlate in the fruit (1). Although susceptibility to CI tends to decrease with advancing maturity (6), very late season grapefruit have been occasionally observed to show a high degree of peel injury when exposed to chilling temperatures (7, 8, 9).

Treatments known to reduce CI were compared to and combined with previously untested pre- and postharvest treatments to gain knowledge for

³The use of trade names is for identification only and does not necessarily imply endorsement.

¹Received for publication November 21, 1974. Florida Agricultural Experiment Stations Journal Series No. 5399.

²The technical assistance of Mrs. Sue J. Wells, Mr. Neil Berger, and Mr. Bert Robertson is gratefully acknowledged.