HortScience 18(6):921–922. 1983.

Burrknot Control on Apple

Eric Young[1]
Department of Horticultural Science, North Carolina State University, Raleigh, NC 27650

Ronald H. Tyler[2]
University of California, Agricultural Extension Service, County of Santa Cruz, Watsonville, CA 95076

Additional index words. rootstock, planting depth, *Malus* sp.

Abstract. **Burrknot development on the aboveground portion of apple (*Malus* sp.) rootstocks Malling Merton (MM) 111 and MM 106 was arrested effectively by direct application of a commercial, emulsified formulation of 2,4-xylenol and m-cresol plus 3 organic penetrants. M-cresol in mineral oil at 1.5% (v/v) was as effective as the commercial formulation in killing the burrknot tissue. Covering untreated burrknots with soil allowed complete rooting from the burrknot within 6 months.**

Burrknots are areas of root initial proliferation that occur on the aboveground portion of many rootstocks of apple. These areas can enlarge as the tree grows and cause trunk fluting or disfiguration. Also, burrknots can act as feeding sites for insect larvae, such as Dogwood borer (*Synanthedon scitula* Harris) (personal observation), and entry ports for fire blight (*Ewinia amylovora* Burrill) (3). The clonal rootstocks MM 111, MM 106, Malling (M) 7 and M 26, have a strong tendency to produce burrknots when exposed aboveground (4).

The best method for preventing burrknot proliferation is to plant the tree so that the entire rootstock is underground. However, commercial apple trees commonly are propagated as much as 40 to 50 cm above the nursery root system, and planting this deep is difficult where there is a hardpan and not advisable in poorly drained soil. Consequently, many apple trees on clonal rootstocks have been planted with 10 to 30 cm of the rootstock exposed and these have developed burrknots and associated problems.

Parish and Covey (2) reported successful control of aerial galls on MM 106 and M 7 rootstocks with an emulsified formulation of 2,4-xylenol and m-cresol [then named Bacticin, now Gallex (AgBioChem., Inc., 3 Fleetwood Ct., Orinda, CA 94563)]. They were unable to determine if the galls were aerial crown gall as reported by Siegler and Piper (6) or burrknots as reported by Rom (3).

This study's purpose was to investigate the use of Gallex and its separate components for control of apple burrknots. Also, the alternative of mounding soil over the burrknots was tested alone and in combination with chemical control. Treatments were applied by painting full-strength Gallex or one of the components on the burrknot and about 1 cm of surrounding bark. Components of Gallex were dissolved individually in liquid petrolatum (mineral oil), used as an inert carrier, in the following concentrations (v/v): m-cresol and 2,4-xylenol at 1.5%; 1,4-dimethylnaphthalene (DMN), 1,2,3,4-tetrahydronaphtalene (THN), and diphenylmethane (DPM) at 10%. These concentrations were reported active on crown gall by Schroth and Hildebrand (5).

Gallex treatments in California were applied on January 21, 1981, to 25 mature 'Newtown' on MM 111. Diameter measurements, across the burrknot from healthy bark to healthy bark, were taken on treated and control burrknots on date of treatment and again on February 23, and October 6, 1982. In North Carolina, Gallex was applied on March 11, 1982 to 12 trees each of mature 'Smoothee Golden Delicious' on MM 111 and MM 106. Measurements were taken on date of treatment and again on November 3, 1982. There was one treated and one control burrknot on each tree.

Gallex component and mounding study was done in North Carolina on 4-year-old 'Smoothee Golden Delicious' on MM 111

Table 1. Burrknot diameter on MM 111 for 2 growing seasons in California after treatment with Gallex on January 21, 1981.

Treatment	Burrknot diam (cm)				
	Jan. 21, 1981	Feb. 23, 1982	Change	Oct. 6, 1982	Change
Control	16.5	17.4	+0.9*	17.8	+0.4*
Gallex	17.6	17.0	−0.6	16.3	−0.7

*Significant at 5% level by Student's *t* test.

Table 2. Burrknot diameter and seasonal change on MM 111 and MM 106 in North Carolina after treatment with Gallex on March 11, 1982.

Rootstock Treatment	Burrknot diam (cm)		
	March 11, 1982	Nov. 3, 1982	Change
MM 111			
Control	5.7	6.5	+0.8*
Gallex	5.5	5.2	−0.3
MM 106			
Control	1.7	1.9	+0.2*
Gallex	2.1	1.5	−0.6

*Significant at 5% level by Student's *t* test.

Table 3. Burrknot diameter, seasonal change, and percentage of burrknot surface with new roots on MM 111 in North Carolina after being treated with Gallex and its components and covered with soil for 6 months.

Treatment[z]	Burrknot diam (cm)			Burrknot surface-rooted (%)
	Mar. 20, 1982	Nov. 11, 1982	Change	
Control	5.1	6.0	+0.9 a[y]	100 a
Gallex	5.0	3.7	−1.3 b	12 d
Cresol	5.3	4.2	−1.1 b	12 d
Xylenol	5.7	5.1	−0.6 b	31 bc
DMN	6.3	5.3	−1.0 b	25 c
THN	6.4	5.0	−1.4 b	17 cd
DPM	5.1	4.4	−0.7 b	38 b

[z]Treatments include: Gallex; m-cresol; 2,4-xylenol; 1,4-dimethylnaphthalene (DMN); 1,2,3,4-tetrahydronaphtalene (THN); and diphenylmethane (DPM).
[y]Mean separation in columns by Tukey's least significant range test, 5% level.

Received for publication April 20, 1983. Paper No. 8825 of the Journal Series of the North Carolina Agricultural Research Service, Raleigh, N.C. Mention of trade names does not constitute a guarantee or warranty of the product by NCARS, nor does it imply approval to the exclusion of other products that may be suitable. The authors thank AgBioChem, Inc. for supplying the Gallex used in these studies. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

[1]Associate Professor.
[2]Farm Advisor.

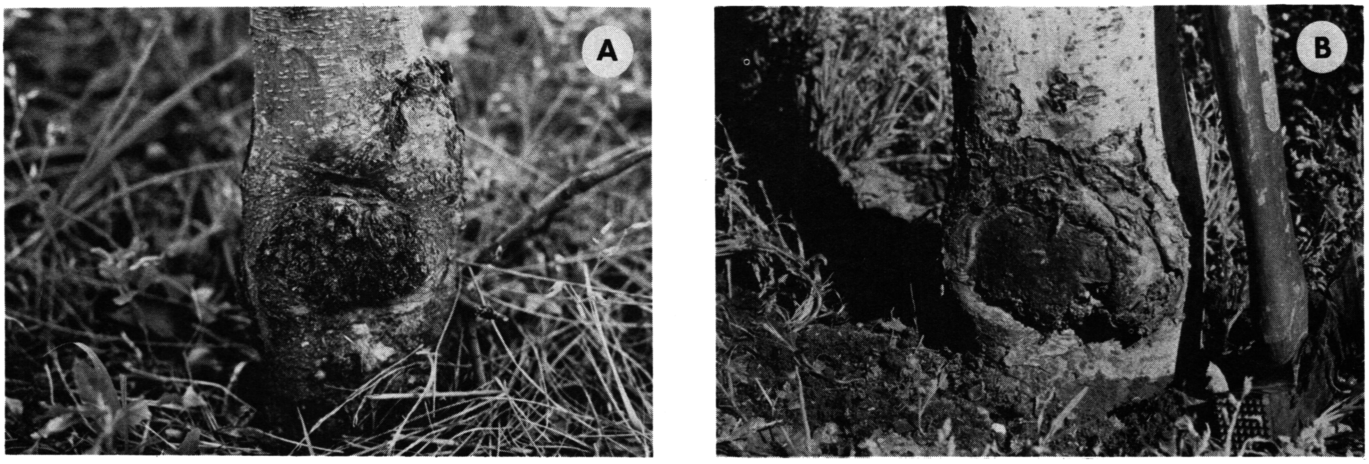

Fig. 1. Untreated burrknot on MM 111 (**A**), burrknot 2 years after treatment with Gallex (**B**).

that had been planted with 30 to 50 cm of the rootstock exposed. Treatments with Gallex or its components were applied and burrknot diameters measured on March 20, 1982. One burrknot on each of 5 trees was used for each treatment and 5 separate trees for the control. All trees had soil mounded around the exposed rootstock on June 1, 1982. Treated and control burrknots were uncovered on November 11, 1982, and the burrknot diameter measured. Also, root development from the burrknot was rated as 0%, 25%, 50%, 75%, or 100% of the burrknot surface rooted. The amount of rooting was considered an indication of the effectiveness of the chemical treatment in suppressing the burrknot tissue.

Gallex treatment caused reduction in burrknot size on both MM 111 and MM 106, while untreated burrknots continued to increase in size (Tables 1 & 2). Treated burrknots continued to shrink and began to heal over during the 2nd season after treatment (Table 1; Fig. 1). Burrknots treated with the components of Gallex also were reduced in size and there were no statistical differences among the various components (Table 3). However, based on the amount of rooting from covered burrknots, only m-cresol and THN killed the burrknot as effectively as Gallex (Table 3). Covered, untreated burrknots rooted completely within 6 months; while covered, Gallex-treated ones shrank in size and rooted very little (Table 3; Fig. 2).

Gallex is effective in arresting burrknot development and promoting shrinkage and healing of the treated area. Where it is practical, mounding soil over the burrknot to allow root development may be an alternative to chemical treatment. It is important to realize that by planting apple trees with the graft union close to the ground, burrknots can be avoided. In light of recent findings that show deep-planted apple trees on some rootstocks may not be better anchored than shallow-planted trees (1), trees on most clonal rootstocks should be propagated no higher than 20 to 25 cm above the nursery roots. This will allow the grower to avoid burrknots and the negative effects of deep planting. In some cases, however, there may be advantages to high-propagated trees that outweigh the burrknot problem. This seems particularly true in the case of M 7a, where a long rootstock shank is needed to allow deep planting to reduce suckering.

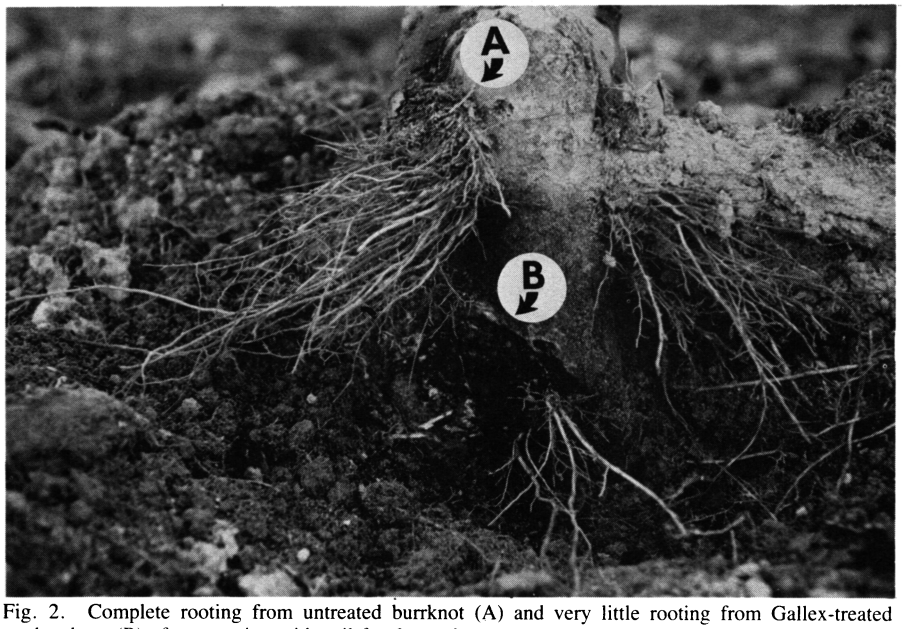

Fig. 2. Complete rooting from untreated burrknot (A) and very little rooting from Gallex-treated burrknot (B) after covering with soil for 6 months.

Literature Cited

1. Lyons, C.G., Jr., K.S. Yoder, and R.E. Byers. 1982. Poor anchorage and growth of spur 'Red Delicious' apple trees with deep crown roots. Scientia Hort. 18:45–47.
2. Parish, C.L. and R.P. Covey, Jr. 1974. Control of aerial galls on apple with an emulsified formulation of 2,4-xylenol and m-cresol. Plant Dis. Rptr. 58:701–703.
3. Rom, R.C. 1970. Burrknot observations on clonal apple rootstocks in Arkansas. Fruit Var. Hort. Dig. 24:66–68.
4. Rom, R.C. and S.A. Brown. 1979. Factors affecting burrknot formation on clonal *Malus* rootstocks. HortScience 14:231–232.
5. Schroth, M.N. and D.C. Hildebrand. 1968. A chemotherapeutic treatment for selectively eradicating crown gall and olive knot neoplasms. Phytopathology 58:848–854.
6. Siegler, E.A. and R.B. Piper. 1929. Aerial grown gall of the apple. J. Agr. Res. 39:249–262.