Evaluation of boron fertilizer applications to pruning wounds for control of *Eutypa lata* and determination of phytotoxicity

Rhonda J. Smith[1], Philippe E. Rolshausen[2] and Walter D. Gubler[2]
[1]University of California Cooperative Extension, 133 Aviation Blvd., Suite 109, Santa Rosa, CA 95403;
[2]Department of Plant Pathology, University of California, Davis, CA 95616; *Email: rhsmith@ucdavis.edu

Eutypa lata is one of several fungi that cause grapevine trunk diseases. These fungi include *Botryosphaeria* spp., *E. lata*, *E. leptoplaca, Togninia* spp, *Phaeomoniella chlamydospora* and *Cylindrocarpon* spp. Historically, most of the cankers found in vines have been attributed to *E. lata*, which causes Eutypa dieback disease; however, in a recent California survey of cankers found in vineyards in 21 counties, *E. lata* was the second most commonly isolated fungus after *Botryosphaeria* spp. (Urbez-Torres et al., 2006).

E. lata infects grapevines through pruning wounds during the dormant season by means of ascospores released from perithecia after rainfall. Infected areas of the grapevine have weak, stunted shoots with shortened internodes and small, chlorotic misshapen leaves. Clusters on these shoots fail to develop. Pruning wounds on older wood in the vicinity of the foliar symptoms are surrounded by cankers which continue to grow and eventually girdle that portion of the vine resulting in spur death. If cankers are not removed, the entire vine eventually dies.

Pruning wounds are more susceptible to infection earlier in the dormant period than later (Petzoldt et al., 1981) thus for many years growers were advised to prune late (after January). Benomyl was found to protect pruning wounds from infection (Moller et al., 1980) and was registered in California from 1976 until 2001 for that purpose. Grape growers did not report disease reduction with the use of benomyl and researchers questioned single-application efficacy (Munkvold et al., 1993). Growers have utilized late pruning as a disease management practice and more recently double pruning has been shown to reduce the risk of infection (Weber et al., 2007).

An application made to pruning wounds consisting of 5% boric acid in a commercial paste was found to significantly reduce disease in field trials; however bud failure was noted in the first node below the treated wound (Rolshausen et al, 2005). In an attempt by some growers to achieve the same disease control by using boron fertilizers instead of boric acid, excessive rates of fertilizer, containing up to 37.7% boric acid equivalent, were used which resulted in similar bud failure (R.J. Smith *unpublished data*). The current trial was conducted to determine if boron fertilizer, used in amounts to contain 5% and 1% boric acid, could control *E. lata* when applied to pruning wounds.

Materials and Methods
Vines were pruned to 3-bud spurs on 28 January 2006 and boron fertilizer treatments were applied on the same date. The boric acid fertilizer source used was Monterey Boron 10® (1.1 lbs of Boron per gallon) and the commercial paste was Doc Farewell's Seal & Heal®. The trial was designed as a randomized complete block with 4 replications and 6 treatments. Treatments were applied to single vine replicates and included a water (negative) control, a positive control, 1% and 5% boric acid equivalent spray applications and the same concentrations of boric acid applied as a paste. All pruning wounds were treated in the vines that received boron applications, including the ends of spurs (one-year wood). The spray treatments were applied with a back pack sprayer at 15 gallons per acre and paste treatments were applied with a brush. On 2 February 2006, wounds were inoculated in all treatments, with the exception of the water control, with approximately 1,000 ascospores of *E. lata* per wound. The water control was not inoculated to determine the rate of natural disease occurrence.

To evaluate the effect of boron applications on percent bud break, the modified E-L System was used to describe stages of shoot growth from node positions on each spur (Coombe, 1995). On 17 April, the basal, first, second and third node positions on all spurs on each single-vine replicate were assigned an E-L stage. On the assessment date the spurs on the water control vines had just over 80% bud break. To evaluate boron concentration in tissue, petioles and blades were collected at bloom and veraison on 5 June and 15 August respectively.

At dormancy on 19 December, two-year wood was collected from each single-vine replicate. The terminal node of 10 spurs on each vine was sampled to determine percent recovery (i.e. percent infection) of *E. lata* from the wood in the method described by Rolshausen et al., 2005. Percent disease control for each

single-vine replicate was calculated as follows: Percent control = 100 x 1-(percent infected spurs/percent infected spurs in the positive control within the same replication).

Results and Discussion

ANOVA was used to determine if percent bud break varied with treatment, replication and node position. Node position was the only factor with a significant effect on percent bud break (f-ratio = 39.55, p = 0.0000). Based on Tukey's HSD multiple comparisons the basal node had a lower average percent bud break than the first, second or third node on all spurs. Boric acid applications did not affect bud break.

Boron concentration in petioles and blades, each sampled at bloom and veraison, was not affected by treatments. Treatment averages in blades sampled at bloom ranged from 75 to 88 ppm and at veraison ranged from 37 to 40 ppm and were not significantly different (p=0.2810 and 0.7990 respectively). Treatment averages in petioles sampled at bloom ranged from 35 to 37 ppm and at veraison ranged from 32 to 34 ppm and were also not significantly different (p=0.1667 and 0.4646 respectively).

The use of 5% and 1% boric acid mixed with the commercial tree wound paste gave excellent control (89% and 81% respectively) (Table 1), and support the results obtained by Rolshausen and Gubler (2005). Spray applications of 5% and 1% boric acid produced 44% and 32% control respectively. These results suggest that; (i) mixing boric acid with a commercial paste greatly increases *E. lata* control; (ii) lower boron concentrations when applied as a paste may be as effective to control *E. lata* however; additional field trials need to be conducted to confirm these findings; (iii) boron fertilizers derived from boric acid may be an option for the control of *E. lata* as federal and state regulations permit.

References:

1. Coombe, B.G. 1995. Adoption of a system for identifying grapevine growth stages. Australian Journal of Grape and Wine Research 1, 104-110.
2. Moller, W.J. and A.N. Kasimatis 1980. Protection of Grapevine pruning wounds from Eutypa dieback. Plant Dis. 64: 278-280.
3. Munkvold, G.P. and J.J. Marois 1993. The effects of fungicides on Eutypa lata germination, growth, and Infection of grapevines. Plant Dis. 77:50-55.
4. Petzoldt, C.H., W.J. Moller and M.A. Sall 1981. Eutypa dieback of grapevine: seasonal differences in infection and duration os susceptibility of pruning wounds. Phytopathology 71:540-543.
5. Rolshausen, P.E., and W. D. Gubler 2005. Use of boron for the control of Eutypa dieback of grapevines. Plant Dis. 89: 734-738.
6. Urbez-Torres, J.R. 2006. Identification and Distribution of Botryosphaeria spp. associated with grapevine cankers in California. Plant Dis. 90:1490-1503.
7. Weber, E.A., F.P. Trouillas and W.D. Gubler 2007. Double pruning of grapevines: a cultural practice to reduce infections by Eutypa lata. Am. J. Enol. Vitic. 58:61-66.

Table 1. Percent recovery of *Eutypa lata* and disease control in spurs treated with boric acid derived from boron fertilizer in a Sauvignon Blanc vineyard in Sonoma County, 2006[a]

Treatment	Mean percent infection[c]	Standard deviation	Mean percent disease control[d]	Standard deviation
1% boric acid spray	35 ab	12.9	32 a	31.0
5% boric acid spray	30 abc	21.6	44 ab	35.3
1% boric acid paste	10 bcd	0.0	81 b	4.6
5% boric acid paste	5 cd	5.8	89 b	13.2
Positive Control[b]	55 a	12.9	---	
Negative Control	0 d	0.0	---	

[a]Pruning wounds were inoculated in all treatments (with the exception of the Negative Control) with approximately 1,000 ascospores of *E. lata* per wound 5 days after boric acid applications were made.
[b]Positive control was inoculated only.
[c]Mean percentages of infected spurs. Values followed by the same letter are not significantly different by Tukey's HSD multiple comparisons test.
[d]Mean percent disease control in each treatment was the average of the percent control over 4 single vine replicates in that treatment. The percent disease control for each single-vine replicate was calculated by Percent control = 100 x 1-(percent infected spurs/percent infected spurs in the positive control within the same replication).