viticulture tech data UPDATE

XylPhi-PD™ Bactericide for use in grapevines.

Efficacy of XYLPHI-PD™ for the Reduction of Pierce's Disease in Vineyards

Among the many challenges facing vineyard managers, Pierce's Disease (PD) represents a particularly formidable threat due to limited options for effective prevention and control. PD is a deadly disease of grapevines caused by *Xylella fastidiosa* bacteria which are easily spread by 2 main vectors, blue-green and glassy-winged sharpshooters. The *X. fastidiosa* bacteria block the xylem of grapevines, causing chlorosis and scorching of leaves that eventually kills entire vines in 1 to 5 years.[1] Thus, PD represents a major threat to major US wine regions, accounting for widespread economic damage (e.g., roguing and replanting of vines, low fruit production, etc.) and costly deployment of resources aimed at disease moderation.

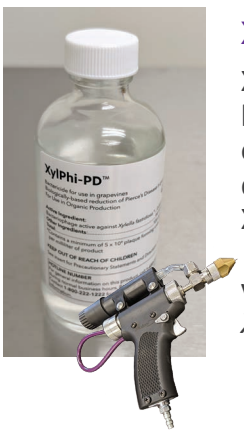
Few methods for controlling and treating PD have been available, with efforts historically focused on controlling the sharpshooter vector (e.g., insecticides) or roguing seriously ill vines, both of which have demonstrated only limited success. However, an option that reduces PD in grapevines is now available, XylPhi-PD.™

KEY POINTS

Multiple field studies assessed the efficacy of XylPhi-PD for the treatment or prevention of Pierce's Disease (PD) in vineyards, when used in accordance with label Directions for Use.

- In a 2015 Texas A&M study with natural infection exposure, 3 monthly XylPhi-PD treatments significantly ($P = 0.047$) reduced PD incidence 44% vs controls.[2]
- A 2017 CA university *X. fastidiosa* challenge study demonstrated preventative and curative efficacy ($P < 0.05$) ranging from 77% to 100% in 2 wine varietals and significantly suppressed symptoms in plants that already had PD.[3]
- 3 monthly XylPhi-PD treatments reduced incidence of PD-positive vines by 36% in just 1 season in a 2019 Wilbur-Ellis commercial field trial conducted at 3 Sonoma CA wineries.[4]

These favorable outcomes distinguish XylPhi-PD as a targeted and cost-effective strategy for effectively protecting valuable vineyards against PD.



XYLPHI-PD™

XylPhi-PD is a novel, OMRI Listed biological treatment for PD, a cost-effective break-through technology developed exclusively for viticulture. XylPhi-PD contains a cocktail of viral bacteriophages (bacteria-killing viruses) that enter and destroy *X. fastidiosa* bacteria.

XylPhi-PD can be flexibly applied as a preventative to protect growing vines under disease pressure, or as a curative after disease symptoms become visible. XylPhi-PD is available in 100-mL vials (treats up to 300 mature vines or 600 young vines), intended for injection into grapevines using the Pulse Xyleject™ pressurized injection device, and has no REI and minimal PPE when used in accordance with label Directions for Use.

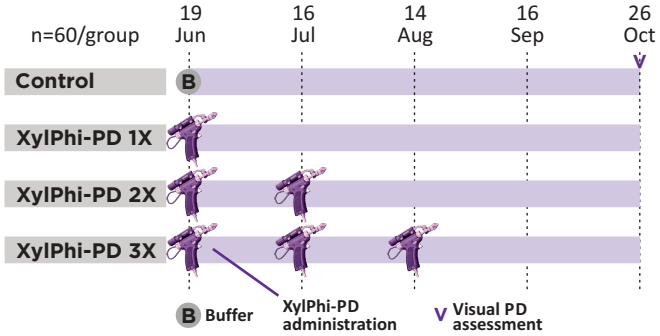
A&P Inphatec

2015 TX: Natural Infection Field Trial

Experiment Design

A field study conducted by Texas A&M University evaluated the efficacy of XylPhi-PD against natural PD infections in an area with high PD pressure.[2] The study involved 240 vines at an Uvalde, TX vineyard with a history of PD, with 30 Chardonnay vines and 30 Cabernet Sauvignon vines randomly assigned to each of 4 treatment groups for injection as follows:

- Control (buffer solution injection), n=60;
- XylPhi-PD 1X: 1 treatment (Jun), n=60;
- XylPhi-PD 2X: 2 treatments (Jun/Jul), n=60;
- XylPhi-PD 3X: 3 treatments (Jun/Jul/Aug), n=60.



All study vines were visually assessed for PD development and symptoms in October. In addition, insect traps quantified the population of sharpshooters in the vineyard, with many tested for *X. fastidiosa* by quantitative polymerase chain reaction (qPCR).

Results

The incidence of vines exhibiting PD symptoms was significantly reduced by use of XylPhi-PD. As shown in Figure 1, the XylPhi-PD 3X group (3 XylPhi-PD treatments at monthly intervals) demonstrated a significant ($P = 0.047$) reduction of PD incidence (10%) compared to controls (18%). This improvement represented 44% relative reduction in PD incidence for the XylPhi-PD 3X group. No significant differences were detected between the other treatment groups.

Disease incidence was significantly less ($P \leq 0.037$) in Cabernet Sauvignon vines than Chardonnay in all 4 treatment groups, an expected outcome since Chardonnay cultivars are typically more susceptible to PD and express symptoms more dramatically than Cabernet Sauvignon.

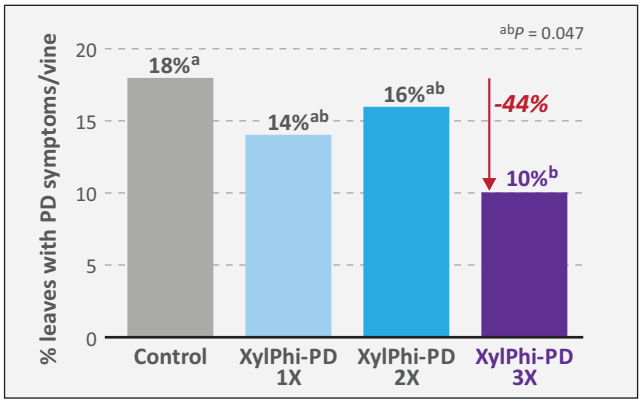


FIGURE 1: Efficacy of XylPhi-PD for treatment of natural PD infection (Texas A&M field trial).

The population of sharpshooter vectors increased dramatically from late May onward, with most recovered insects testing positive for *X. fastidiosa*. These data confirmed the vineyard was exposed to infective PD pathogens via natural vectors.

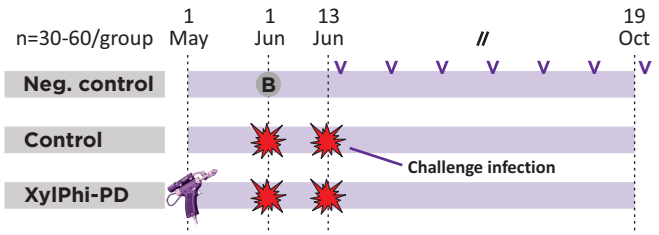
2017 CA: Treatment of Vines Intentionally Infected with PD

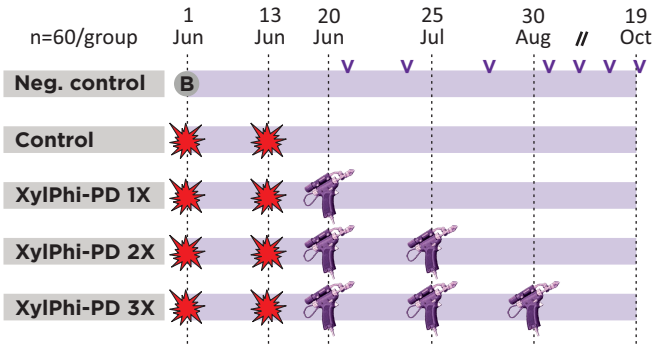
Experiment Design

A California university field study evaluated the preventive and treatment efficacy of XylPhi-PD in vines intentionally infected with PD (challenge infection).[3] The 'prevention' portion of the study involved 150 vines at a vineyard with a history of PD damage, with 1:1 ratio of Chardonnay and Cabernet Sauvignon vines randomly assigned to each of 3 treatment groups for injection as follows:

- Negative control (buffer), n=60;
- Control (challenged), n=60;
- XylPhi-PD: 1 pre-challenge treatment (May) n=30.

The control and XylPhi-PD groups received 2 challenge doses of *X. fastidiosa* (1 Jun and 13 Jun) starting a month after XylPhi-PD administration.





The *same* experimental structure and control groups were used for the 'treatment' arm of the study. For this protocol, 3 additional groups (total of 180 vines, equal Chardonnay and Cabernet Sauvignon) were administered XylPhi-PD 1, 2, or 3 times after completion of the 2 challenge doses of *X. fastidiosa*, as follows:

- XylPhi-PD 1X: 1 treatment (Jun), n=60;
- XylPhi-PD 2X: 2 treatments (Jun/Jul), n=60;
- XylPhi-PD 3X: 3 treatments (Jun/Jul/Aug), n=60.

All study vines were observed for signs of PD through mid October.

Results

The severity of PD in vines exhibiting symptoms was significantly reduced by strategic use of XylPhi-PD, even in the face of a virulent challenge infection. As summarized in Figure 2, preventative administration of XylPhi-PD reduced the severity of disease (as measured by average percentage of leaves displaying PD symptoms) at 20 weeks post-challenge by 100% ($P < 0.05$) and 93% ($P < 0.05$) in Chardonnay and Cabernet Sauvignon varietals, respectively, compared to controls. For the treatment phase

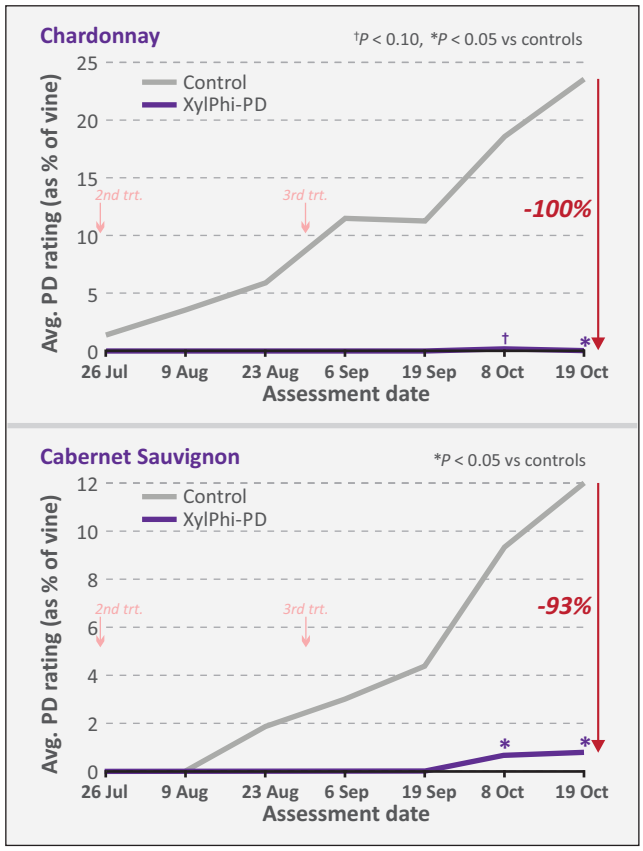


FIGURE 2: Efficacy of XylPhi-PD for ***PREVENTION*** of PD challenge infection (CA field trial).

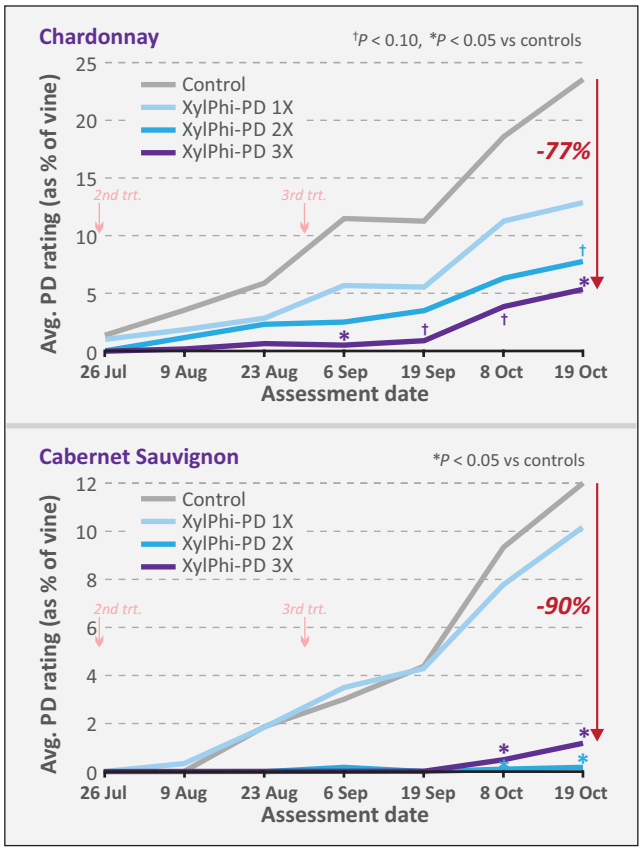


FIGURE 3: Efficacy of XylPhi-PD for ***TREATMENT*** of PD challenge infection (CA field trial).

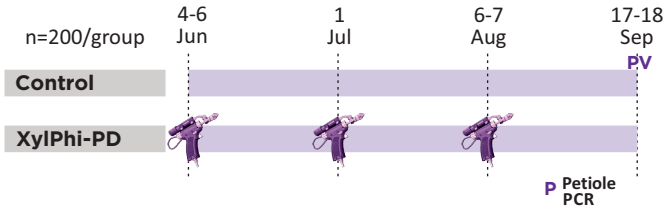
of the study (Figure 3), post-challenge XylPhi-PD treatments reduced PD severity by 77% ($P < 0.05$) and 90% ($P < 0.05$) for Chardonnay and Cabernet Sauvignon varietals, respectively. Increasing the number of XylPhi-PD treatments resulted in greater reductions in disease severity. No vines in the negative control group were affected.

2019 CA: Natural Infection Field Trial

Experiment Design

A 15-week, multi-location commercial (Wilbur-Ellis) field study evaluated the efficacy of XylPhi-PD against naturally occurring PD.[4] The study involved 400 vines (Chardonnay, Pinot Noir) at 3 Sonoma CA wineries (1 winery had 2 test fields) with a history of PD. Vines were randomly selected in treatment blocks at each site and assigned to either of 2 treatment groups as follows:

- Control (untreated), n=200 (50/site);
- XylPhi-PD: 3 treatments (Jun/Jul/Aug); 80 µL of XylPhi-PD injected twice in the trunk and once in each cordon (4-6 injections = 1 treatment); n=200 (50/site).



Six petioles from each vine were collected in September for qPCR analysis and confirmation of *X. fastidiosa* infection. Additionally, all study vines were visually assessed for PD development and symptoms.

Results

Overall PD incidence was relatively low due to an unusually cold and wet preceding winter. Still, XylPhi-PD treatment yielded a 36% reduction (Figure 4) in the number of vines PD-positive by qPCR (9%) compared to untreated control vines (14%) when assessed just 6 weeks after the last treatment.

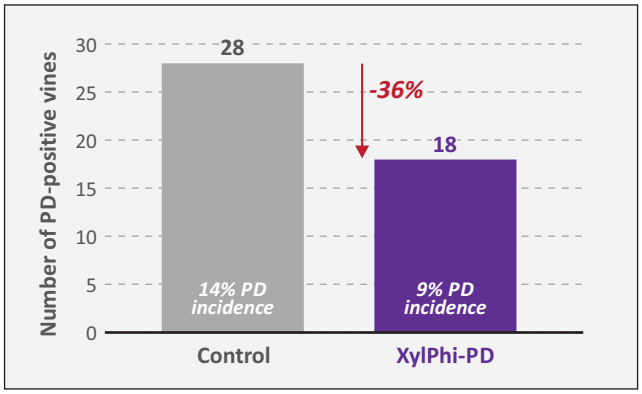


Figure 4: Efficacy (by qPCR) of XylPhi-PD for treatment of natural PD infection (CA Wilbur-Ellis field trial after 1 season of treatment).

Conclusions

In 3 studies, XylPhi-PD treatment of diverse wine varietals prompted reductions in PD incidence and/or severity, under conditions of both natural and challenge infection with *X. fastidiosa*. XylPhi-PD consistently demonstrated significant efficacy across differing conditions and locales. These favorable outcomes distinguish XylPhi-PD as a targeted and cost-effective strategy for effectively protecting valuable vineyards against PD.

References

1. Pierce's disease research updates. CDFA. http://piercesdisease.cdfa.ca.gov (accessed August 2020).
2. Texas A&M research progress report, 2016. Data on file.
3. California field trial progress report, 2017. Data on file.
4. Field trial report, 2019. Wilbur-Ellis/A&P Inphatec. Data on file.

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