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Environmental Policy and Behavior
Research Brief

An Economic Case for Early Adoption of Practices to Prevent and Manage Grapevine Trunk Diseases in the Northern San Joaquin Valley Region: Preliminary Results

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Issue

Trunk, or wood-canker, diseases, including Botryosphaeria dieback, Esca, Eutypa dieback, and Phomopsis dieback, present a serious challenge to vineyard productivity. The majority of California vineyards over age 10 are likely infected and yield losses can reach over 90%. The overall economic impact of losses to Eutypa alone has been estimated at 14% of gross producer value. Trunk diseases take multiple years to develop and start showing symptoms years after infection has already occurred, after which point management options are limited. While preventative management practices are available, there is a hesitancy to start using them in newly-established vineyards, possibly due to uncertainties about cost-effectiveness and disease-control efficacy.

Key Findings

Based on economic analyses for a 25-year-old vineyard in the Northern San Joaquin Districts, we found that growers who adopt preventative practices in all but one scenario have net benefits per acre per year that are greater than when no action is taken. When preventative practices are adopted when a vineyard is ten years old, the net returns remain positive for years longer than when nothing is done, extending the profitable lifespan of the vineyard by two to twelve years. Net returns are likely to remain positive for an additional year or more, if practices are adopted even earlier.

Methodology

We conducted a simulated economic experiment in which we construct a representative bioeconomic model for winegrape production in an infected vineyard. Our data comes from the scientific literature, from interviews with growers, pest control advisors, and farm advisors, and from responses to grower survey questionnaires. The baseline model simulates production from a healthy vineyard and subjects it to a trunk disease, assuming no preventative action is taken. We then simulate scenarios where different practices with varying costs and efficacy are adopted at different vineyard ages. We use pairwise comparisons between the baseline model and these scenarios to gauge the potential economic gains from adopting these practices, relative to no action or to waiting until a vineyard has matured and symptoms of trunk diseases (and yield loss) are thus widespread.

We are also conducting a survey of growers throughout California's grape-growing regions to better understand trends in usage, when preventative practices are adopted, and grower perceptions of efficacy. UCCE Viticulture farm advisors and industry representatives helped design the survey, and organized meetings where we conduct the survey. The economic research will next consider possible market effects due to early adoption, as well as evaluate grower perceptions of practice efficacy and adoption timing. Combined, this research will guide development of new extension tools that clearly communicate the economic advantages of preventing infection in newly-established vineyards.

Scenarios

In the analysis, we consider 9 combinations of practice scenarios, which differ by cost ($0, $59, and $478 per acre per year), assuming variability in efficacy as reported from field trials with different trunk diseases (25%, 50%, and 75%), and adopting the practices in vineyards of different ages (year 3, year 5, and year 10). Table 1 provides the range of efficacy rates compiled from the scientific literature. Figures 1 and 3 show the infection rates used in the analysis when no action is taken versus when practices with 75% and 25% disease control efficacy rates are adopted. Figures 2 and 4 show the corresponding average yield per acre for this region for a healthy vineyard, a vineyard when no action is taken, and when practices are adopted at different ages. The range of net returns per acre per year averaged over a 25-year lifespan for a healthy vineyard is $$1,996 greater than those for an infected vineyard (ranging from $1,520 to -$476).

Table 1. Disease Control Efficacy Ranges from the Scientific Literature

Trunk Disease	Delayed Pruning	Double Pruning	Pruning-wound Protectant
Botryosphaeria	58 – 72%	58 – 72%	60 – 80%
Esca	28 – 87%	28 – 87%	52 – 58 %
Eutypa	75 – 97%	75 – 97%	100%

Note: These three practices have been evaluated in different field trials, in independent studies. We report data from these studies here, in the form of the percentage of pruning wounds protected from infection. We assume that delayed pruning and double pruning are equally effective. For Topsin, these results are only for hand-painting of pruning wounds, and not for spray applications of this fungicide.

Figure 1. Infection Rate with No Action and 75% Disease Control Efficacy at Varying Ages

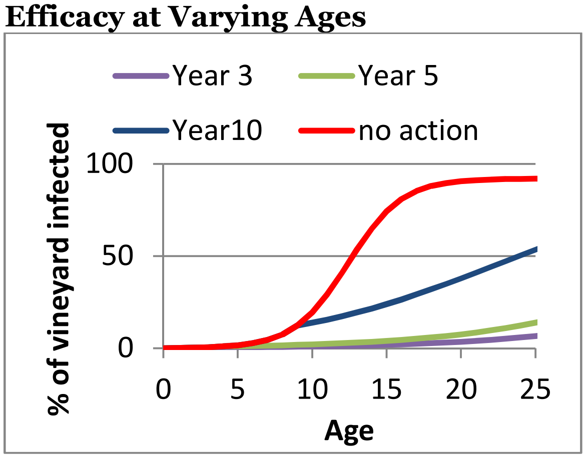


Figure 2. Yield per Acre for Healthy, No Action, and 75% Disease Control Efficacy at Varying Ages

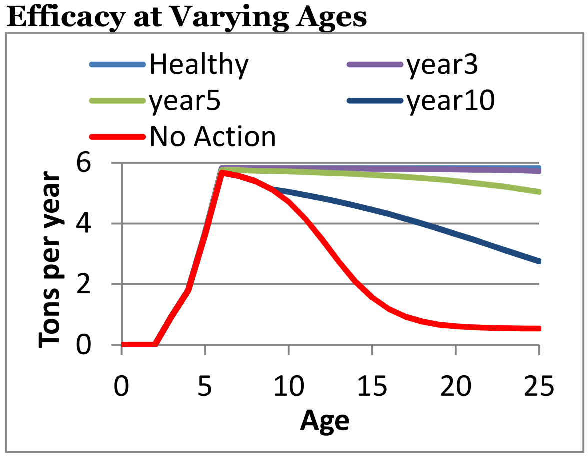


Figure 3. Infection Rates with 25% Disease Control Efficacy at Varying Ages

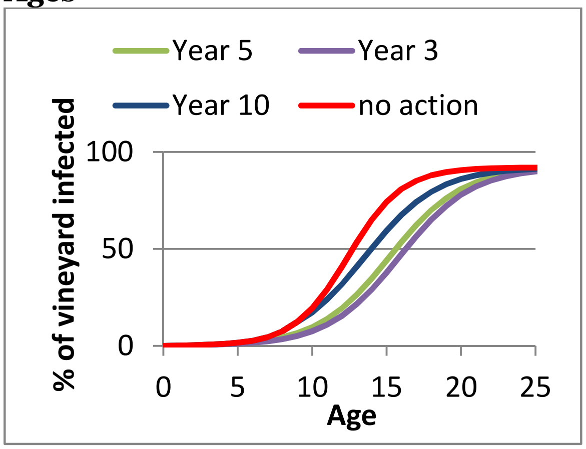
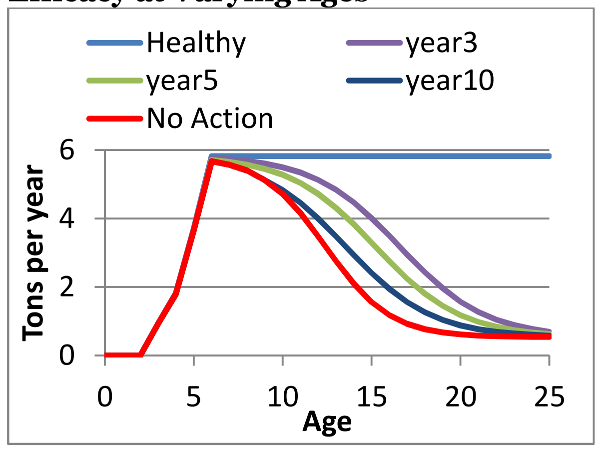


Figure 4. Yield per Acre for Healthy, No Action, with 25% Disease Control Efficacy at Varying Ages



Detailed Results

Table 2 shows differences in net returns per acre per year averaged over a 25-year lifespan for each scenario relative to the no action scenario. Net returns are larger in every scenario except when double pruning (with a cost that is 18% of the average annual net returns for a healthy vineyard) with 25% disease control efficacy is adopted in year 10. However, waiting until year 10 brings substantially lower profits, compared to starting in years 3 or 5. You can see that the year 10 values are in all cases less than half that of year 5 values.

Table 2. Difference in Net Returns per acre per year between Practice Scenarios and No Action Scenario (averaged over a 25 year lifespan).

	Delay Pruning	Topsin, Painted	Double Pruning
Practice Cost Scenario	$0	$72	$273
year=3,25% Efficacy	$576	$509	$324
year=5,25% Efficacy	$365	$304	$136
year=10,25% Efficacy	$116	$70	-$59
year=3, 50% Efficacy	$1,588	$1,522	$1,337
year=5, 50% Efficacy	$1,121	$1,061	$892
year=10, 50% Efficacy	$468	$421	$293
year=3, 75% Efficacy	$1,977	$1,910	$1,726
year=5, 75% Efficacy	$1,812	$1,751	$1,582
year=10, 75% Efficacy	$833	$787	$658

Note: values are calculated for three levels of disease control efficacy (25, 50, and 75%) because the efficacy of these practices varies among trunk pathogens (see Table 1).

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Waiting until year 10 can significantly shorten the number of years the vineyard generates positive net returns (i.e., the profitable lifespan). (25 years is an arbitrary cutoff for our analyses – Vineyards are replanted for different reasons, not always trunk-disease related)

If we assume that the practices are only 25% effective (for e.g., delayed or double pruning protected only 28% of pruning wounds against Esca in one study), they do little to extend the profitable lifespan. The profitable lifespan is improved only by 1 to 5 years over taking no action, depending on when the practice is adopted.

When a practice is 50% effective, we see that adopting it just prior to year 10 can increase these lifespans by 3 to 4 years. If adopted just prior to year 5, these lifespan increase by another 5 years (to 20-21 years). If adopted just prior to year 3, rather than year 5, then we see a vineyard's profitable lifespan grow an additional 4 to 5 years (to 25 years).

When growers adopt a practice that is 75% effective, waiting until year 10 still brings about increases in these lifespans by 10 to 12 years (to 22-24 years). However, as previously highlighted, it is important to keep in mind that the levels of profitability are lower if you wait until year 10, compared to adopting preventative practices with 75% efficacy in years 3 or 5.

Figure 5. Profitable Lifespan for Vineyard in Northern San Joaquin Valley Region