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Research Brief

An Economic Case for Early Adoption of Practices to Prevent and Manage Grapevine Trunk Diseases in the Central Coast: 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 grape growers. Many vineyards throughout California over age 10 are likely infected and yield losses in such vineyards 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 a long time to develop and often become symptomatic only years after infection has already occurred, at which point management options are limited. While preventative management practices are available, grape growers may be hesitant to use them due to uncertainties about cost-effectiveness and disease control efficacy.

Key Findings

We found that growers who adopt preventative practices in all but one scenario (when the cost of the practice is largest) have net benefits per acre per year averaged over a 25 year lifespan that are greater than those when no action is taken to control an infection (for a net return per acre per year of -$1,110). Also, practices with moderate and high disease control efficacy adopted in infected vineyards before the 3rd or 5th growing seasons provided growers with positive overall profits over a 25 year lifespan, except again when the cost of the practice is largest. When these practices are adopted early (prior to the 3rd or 5th growing season) net returns from established vineyards remain positive longer, likely extending vineyard lifespans by 5 to 10 years.

Methodology

We conducted a simulated economic experiment in which we construct a representative bioeconomic model for winegrape production when trunk diseases are present, based on the scientific literature, interviews with growers, pest control advisors, and farm advisors, and from responses to grower survey questionnaires. The baseline model simulates production, assuming no action is taken to prevent infection in the vineyard. We then simulate scenarios where different practices with varying costs and disease control efficacy are adopted at different vineyard ages. We use pairwise comparison between the baseline model and these scenarios to gauge the potential gains from adopting these practices, relative to no action or to waiting until a vineyard has matured and symptoms of trunk diseases are thus apparent.

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. 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 provide us with a better understanding of the long-term efficacy of these management practices and the incentives motivating grower decision-making. We hope that this information will, in turn, provide growers and other managers a better understanding of how best to deal with trunk diseases.

Scenarios

In the analysis, we consider two baseline scenarios (a healthy vineyard and an infected vineyard) and 9 practice scenarios, which differ by cost ($0, $72, and $359 per acre per year), disease control efficacy (25%, 50%, and 75%), and age practice is adopted (prior to the 3rd, 5th, and 10th growing seasons). 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 yield per acre for a healthy vineyard, a vineyard when no action is taken, and those in which 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 are $2,071 greater than those for an infected vineyard (ranging from $961 to -$,1110).

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%

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

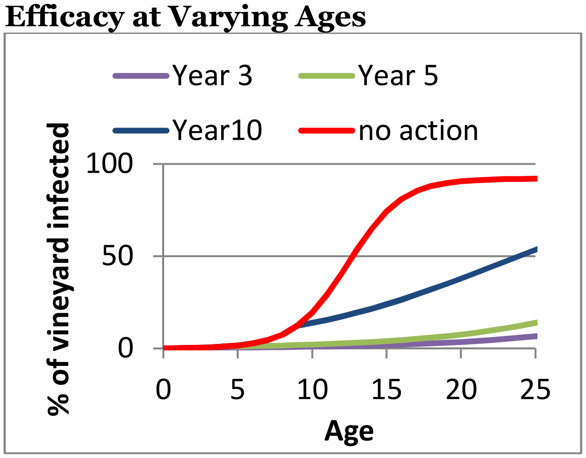


Figure 2. Yield per Acre for Healthy, No Action, and 75% Disease Control Efficacy at Varying Ages

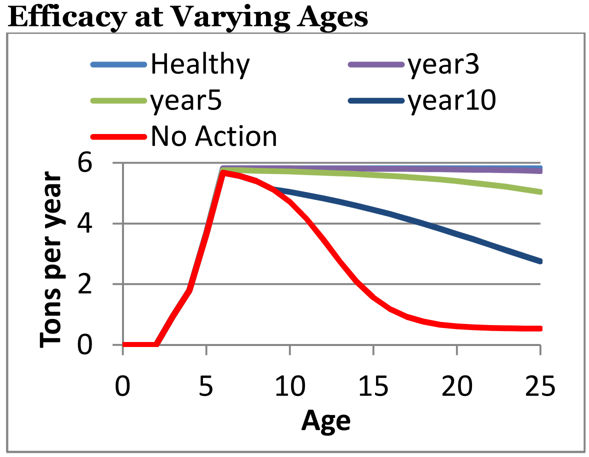


Figure 3. Infection Rates with 25% Disease Control Efficacy at Varying Ages

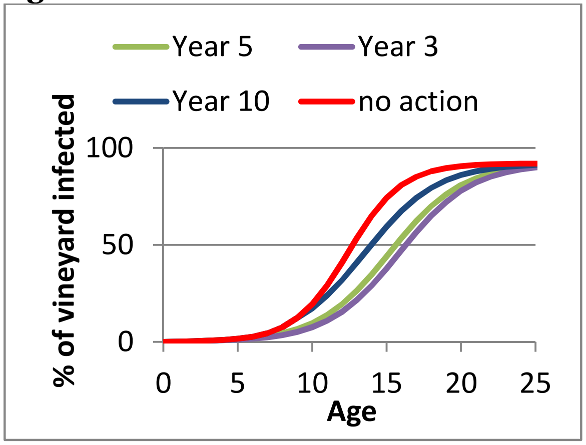
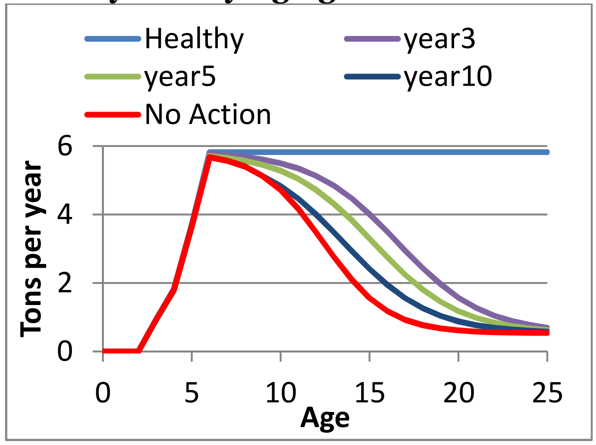


Figure 4. Yield per Acre for Healthy, No Action, with 25% Disease Control Efficacy at Varying Ages



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 37% of the average annual net returns for a healthy vineyard) with 25% disease control efficacy is adopted just prior to the 10th growing season. Additionally, when the difference in net returns exceeds $1,110, a grower will experience positive overall profits over a 25 year lifespan. Growers who face infection from trunk diseases will be able to generate positive overall returns from a vineyard if they adopt practices that have 50% and 75% disease control efficacy rates just prior to the 3rd or 5th growing season, except when adopting double pruning with a 50% disease control efficacy just prior to the 5th growing season.

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	**$0**	**$72**	**$359**
Scenario			
year=3,25% Efficacy	$651	$584	$321
year=5,25% Efficacy	$440	$379	$139
year=10,25% Efficacy	$191	$145	-$38
year=3, 50% Efficacy	**$1,664**	**$1,597**	**$1,334**
year=5, 50% Efficacy	**$1,197**	**$1,136**	$896
year=10, 50% Efficacy	$543	$497	$313
year=3, 75% Efficacy	**$2,052**	**$1,986**	**$1,722**
year=5, 75% Efficacy	**$1,887**	**$1,826**	**$1,586**
year=10, 75% Efficacy	$844	$797	$614

We also find when we look at the profitability of each year in established vineyards that waiting until just prior to the 10^{th} growing season to adopt a practice significantly shortens the number of years the vineyard generates positive net returns. This suggests that adopting at such a late age shortens vineyard lifespan. (We do not have specific details on when a grower will replace an existing vineyard and thus do not make more detailed inferences about the productive lifespan of a vineyard.) When practices with 25% disease control efficacy are applied, they do little to extend the profitable lifespan.

When a practice has a 50% disease control efficacy, we see that adopting it just prior to the 5^{th} growing season, rather than the 10^{th} growing season, increases the profitable lifespan by nearly 5 years. When a grower adopts this same practice prior to the 3^{rd} growing season, rather than the 5^{th} growing season, then we see a vineyard profitable lifespan grow from 19 to 24 years, except when double pruning is adopted. In this latter case, the profitable lifespan only grows from 18 to 21 years.

When growers adopt a practice that has a 75% disease control efficacy just prior to the 5^{th} growing season, instead of the 10^{th} growing season, we see the profitable lifespan increase from 20 to 25 years for delayed pruning and pruning wound protectant, and from 17 to 25 years for double pruning. When a grower adopts practices with the same disease control efficacy just prior to the 3^{rd} growing season, rather than the 5^{th} growing season, the profitable lifespan does not change. Although we expect these profitable lifespans to be greater with the earlier adopt rate, we cannot make an inference about the extent of this change given that we limit the lifespan of all vineyards to 25 years to conduct our pairwise comparisons.

Figure 5. Profitable Lifespan for Representative Vineyard in Central Coast