



## **4<sup>th</sup> USDA-SCRI Advisory Board Meeting**

*Economic benefits of disease prevention  
in young vineyards*

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- **Adoption of preventative practices increases net returns to growers**
- **Adoption of preventative practices increases profitable lifespan**
- **The time it takes for a practice adopted in young vineyards to outperform no action is long given slow growth of disease**
- **The break-even perceived risk of infection is low**
- **The % increase in net benefits of adopting earlier in an infected vineyard may not be enough to offset the % increase in the cost if it is not.**
- **Need to provide information on economic benefits of early adoption**

Through our simulation analysis, we found adoption of preventative practices increase net returns in infected vineyards. These practices also extend the number of years a mature vineyard generates positive annual net returns. In some cases by more than 50%. However, delayed pruning which adds no extra cost, above and beyond conventional pruning costs, cannot be applied everywhere given reported labor constraints. Application of pruning wound protectant and double pruning, which are costly to adopt, may take up to 10 years to generate cumulative net returns greater than those from taking no action. We also considered the effect uncertainty about infection has on adoption decisions. The empirical evidence that growers must have very low expectations about infection to not adopt highly effective practice. The perceived probability of infection that leads to adoption may be greater than 0.5 when the practice has high costs (double pruning). Interestingly, we also find evidence that when the practice is highly effective in control trunk diseases, growers may wait to adopt because the expected benefit of adopting in an infected vineyard at an earlier time does not offset the expected cost of adopting when the vineyard is uninfected. This also occurs at very low probabilities.

We have learned that many growers and PCAs believe vineyards are likely infected with trunk diseases. The long time lag to see benefits from adopting may lead to uncertainty about the practices and their efficacy, limiting grower adoption. Another reason they may not be adopting is that they do not have information about the economic benefits of adopting preventative practices in young vineyards.

## Profitable Lifespan – Delayed Pruning

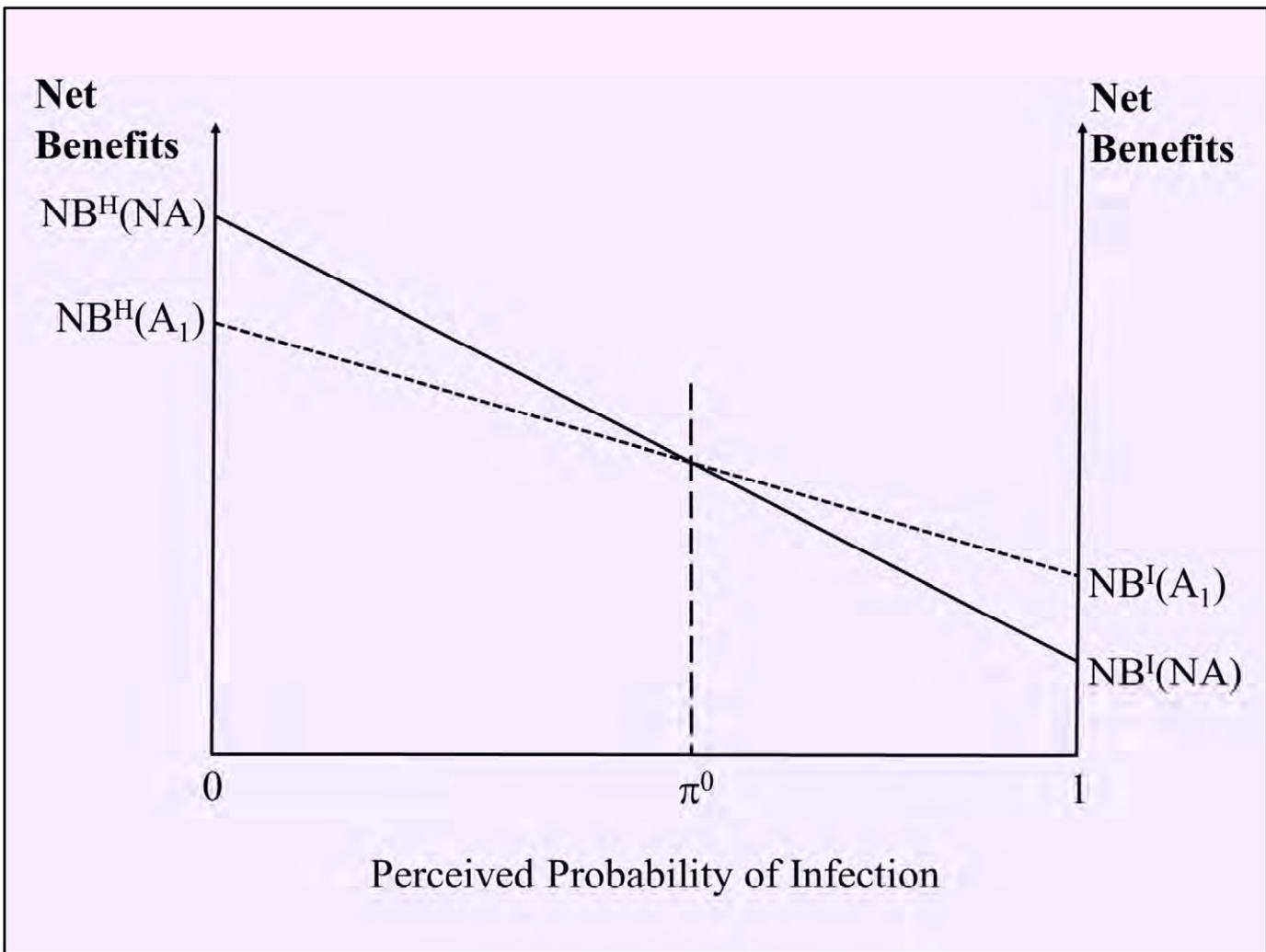
	No Action	25% DCE			50% DCE			75% DCE		
		Year 3	Year 5	Year 10	Year 3	Year 5	Year 10	Year 3	Year 5	Year 10
<b>Napa</b>	14	18	17	16	25	24	19	25	25	25
<b>No. San Joaquin</b>	12	15	15	13	22	20	15	25	25	22
<b>Central Coast</b>	12	16	15	14	23	21	16	25	25	24
<b>No. California</b>	13	17	16	14	24	22	17	25	25	25
<b>Sonoma</b>	12	16	15	13	22	21	16	25	25	23

Here we see how the profitable lifespan of a vineyard increases with adoption of pruning wound protectant. The table shows the age when the vineyard last generates positive annual net returns. When a practice is adopted at year 3 an infected vineyard will see from roughly 25% TO 50% more years of positive annual net returns relative to taking no action. The lower end of that range falls slight when adoption occurs in year 5. When adoption occurs in year 10 we may see as little as one additional year of positive annual net returns.

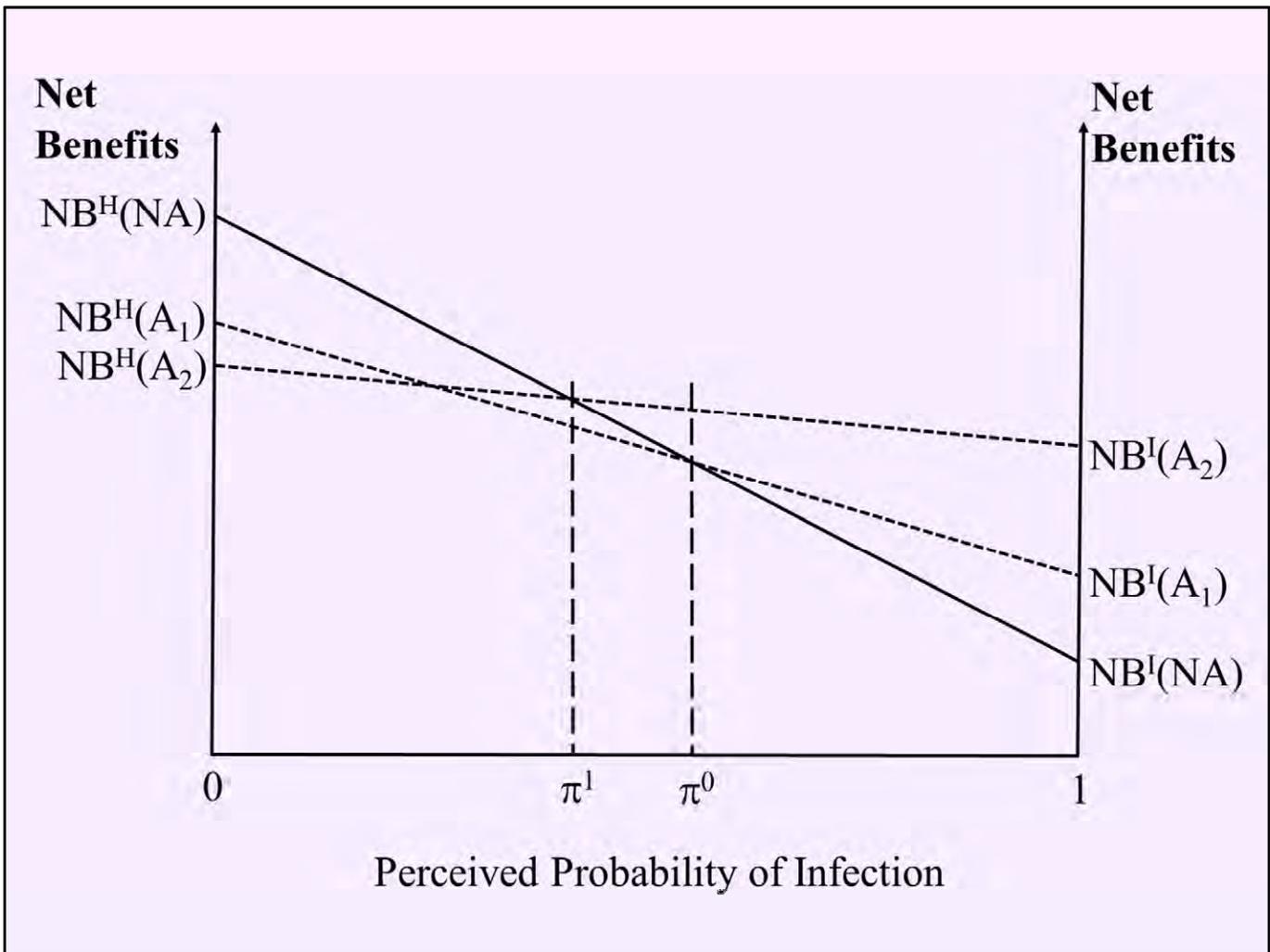
## Age Practice Outperforms No Action

Practice scenario	25% DCE			50% DCE			75% DCE		
	Year 3	Year 5	Year 10	Year 3	Year 5	Year 10	Year 3	Year 5	Year 10
<b>Napa</b>									
Topsin	6	6	10	5	5	10	4	5	10
Double Pruning	10	9	11	9	8	10	8	8	10
<b>No. San Joaquin</b>									
Topsin	9	9	10	8	8	10	7	7	10
Double Pruning	11	11	12	10	10	11	10	10	10
<b>Central Coast</b>									
Topsin	9	9	10	8	8	10	8	8	10
Double Pruning	11	11	12	10	10	11	10	9	10
<b>Northern California</b>									
Topsin	7	7	10	6	6	10	6	6	10
Double Pruning	10	10	11	10	9	10	9	9	10
<b>Sonoma</b>									
Topsin	7	7	10	6	6	10	6	6	10
Double Pruning	10	10	11	9	9	10	9	9	10

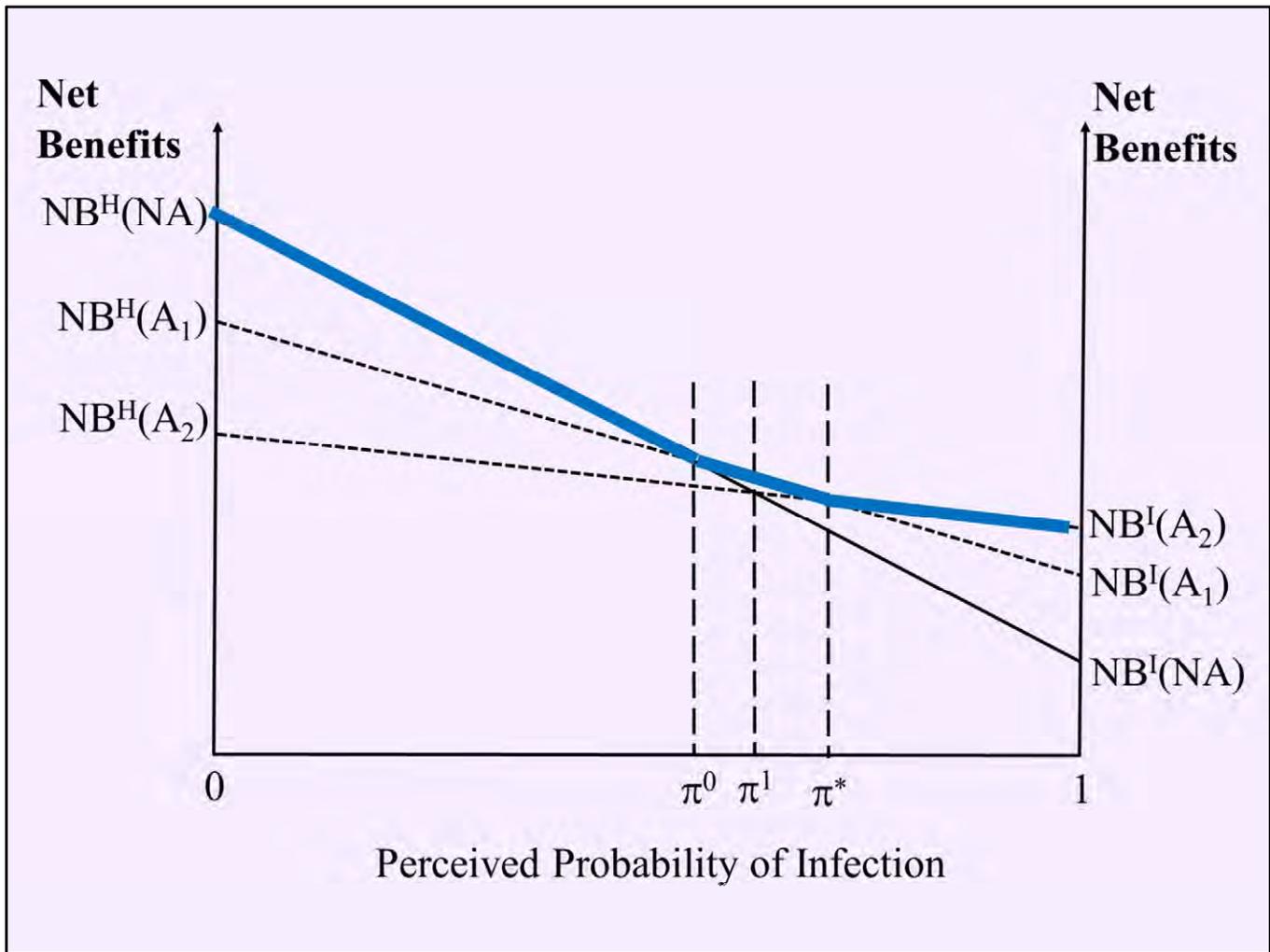
Here we see how long it takes for practices to outperform no action in terms of cumulative net returns. The table shows the age when an infected vineyard that adopts the practice outperforms an infected-untreated vineyard. Practices adopted in year 3 and year 5 may take many years to outperform no action. This is due to the long time lag in the growth of trunk diseases. By year 10 the disease is widespread and practices pay off quickly.



Here we model the adoption decision in terms of the perceived probability of infection. The two intersection lines represent expected net benefits over the vineyard's lifespan with adoption (A<sub>1</sub>) and without (NA). The H and I superscripts denote a healthy and an infected state of the vineyard, respectively. Where they intersect indicates the probability that separates growers into non-adopters and adopters (going from left to right). We consider how this probability changes with changes in age of adoption, practice cost, disease control efficacy, and discount rate. Age of adoption and discount rate resulted in ambiguous changes in the probability, while increases in c and decreases in disease control efficacy increase this probability.



When we adopt sooner we may see a leftward shift in the probability



Or a rightward shift. It will depend on whether the expected increase in the cost of earlier adoption when the vineyard is healthy is offset by the expected increase in benefits when the vineyard is infected. We find evidence for both situations in the simulation analysis presented in the following table.

Practice scenario	25% DCE			50% DCE			75% DCE		
	Year 3	Year 5	Year 10	Year 3	Year 5	Year 10	Year 3	Year 5	Year 10
<b>Napa</b>									
Topsin	0.024	0.026	0.043	0.010	0.010	0.016	0.007	<b>0.007</b>	0.008
Double Pruning	0.159	0.173	0.285	0.065	0.068	0.104	0.048	<b>0.044</b>	0.051
<b>No. San Joaquin</b>									
Topsin	0.106	0.115	0.190	0.043	0.045	0.069	0.032	<b>0.030</b>	0.034
Double Pruning	0.326	0.355	0.585	0.133	0.139	0.214	0.098	<b>0.091</b>	0.105
<b>Central Coast</b>									
Topsin	0.134	0.146	0.240	0.054	0.057	0.088	0.040	<b>0.037</b>	0.043
Double Pruning	0.306	0.333	0.549	0.125	0.130	0.201	0.092	<b>0.086</b>	0.099
<b>No. California</b>									
Topsin	0.047	0.051	0.084	0.019	0.020	0.031	0.014	<b>0.013</b>	0.015
Double Pruning	0.234	0.255	0.421	0.095	0.100	0.154	0.071	<b>0.066</b>	0.076
<b>Sonoma</b>									
Topsin	0.049	0.053	0.088	0.020	0.021	0.032	0.015	<b>0.014</b>	0.016
Double Pruning	0.221	0.240	0.396	0.090	0.094	0.145	0.066	<b>0.062</b>	0.071

This table presented the probability that separates non-adopters and adopters based on perceived probability of infection. When the practice is highly effective (75% dce), it pays for some to wait until year 5 to adopt given the expected additional cost of adopting in year 3 if the vineyard is healthy is not offset by the expected additional benefit if the vineyard is infected.

## **Development of Extension Tools**

### **Grower Survey**

- **Validate the numbers we use in our analysis**
- **Provide basis for district-level analysis**

### **On-line Management Options Tool**

- **Phase I: Portal for results for different districts**
- **Phase II: Interactive site for growers can submit costs, yields, and prices for their operation**

Our work continues with the development of extension tools to disseminate our findings. To do so, we conducted a grower survey to  
validate the numbers used in the adoption analysis  
provide data for district-level analysis

The goal is to develop an on-line trunk disease management options tool

## **Grower Survey**

**We asked questions about**

- **cultivars,**
- **annual establishment costs,**
- **annual maintenance costs in established vineyards,**
- **about annual yield,**
- **about practice costs, and**
- **about removal conditions**

## More Detailed Results

### Primary Cultivars used in Total Cash Costs

District	Cultivars
8	Cabernet Sauvignon (3), Pinot Noir
7	Chardonnay (3), Pinot Noir
4	Cabernet Sauvignon (4)
3	Chardonnay, Wine Grapes, Pinot Noir
11	Cabernet Sauvignon (2), Zinfandel
10	Zinfandel

We received information on a variety of cultivars in different crush districts. As expected Cabernet Sauvignon and Chardonnay comprise the majority.

**Reported product use and average cost of single hand-painted application of pruning wound protectant**

	topsin	b-lock	vitiseal	rally	labor	materials	overhead	Total
<b>Overall</b>	<b>0.42</b>	<b>0.58</b>	<b>0.83</b>	<b>0.08</b>	<b>\$77.75</b>	<b>\$19.27</b>	<b>\$27.60</b>	<b>\$109.22</b>
<b>District 8</b>	<b>0.33</b>	<b>1</b>	<b>0.67</b>	<b>0</b>	<b>\$59.33</b>	<b>\$14.33</b>	<b>\$3.00</b>	<b>\$74.67</b>
<b>District 4</b>	<b>0.5</b>	<b>0.5</b>	<b>1</b>	<b>0</b>	<b>\$86.25</b>	<b>\$21.75</b>	<b>\$32.50</b>	<b>\$124.25</b>
<b>District 3</b>	<b>0.33</b>	<b>0.67</b>	<b>1</b>	<b>0</b>	<b>\$76.67</b>	<b>\$20.67</b>	<b>\$20.00</b>	<b>\$110.67</b>
<b>District 10</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>\$60.00</b>	<b>\$20.00</b>		<b>\$80.00</b>
<b>District 11</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>\$120.00</b>		<b>\$57.60</b>	<b>\$177.60</b>

This table shows percentage of pruning wound applicant usage among respondents as well as costs of application.

**Reported product use and cost of single tractor application of pruning wound protectant**

	topsin	b-lock	vitiseal	rally	labor	materials	overhead	Total
<b>Overall</b>	<b>0.2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>\$24.00</b>	<b>\$14.50</b>	<b>\$12.10</b>	<b>\$50.60</b>
<b>District 8</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>\$42.50</b>	<b>\$12.50</b>	<b>\$11.50</b>	<b>\$66.50</b>
<b>District 7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>\$6.30</b>	<b>\$12.30</b>	<b>\$6.50</b>	<b>\$25.20</b>
<b>District 4</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>\$40.00</b>	<b>\$25.00</b>	<b>\$30.00</b>	<b>\$95.00</b>

Very few respondents used tractor application. Among them most used rally as the protectant.

**Reported Pruning Method (Hand = 1 Mechanical =2) and average cost of double pruning**

	<b>1st Pass Method</b>	<b>2<sup>nd</sup> Pass Method</b>	<b>1st Pass</b>	<b>2<sup>nd</sup> Pass</b>	<b>Overhead</b>	<b>Total</b>
<b>Overall</b>	<b>1.625</b>	<b>1</b>	<b>\$140</b>	<b>\$290</b>	<b>\$112</b>	<b>\$542</b>
<b>District 8</b>	<b>2</b>	<b>1</b>	<b>\$108</b>	<b>\$275</b>	<b>\$10</b>	<b>\$393</b>
<b>District 7</b>	<b>1.5</b>	<b>1</b>	<b>\$105</b>	<b>\$200</b>	<b>\$87</b>	<b>\$392</b>
<b>District 4</b>	<b>2</b>	<b>1</b>	<b>\$125</b>	<b>\$458</b>	<b>\$135</b>	<b>\$718</b>
<b>District 3</b>	<b>1</b>	<b>1</b>	<b>\$200</b>	<b>\$50</b>	<b>\$100</b>	<b>\$350</b>
<b>District 10</b>	<b>1</b>	<b>1</b>	<b>\$272</b>	<b>\$327</b>		<b>\$599</b>
<b>District 11</b>	<b>1.625</b>	<b>1</b>	<b>\$127</b>	<b>\$233</b>	<b>\$103</b>	<b>\$463</b>

This table shows the methods for each pass in a double pruning regime as well as costs for each pass and overhead.

**Percentage Loss in Yield at Time of Removal relative to Reported Healthy Mature Vineyard Yield**

	<b>n</b>	<b>average</b>
<b>Overall</b>	<b>21</b>	<b>49.89%</b>
<b>District 8</b>	<b>5</b>	<b>55.82%</b>
<b>District 7</b>	<b>4</b>	<b>55.00%</b>
<b>District 4</b>	<b>5</b>	<b>42.38%</b>
<b>District 3</b>	<b>3</b>	<b>48.75%</b>
<b>District 10</b>	<b>1</b>	<b>42.86%</b>
<b>District 11</b>	<b>3</b>	<b>47.22%</b>
<b>Cabernet Sauvignon</b>	<b>11</b>	<b>46.26%</b>
<b>Chardonnay</b>	<b>4</b>	<b>56.56%</b>

Overall, yield losses reach 50%, on average, at time of vine removal.

### Percentage of Systematic Vines at Time of Removal

	<b>n</b>	<b>average</b>
<b>Overall</b>	<b>21</b>	<b>52.00%</b>
<b>District 8</b>	<b>6</b>	<b>48.00%</b>
<b>District 7</b>	<b>3</b>	<b>45.00%</b>
<b>District 4</b>	<b>5</b>	<b>54.60%</b>
<b>District 3</b>	<b>4</b>	<b>62.50%</b>
<b>District 10</b>	<b>1</b>	<b>50.00%</b>
<b>District 11</b>	<b>2</b>	<b>47.50%</b>
<b>Cabernet Sauvignon</b>	<b>11</b>	<b>53.30%</b>
<b>Chardonnay</b>	<b>3</b>	<b>50.00%</b>

52% of vines, on average, show symptoms at time of vine removal. This result is consistent with the yield losses at time of removal.