Research in Plain English

Mitigating the Economic Impact of Grapevine Red Blotch: Optimizing Disease Management Strategies in U.S. Vineyards

Research in Plain English provides brief, non-technical summaries of journal articles by Cornell faculty, students, and staff.

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Summary by Raquel Kallas


Red Blotch on Carignane. Photo by M. Fuchs

Background. Grapevine Red Blotch Disease (GRBD) is a relatively new issue faced by growers in the U.S. The virus is known to be graft transmissible, and its effects include slowed or stalled sugar accumulation in berries (typically by 2-4 Brix) and low levels of anthocyanins, tannins, and other phenolics. There is limited preliminary information at this time that GRBD reduces yields by 3-10%. Symptoms appear as red blotches and red veins on the leaves of red grape varieties, while the leaves of white varieties will have chlorotic (yellow) blotches that sometimes become necrotic (brown and dead). However, infected vines do not always display visual symptoms. Visual diagnosis of GRBD is complicated further because it is easily confused with grapevine leafroll disease – laboratory testing of tissue samples is the only way to confirm a diagnosis.

An economic analysis of three different vineyard management strategies to address GRBD was performed. To understand the extent of the problem as it relates to the industry, 32 vineyard managers from Napa, Sonoma, Washington, and Long Island provided information on their experiences with disease incidence, disease history, sourcing of nursery stock, planting methods, and diseased fruit quality. Their responses were used as inputs in the economic model.

Note: Information on the vector and spread of GRBD was not available when this study was carried out. Therefore, all estimates are conservative in terms of negative impacts. The three cornered alfalfa tree hopper (Spissitilus festinus) has since been identified as a GRBD vector (Bahder et al. 2016). Additional research on the vector and disease ecology will hopefully provide further insight for optimizing management strategies.

Strategies and Scenarios: The three management strategies for a vineyard infected with GRBD were as follows:

1. *Do nothing*
    - Assumes that the disease will progress at a rate of 5% per year (due to limited knowledge of vector at time of publication)
2. *Rogue and replace vines*
    - Assumes that you will reduce the amount of vines diseased by 50% every year by replacing visually symptomatic vines, there will always be a 1% infection level present at best
    - Assumes $14.60 per vine replacement cost, including material and labor
3. *Total vineyard replacement*
    - Assumes costs include removal of vines, site preparation (soil amendments, vine layout, and cover crops)
    - Assumes trellising and irrigation are salvaged

The scenarios influencing which management strategy is optimal were as follows:

1. Time of disease onset
    - Year 3, 8, or 10 (assumes a 25 year vineyard lifespan)
2. Initial incidence of infection
    - 5%, 15%, 30%, or 60%
3. Price penalties for reduced quality
    - 25%, 50%, or 100%

Economic Analysis. Net present values (NPV) were calculated for all scenarios. The NPV is a function of:

- Annual yield per hectare
- Incidence of infection
- Annual cost of producing grapes
- Annual cost of managing virus
- Regional price of grapes per metric ton
- Assumption of a vineyard lifespan of 25 years

The economic impact of GRBD was then calculated as the difference between NPV of a healthy vineyard and NPV of a vineyard under one of the specified management strategies - an optimal management strategy will have minimal difference.

Note: The analysis assumed a fixed price penalty for infected grapes over the entire lifespan of the vineyard. In real life, the price penalty may increase or decrease depending on other market forces.

Grapevine red blotch disease (GRBD) control decision matrix: Optimal strategies and associated cost-savi a "no GRBD control" strategy.

Initial GRBD incidence rate	Optimal management strategy: [a,b,c] Napa County, CA			Optimal management strategy: [a,b,c] Sonoma County, CA			Optimal management strategy: [a,b,c] Eastern WA			Optim s Lo
	25% price penalty	50% price penalty	100% price penalty	25% price penalty	50% price penalty	100% price penalty	25% price penalty	50% price penalty	100% price penalty	25% price penalty
5%										
Year 3 onset	RR $3290	RR $11,774	RR $28,904	RR $1557	RR $6260	RR $15,666	DN n/a	RR $301	RR $4216	RR $505
Year 8 onset	RR $616	RR $5570	RR $15,465	RR $146	RR $2868	RR $8313	DN n/a	DN n/a	RR $1155	DN n/a
Year 10 onset	DN n/a	RR $3783	RR $11,446	DN n/a	RR $1906	RR $6895	DN n/a	DN n/a	RR $258	DN n/a
15%										
Year 3 onset	DN n/a	RR $8784	RR $28,781	DN n/a	RR $4420	RR $15,312	DN n/a	DN n/a	RR $3911	DN n/a
Year 8 onset	DN n/a	RR $3568	RPL $15,574	DN n/a	RR $1665	RPL $8256	DN n/a	DN n/a	RPL $1861	DN n/a
Year 10 onset	DN n/a	RR $1905	RPL $11,347	DN n/a	RR $1562	RR $6749	DN n/a	DN n/a	RR $145	DN n/a
30%										
Year 3 onset	DN n/a	RR $9245	RR $33,618	DN n/a	RR $4412	RR $17,773	DN n/a	RPL $134	RPL $5702	DN n/a
Year 8 onset	DN n/a	RPL $3025	RPL $20,709	DN n/a	RPL $1459	RPL $10,031	DN n/a	DN n/a	RPL $3305	DN n/a
Year 10 onset	DN n/a	RPL $3096	RPL $15,631	DN n/a	RPL $862	RPL $7749	DN n/a	DN n/a	RPL $587	DN n/a
60%										
Year 3 onset	DN n/a	RPL $10,601	RPL $44,310	DN n/a	RPL $6279	RPL $24,738	DN n/a	RPL $2002	RPL $9597	DN n/a

[a]RR: rogue and replant; RPL: replace entire vineyard; DN: do nothing (do not manage GRBD) and n/a: not applicable.
[b]Values (USD/hectare) represent the cost savings of pursuing the optimal strategy listed (RR, RPL, or DN) compared management."
[c]n/a, not applicable.

The Decision Matrix: Management strategies and cost savings compared to doing nothing about GRBD. Reproduced from Ricketts et al. 2017

A few takeaways from the Decision Matrix:

- At low (1-5%) levels of infection, roguing and replanting makes more financial sense than taking the hit from penalty costs (true for all regions except Washington, where grape prices are relatively low to being with)
- When the penalty cost is 50% or greater,the threshold for switching strategies from rouging and replacing to total vineyard replacement is at 30% initial disease incidence (regardless of the age of the vineyard)

Conclusions. The regions evaluated in this study are diverse in climate, production costs, grape varieties, and target markets – hence, the decision making matrix is needed to account for these variables. The cost of doing nothing varies widely: for example, losses can range from $2,213/ha in eastern Washington (given low initial disease incidence and a low price penalty), up to $68,548/ha in Napa (given high initial incidence and a high price penalty). Additional research on the vector of GRBD is needed to improve understanding of the spread of the disease and possible alternative management strategies. Nonetheless, this study suggests that industry and policymakers need to pay close attention to this disease and to continue making efforts to identify strategies to minimize impacts of GRBD.

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