Financial Considerations for Red Blotch Disease Management

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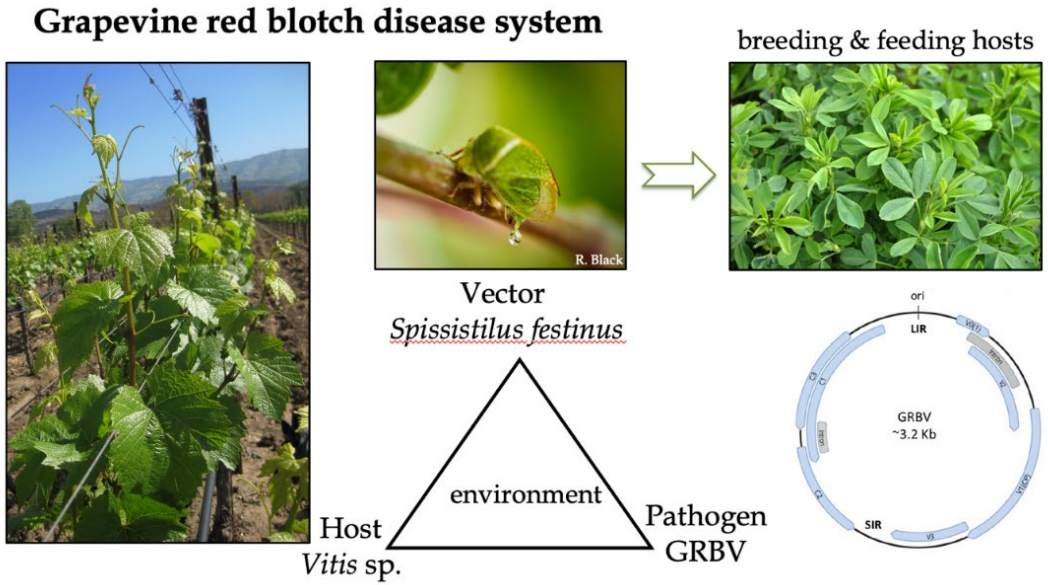
Grapevine red blotch disease (GRBD) is a consequential viral disease affecting vineyards in California. Disease management decisions are informed by various factors, including disease incidence, pattern of spread, virus latency, and vector biology. Although grounded in biology, management decisions are strongly influenced by other factors, including financial resources and farming logistics.

This decision-making aid outlines the potential financial impacts of GRBD management on annual and cumulative profit, in an attempt to provide economic context for decision-making for GRBD. It is intended to be a complement to other educational resources, including a factsheet on GRBD ecology produced by the UCCE-Napa viticulture program. It draws upon data collected in 11 commercial vineyard blocks in Napa County, from 2021-2024. These data include annual surveys of disease incidence, diagnostic testing, vector occurrence, and vector infectivity.

This decision-making aid was produced by a working group of industry and UCCE professionals, drawing upon their experience farming winegrapes and managing GRBD in Napa County. Values and assumptions described in the appendix were applied to observations of spread described in the GRBD ecology factsheet. Economic models were developed projecting potential financial outcomes given certain management scenarios. Key parameters for the models include the assumptions that *Vitis vinifera* cv. Cabernet Sauvignon is farmed conventionally, with an average sale price of $9049/ton. Models initiate with vines at peak production. The models do not account for certain costs such as vineyard management fees, nor do they account for inflation. Values reflect dollar values in 2025, at the time of writing.



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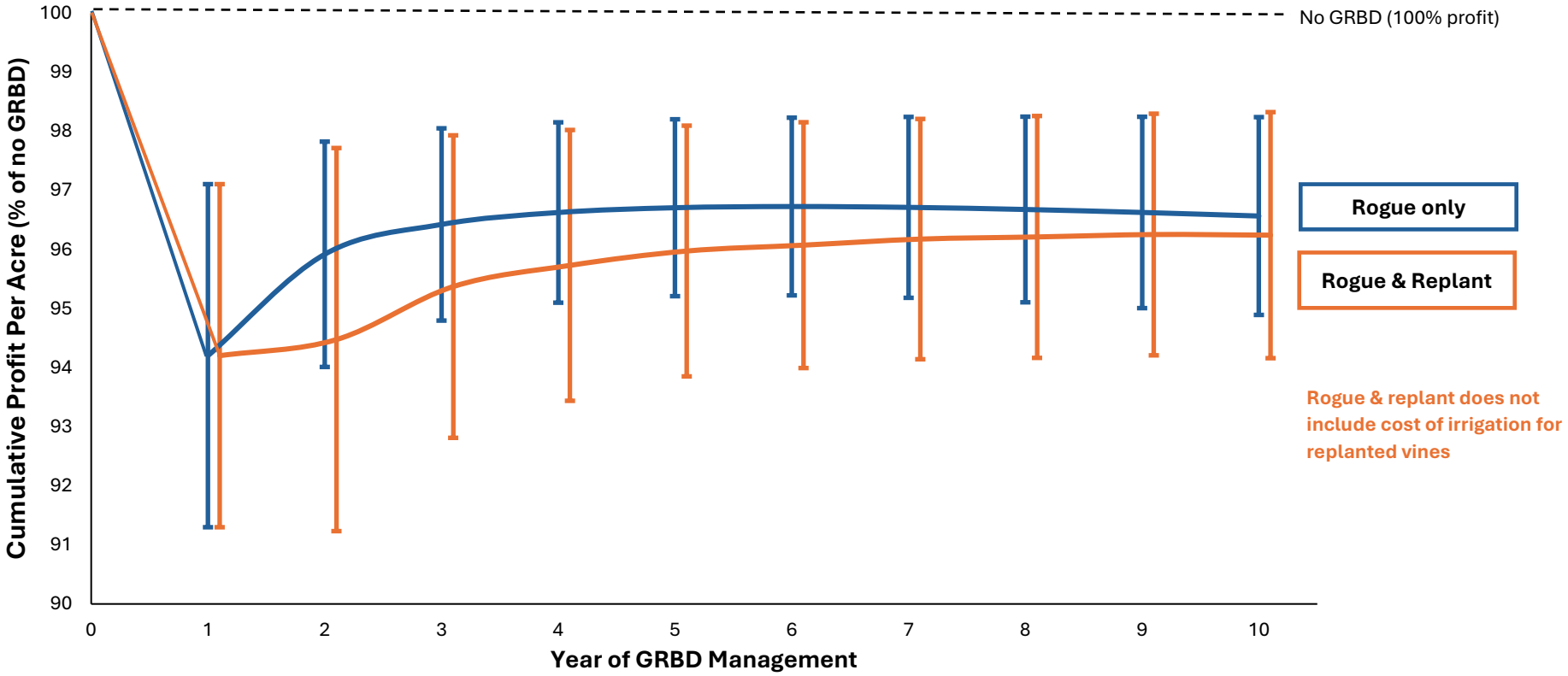
At low incidence and low disease pressure*, annual removal of symptomatic vines maintains block profitability.

Due to the low incidence, vine-by-vine roguing is more efficient without replanting missing vines.



Drawbacks of 'DO NOTHING' strategy

Low impact on income BUT high risk of spread resulting from persistent inoculum, leading to greater consequences for the block, neighborhood, and region

Mixed outcomes of 'ROGUE & REPLANT' strategy

1. Maintains quality and yield
2. Logistically challenging to coordinate replanting
3. Higher cost to implement compared to rogue-only means that cumulative profit over the next decade will be similar

Benefits of 'ROGUE ONLY' strategy

1. Maintains quality
2. Logistically easy to implement
3. Maintains profitability: cumulative losses of 3.5% - 6% over 10 years
4. Reduces inoculum pressure in block & region

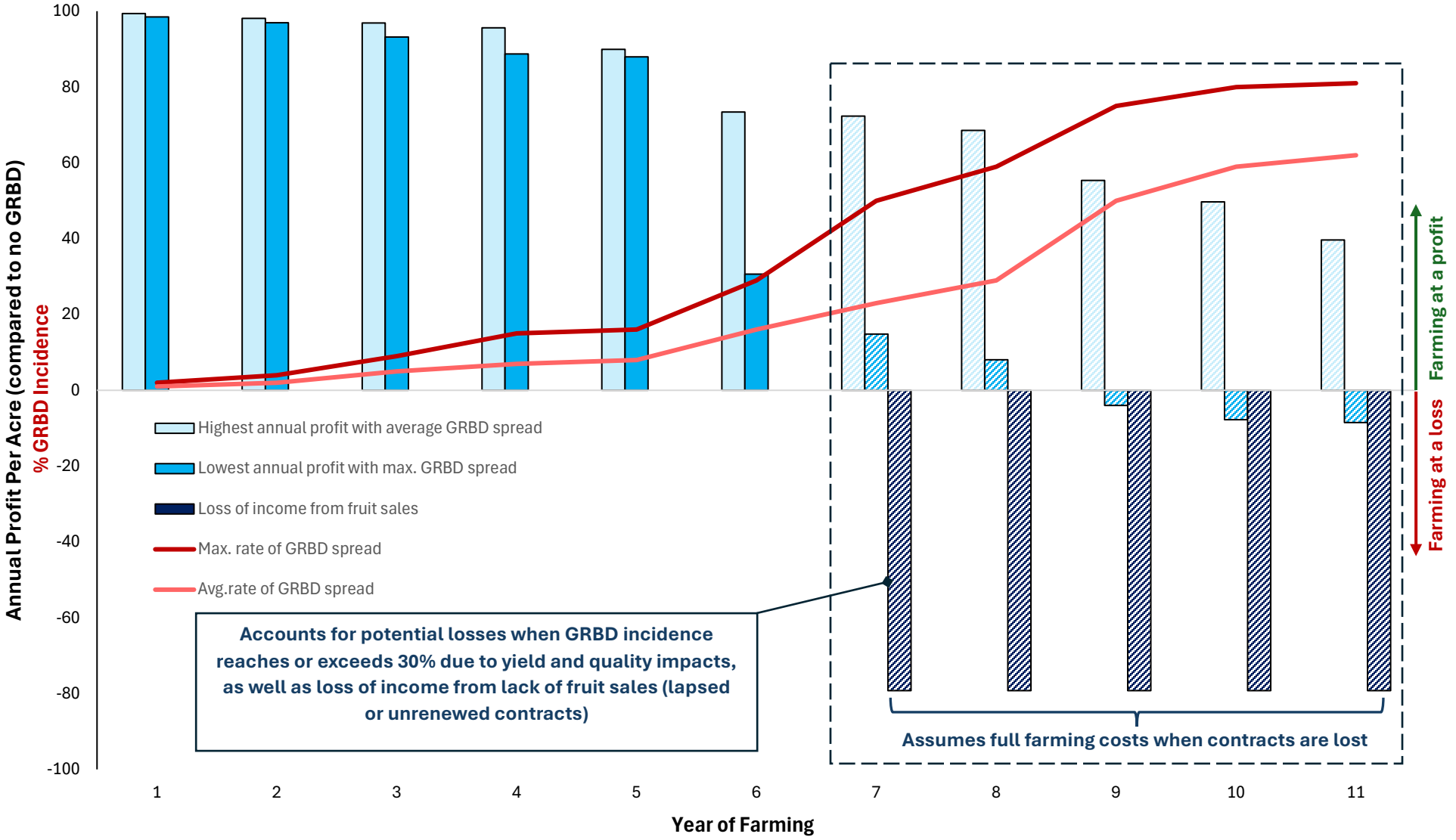
**Low disease incidence*: initial incidence of visual symptoms is <1%*

Low disease pressure: distant source of inoculum and no local clustering of diseased vines; annual reinfection rate <1%

Under conditions of high disease pressure*, annual profits decrease when GRBD is not managed.

Once disease incidence reaches 30%, there is a high likelihood of profit losses.

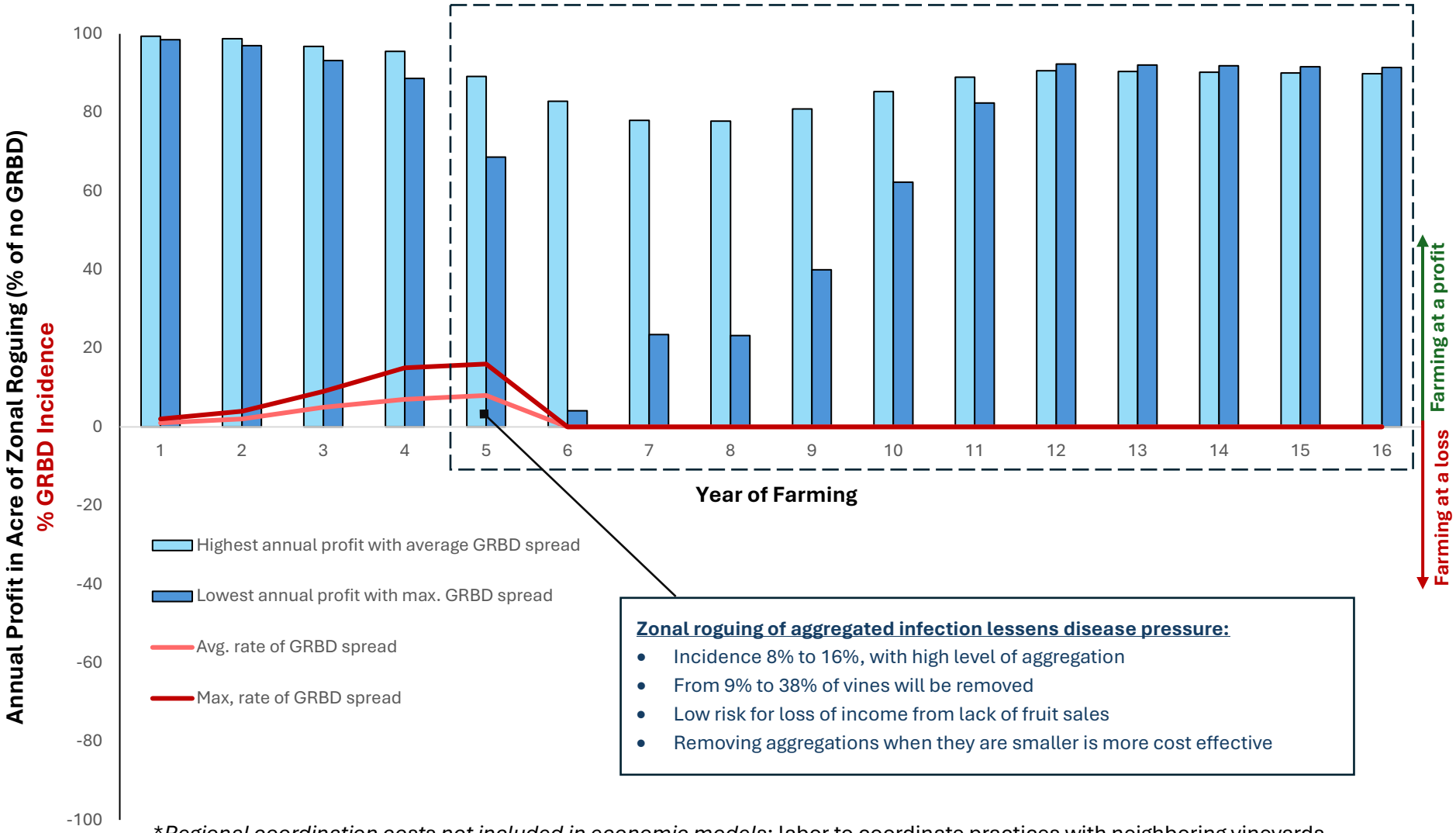
Persistent sources of inoculum increase the risk of spread and economic consequences of the disease.



**High disease pressure*: Local (or adjacent) aggregated source of inoculum drives infections progressively from 1% to >50% incidence

‘Zonal roguing’ of aggregated infections removes source of inoculum.

Blocks remain profitable and coordinated efforts* reduce regional disease pressure.

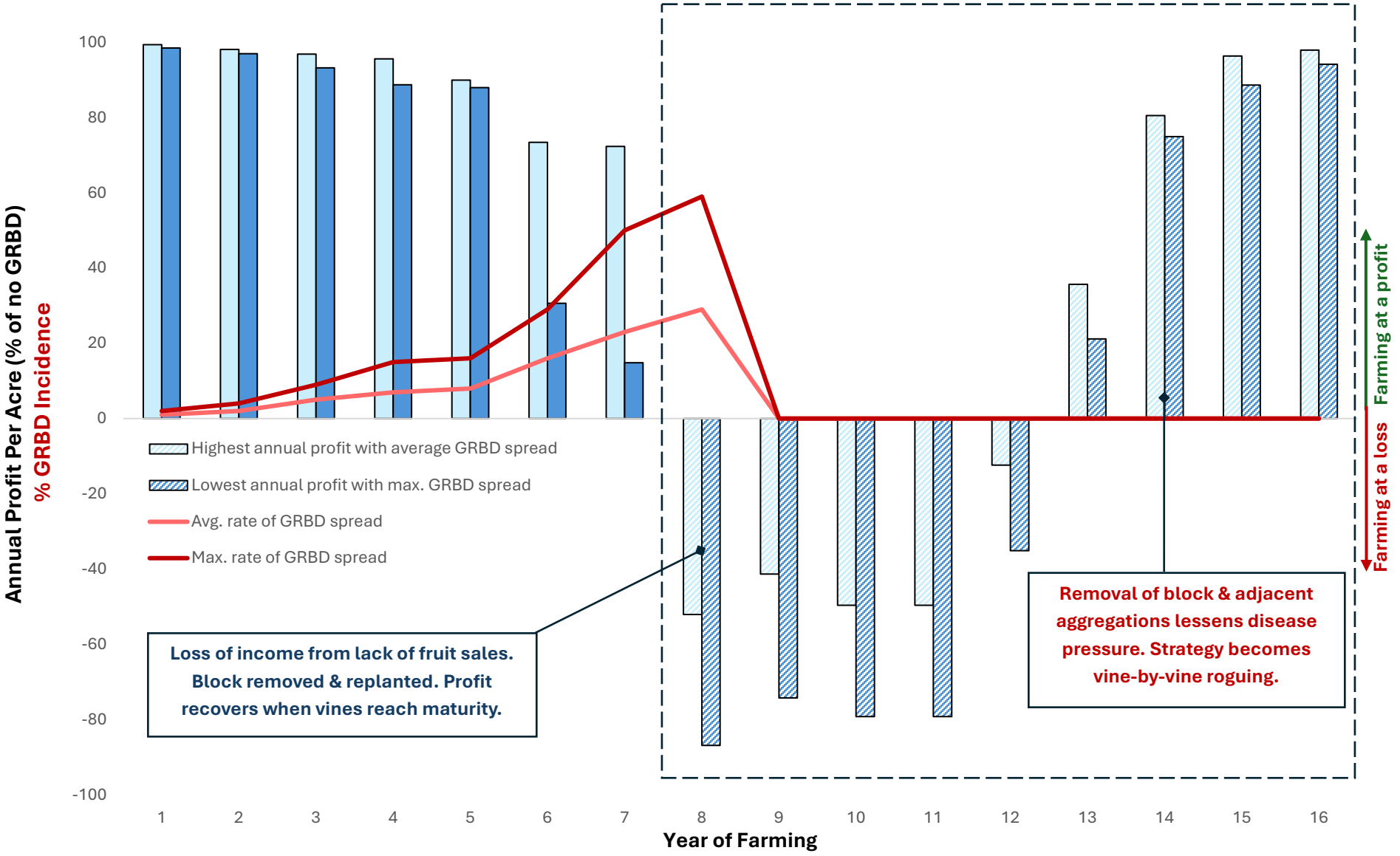


**Regional coordination costs not included in economic models*: labor to coordinate practices with neighboring vineyards.
Staff from neighboring vineyards meet independently and/or through a neighborhood group that typically meets 3 to 9 hours per year.

‘Block removal and replant’ is effective when all adjacent sources of inoculum are removed.

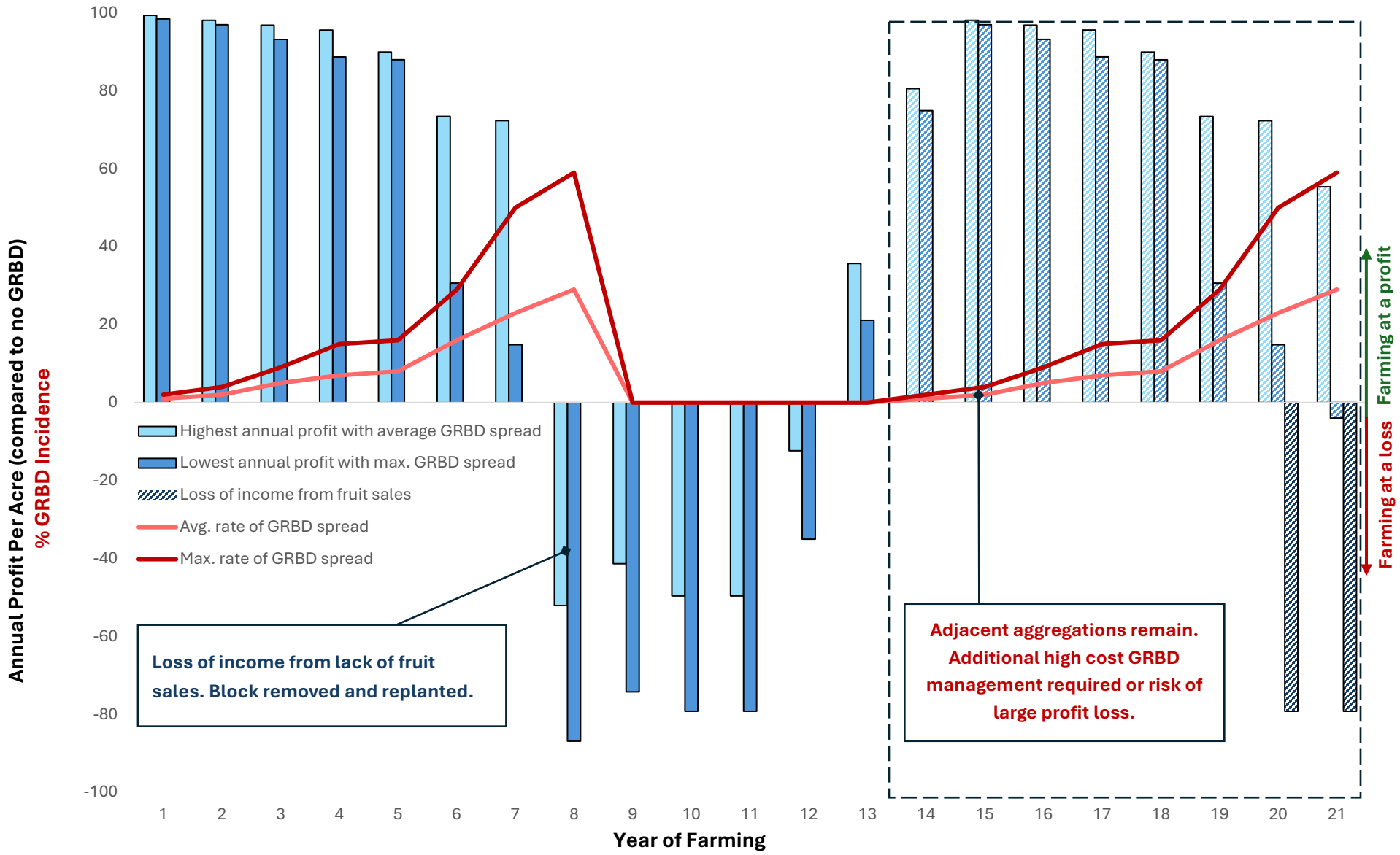
Despite a temporary loss of income, the block returns to profitability.

Coordinated efforts reduce regional disease pressure.



Effectiveness of ‘block removal and replant’ is severely reduced when adjacent sources of inoculum remain.

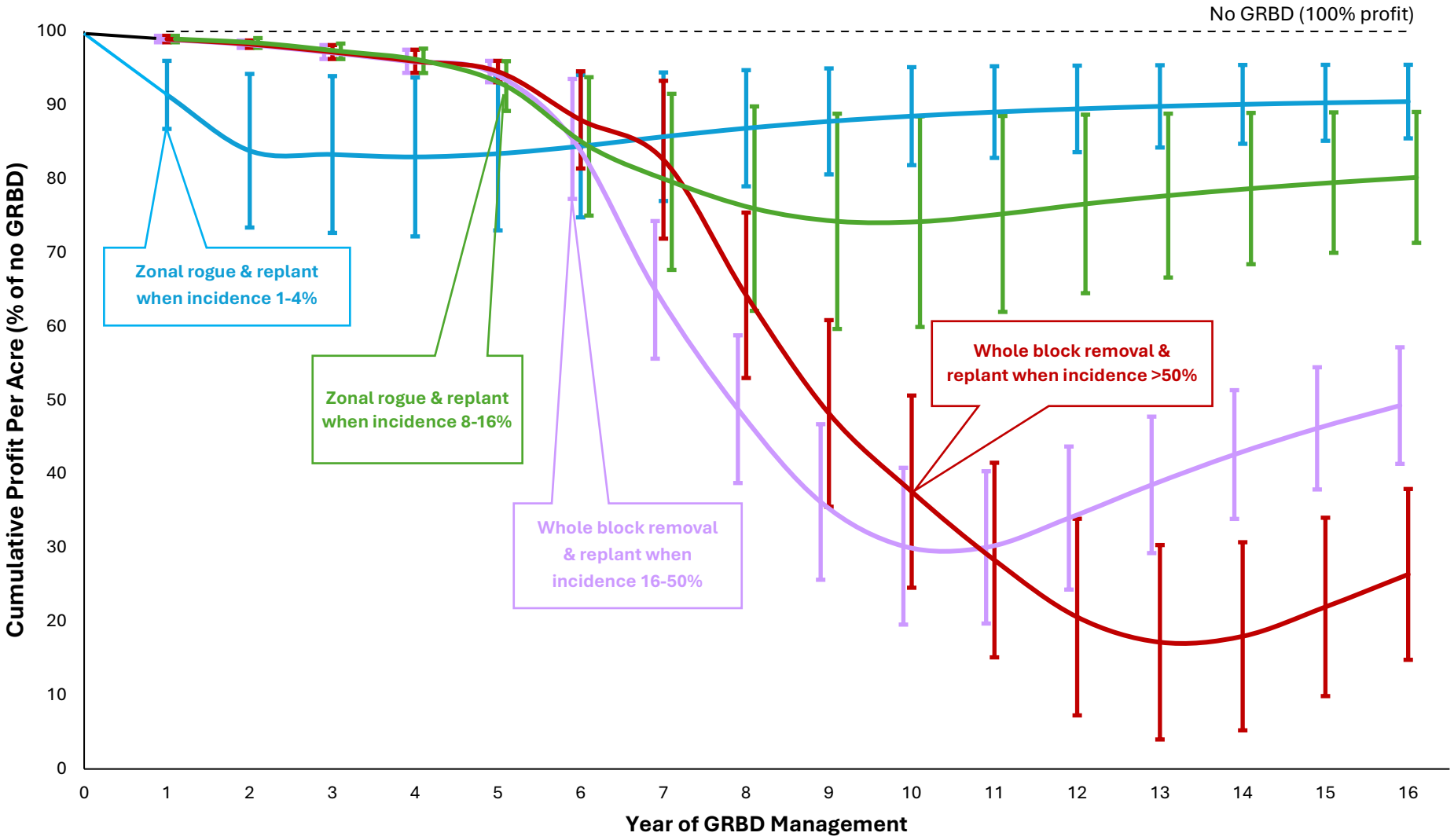
Failure of coordinated efforts has economic consequences due to heightened risk of reinfection.



Successful neighborhood coordination and early action reduce cumulative, long-term consequences and risk.

Coordinated efforts reduce regional disease pressure.

Delaying roguing in pursuit of short-term profits reduces cumulative earnings.



APPENDIX: ESTIMATED VALUES AND PARAMETERS USED

Note. Values are estimates for Napa County only.

Members of the working group:

- UCCE-Napa: Malcolm Hobbs, Sarah MacDonald, Hannah Fendell-Hummel, Jennifer Rohrs, Monica Cooper
- Napa wine grape industry: Amielia Adams, Amanda Arnold, Brianna Beighle, Chris D'Alo.

MODEL ASSUMPTIONS. The following assumptions were made for the economic modeling:

1) Modeling only considers secondary spread of GRBV. Primary infections from plant material are not considered, and replants are assumed to be free from GRBV.
2) Management strategies are effective although some, such as zonal roguing, are currently under investigation.
3) Management strategies for aggregated spread successfully return a vineyard block to a low incidence, no aggregation scenario. This assumes high neighborhood collaboration with aggregations removed in adjacent blocks. When aggregations in neighboring blocks are not removed management strategies return a vineyard block to a low incidence aggregated scenario.
4) Modeling considers a single vineyard block, specifying patterns of incidence and spread within that block. It does not directly model concurrent actions in the surrounding area that may be part of a neighborhood or regional approach to disease management.
5) Estimated rates of GRBD spread were generated using observations from 11 Napa vineyard sites. Faster or slower rates of spread may be observed.

COSTS AND DEFINITIONS. We have generated value ranges reflecting "typical" costs for farming a vineyard on the floor of the Napa Valley, while recognizing a broader range of situations exists within Napa County. Costs for individual vineyards may be higher or lower depending on their unique situation.

Significant costs NOT included are:

- Vineyard management fees (typically 40%-50% of farming costs).
- Initial costs to establish or purchase block.
- Increased irrigation frequency for replanted vines, which are typically 2-3 times higher with a second irrigation line.
- Extra costs for multiple fruit picks at harvest.
- Potential changes over time for income and costs, such as fluctuations in grape prices or inflation. Values used were retrieved in 2025 and reflect dollar values at the time of writing.

Item	Range (set as an average or minimum to maximum range)	Source (published literature, UCCE-Napa research, and proprietary sources)
SPREAD DEFINITIONS		
Low Disease Pressure	Initial visual symptom incidence <1%; no aggregation (distant source of inoculum, annual reinfection rate <1% of vines)	UCCE-Napa GRBD Progression Handout
High Disease Pressure	Local (or adjacent) aggregated source of inoculum drives infections progressively from 1% to >50% incidence	
VINEYARD CHARACTERISTICS		
Average vine density	795 vines/acre	Napa Working Group
GRAPE INCOME		
Average price for Cabernet Sauvignon	$9049/ton	California Grape Crush Preliminary Report, Feb 10 2025, CDFA
YIELD		
Vine production by vine age	1-2 years: No production 3 years: 1 ton/acre 4 years: 2.3 tons/acre 5 years: 3.5tons/acre 6 years: 4 tons/acre	Napa Working Group
Reduced tonnage for replanted vines individually rogued	Production capped at 2 tons/acre (increases scaled over vines aged 3-6 years)	
FARMING COSTS		
Basic annual conventional farming costs (not including management fee)	$12,000 to $16,000/acre	Napa Working Group & Napa Green website
Installation of 2nd irrigation line if required for replants	$1,000/acre	Napa Working Group
GRBD IMPACT COSTS		
On quality	Penalty takes effect from 20%	Ricketts et al. (2017) Am J Enol Vitic 68:1 Giradello et al. (2019) J Agric Food Chem, 67, 5496−5511 Giradello et al. (2020) Molecules, 25, 3299
	Brix lowered between 0.8-2.4 of ideal for Napa	
	-$500 per .5 Brix under desired	Napa Working Group
Loss of contracts for selling grapes	Chance of losing contracts from 30% incidence	Napa Working Group
On yield	Infected vines yield 42% lower on average	Bowen et al (2020) Am J Enol Vitic 71:4
GRBD MANAGEMENT PRACTICES		
Outsourced diagnostic assays	$455 to $1300/acre (7-20 composite samples/acre at $65 per sample for lab costs and labor). Conducted when block is	Napa Working Group

	initially assessed for GRBD and within zonally rogued secondary monitoring area. *Note, if in-house loop-mediated isothermal amplification (LAMP) is implemented instead of outsourced diagnostic assays, savings may reach 1.6% to 5.4% of profit per acre in the year vines are tested, excluding the initial investment of $3,000 to $4,000 for LAMP equipment (Rohrs et al. (2024) Am J Enol Vitic 75:0750023).*	
Catalog symptomatic vines (mapping)	$150 to $250/acre for labor. Occurs annually in scenarios where management occurs (not in 'no management' scenarios.	Napa Working Group
Vine-by-vine rogueing	$7.2/vine (20min per vine at labor rate of $21.50/hour; not including travel to site. Vine-by-vine roguing occurs annually to remove random infections.	
Replant individual vines labor	$1.5/vine (15 vines/hour at labor rate of $21.50/hour; not including travel to site)	
Replanting materials	$9 to $11/vine (rootstock $3.58; cutting $0.71 to $1.60; Bench grafted $4.70 to $5.46; carton $0.35)	
Replanting schedules & yields of replants	Replanting following vine-by-vine roguing takes place once every 2 years, the maximum yield of replanted vines is 2 tons/acre. Replanting following zonal roguing models the acre in which the aggregation is present with vines reaching a maximum yield of 4 tons/acre. Total profits will be higher if the aggregation is part of a larger area as the overall proportion of vines rogued will be lower.	
Zonal Roguing	Extrapolated from costs above to remove aggregated infections and surrounding vines	
Vineyard block removal cost	$1,500 to $5,000/acre	Wine Business article Mar 2024; Napa Working Group
Vineyard block replanting cost	$10,000 to $15,000/acre	Napa Working Group
Survival rate of vines individual rogued & replanted	90 to 100% of vines survive	
Survival rate of vines zonally rogued or whole block replanted	98.5 to 99.5% of vines survive	
Extra water costs for young vines	2 to 3 times normal rate	