Photo: M. Fuchs

# The Economics of Grapevine Leafroll Disease: Case Studies from the Finger Lakes

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Pest Management Symposium: Impacts in the Vineyard and Winery
36th ASEV-ES Annual Conference
July 12, 2011, Baltimore, MD

## Outline

- Background
- Economic impact literature
- Contribution
- Methodology

  Survey, parameters, scenarios, economic analysis
- Results and discussion
- Next steps

## Background

- Grapevine Leafroll Disease (GLD): one of the most important grapevine virus diseases
- Horticultural impact: lower vigor, yield and quality
- Disease management:
  - no control, roguing and replanting, or vineyard replacement
  - based on a variety of factors but not on economic impact
  - may not be profit-maximizing

## Literature

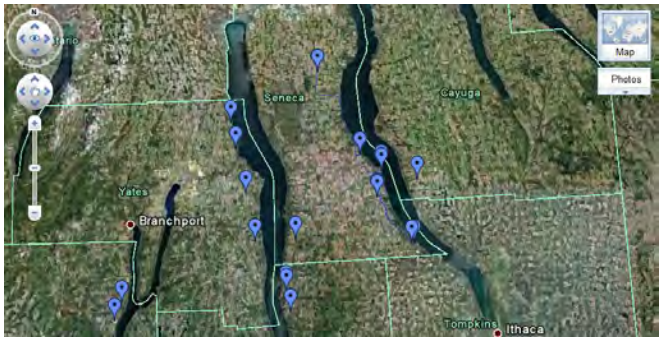
- Walker et al. (2004) in New Zealand:
  - Losses estimated at $8,600/acre by year 12, 15 and 17 (3 infection risk scenarios)
  - Replanting economically justified by year 6, 8 and 11
- Nimmo-Bell (2006):
  - Vine roguing more cost-effective than total vineyard replacement in year 6
  - It reduced the disease losses 6 to 7-fold when compared to ‘no control’

## Contribution

- Estimate profitability impact of GLD in *V. vinifera* cv. Cabernet franc in Finger Lakes vineyards of New York
- Recommend loss-minimizing management strategies for disease control under several scenarios

## Methodology

Survey of Finger Lakes vineyard managers (2009-2010)




## Methodology

- Survey of vineyard managers (2009-2010)
  - perceived ranges of GLD prevalence
  - magnitudes of yield reduction due to disease
  - disease control measures adopted
  - penalties incurred due to poor fruit quality

## Methodology

- Survey of vineyard managers (2009-2010)
- Parameters used for scenario construction
  - GLD prevalence: 1 to 60%
  - Spread of GLD by vectors: model of GLRaV-3 spread by Walker et al. (2004) and Charles et al. (2009)
    - 50% prevalence predicted in year 8 and 90% in year 12
  - Methods of GLD control: no control, roguing, vineyard replacement
  - Yield reduction: 30 and 50%
  - Fruit quality alteration: 0 and 10% price penalty

## Methodology

- Survey of vineyard managers (2009-2010)
- Parameters used for scenario construction
- Scenarios:
  (1) baseline (or no GLD infection)
  (2) no disease control
  (3) GLD prevention: virus-tested certified vines
  (4) roguing
  (5) vineyard replacement, and
  (6) late vector-mediated GLD infection

## Methodology

- Survey
- Parameters
- Scenarios
- Economic analysis:
  –Financial tool: Net Present Value per acre over 25 years
  –GLD losses: NPV(baseline)-NPV(scenario)
  –Optimal control measures: highest NPV

| Yr | Revenues | Costs | Cash flow |
|---|---|---|---|
| 0 | 0 | 6097 | (6097) |
| 1 | 0 | 10079 | (10079) |
| 2 | 0 | 839 | (839) |
| 3 | 5610 | 1526 | 4084 |
| 4 | 4488 | 3606 | 882 |
| 5 | 3927 | 2899 | 1028 |
| 6 | 3647 | 2744 | 903 |
| 7 | 3820 | 2629 | 1192 |
| 8 | 4712 | 2514 | 2199 |
| 9 | 5189 | 2514 | 2676 |
| 10 | 5436 | 2514 | 2922 |
| 11 | 5554 | 2514 | 3040 |
| 12 | 5554 | 2514 | 3040 |
| 13 | 5554 | 2514 | 3040 |
| 14 | 5554 | 2514 | 3040 |
| 15 | 5554 | 2514 | 3040 |
| 16 | 5554 | 2514 | 3040 |
| 17 | 5554 | 2514 | 3040 |
| 18 | 5554 | 2514 | 3040 |
| 19 | 5554 | 2514 | 3040 |
| 20 | 5554 | 2514 | 3040 |
| 21 | 5554 | 2514 | 3040 |
| 22 | 5554 | 2514 | 3040 |
| 23 | 5554 | 2514 | 3040 |
| 24 | 5554 | 2514 | 3040 |
| 25 | 5554 | 2514 | 3040 |
| | | NPV | 6,671 |

## Results

GLD-led losses under no control: $10,300 to $16,600/acre

| Scenarios | | Losses ($/acre) |
|---|---|---|
| 30% yield reduction | no penalty, | 10,300 |
| | 10% penalty | 10,700 |
| 50% yield reduction | no penalty, | 16,300 |
| | 10% penalty | 16,600 |

## Results

Value of planting vines derived from certified, virus-tested stocks

| Scenarios | Losses ($/acre) |
|---|---|
| Clean vines | 750 |
| Roguing | 1,300-22,700 |
| Vineyard replacement | 10,000 |
| No control | 10,300-16,600 |

## Results

Roguing or vineyard replacement?

threshold

| Roguing scenarios | 1% | 20% | 25% | 26% | 30% |
|---|---|---|---|---|---|
| Losses ($/acre) | 1,300 | 7,600 | 9,400 | 10,100 | 11,300 |

$ 10,000/acre

Vineyard replacement

Rogue when infection ≤ 25%,replace vineyard otherwise

## Results

Late vector-mediated GLD infection

| Late vector-mediated infection scenarios | Roguing impact ($/acre) |
|---|---|
| Year 12 | $3,752 |
| Year 16 | $4,748 |
| Year 20 | ($343) |

Not economical to rogue if vineyard is in its 5th year before end of lifespan

## Results

When is 'no control' optimal?
Disease management matrix

| 50% yield reduction | 10% penalty | No penalty |
|---|---|---|
| ≤ 25% infection | rogue | rogue |
| > 25% infection | replace vineyard | replace vineyard |

Same recommendation as before

## Results

When is 'no control' optimal?
Disease management matrix

| 30% yield reduction | 10% penalty | No penalty |
|---|---|---|
| ≤ 25% infection | rogue | rogue |
| > 25% infection | replace vineyard | indifferent |
| **<30% yield reduction** | | |
| ≤ 25% infection | rogue | rogue |
| > 25% infection | replace vineyard | do not control |

Not economical to control under high GLD prevalence: if low yield reduction and no price penalty

## Discussion

- Economic impact consistent with literature

| Study | GLD losses |
|---|---|
| This study (2011) | $10,300-$16,600/acre |
| Nimmo-Bell (2006) | $19,000/acre |
| Walker et al (2004) | $13,000-$20,000/acre |

- Cabernet franc in Finger Lakes: 69% prevalence →94 acres→ $1 to $1.5 million

## Discussion

- Paying a premium for 'clean' planting material is financially rewarding
- Roguing or vineyard replacement justified only if:
(1) yield reduction high enough and/or
(2) price penalty enforcement and/or
(3) vines young enough
- 25% threshold same under low and high grape price scenarios

## Next steps

- Survey prevalence of GLD and its vectors over time in order to calibrate
- Bioeconomic models of disease control
- Incorporate impacts of cooperative vs. non-cooperative disease control behavior
- Study impact at national level

**For more information:**
*Economic Impact of Grapevine Leafroll Disease on Vitis vinifera cv. Cabernet Franc in Finger Lakes Vineyards of New York*, Working Paper No. WP-2011-14, Charles H. Dyson School of Applied Economics and Management. Available at http://dyson.cornell.edu/research/wp.php

Thank you!

Questions and Answers

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