Kentville Research Development Centre

Working towards sustainable viticulture: Research at KRDC

Deb Moreau, Harrison Wright, Charlie Forney, Jun Song, Keith Fuller, Lihua Fan, Shawna MacKinnon, John Delong, Dale Hebb, and Shawkat Ali

What is sustainable viticulture?

- "Sustainable" a keyword in agriculture (some would argue a 'buzzword')
- Systems approach to managing a vineyard in a way that balances economic, environmental, and social goals.
- In recent years, climate change has become a factor.

LODI RULES FOR SUSTAINABLE WINEGROWING

- Ecosystem Management
- Vineyard Establishment and Replanting
- Viticulture
- Soil Management
- Water Management
- Pest Management
- Human Resources Management
- Shop and Yard Management
- Wine Quality and Consumer Satisfaction

References:

Schultz, 2008. https://doi.org/10.1111/j.1755-0238.2000.tb00156.x

Zambon et al., 2018. *Sustainability*, *10*(2), 320; https://doi.org/10.3390/su10020320

Ontario Viticulture Sustainability at https://www.grapegrowersofontario.com/1052

Lodi Rules for Sustainable Winegrowing at https://www.lodigrowers.com/

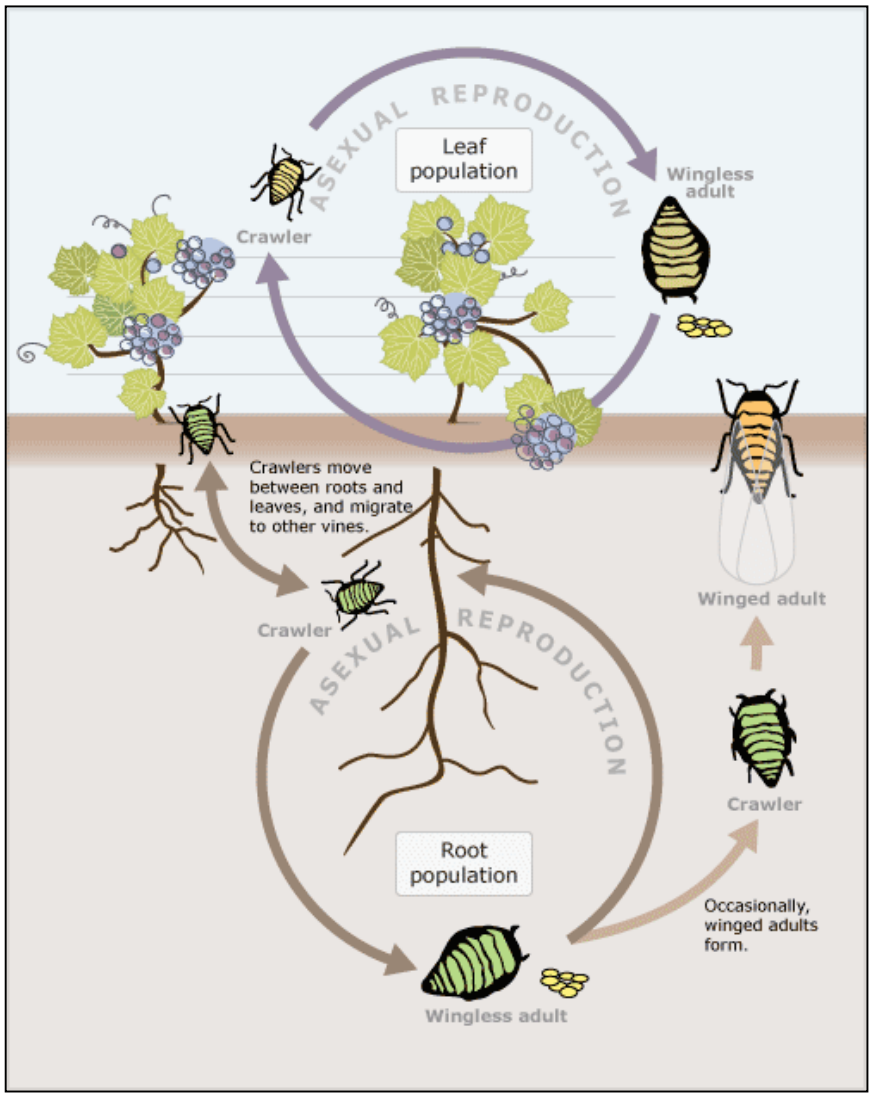
Towards sustainable pest & disease management

Research Team:

Deb Moreau, Susan Carbyn, Mark Ritchie, Deb Oxby

- Mapping and site characterization
- Understanding grapevine viruses
- Phylloxera studies
- Habitat diversification
- Climate change impacts on pests

Phylloxera Trials

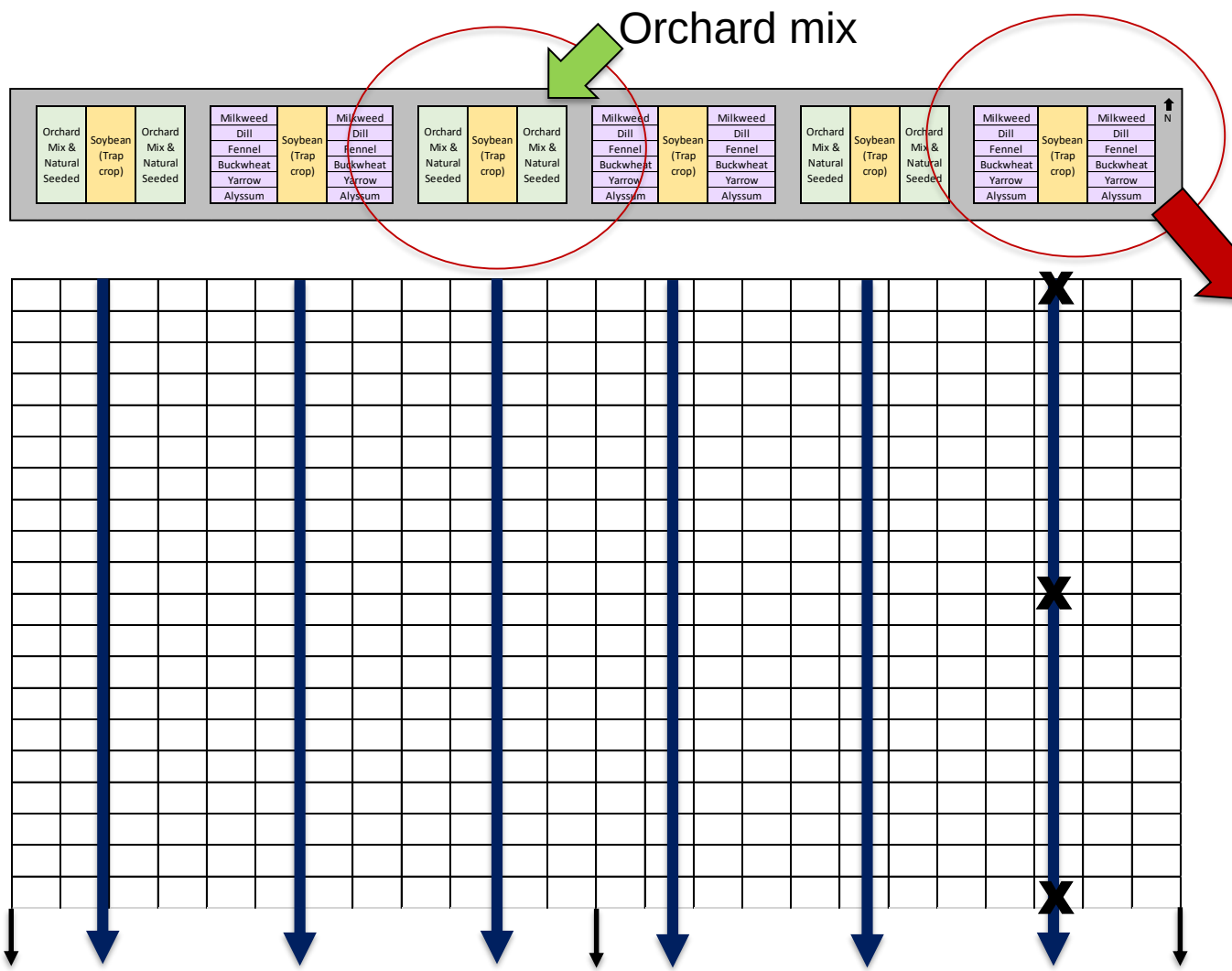


Objectives:

- Commercial study
  - Evaluate abundance over time
  - Relate to environmental factors
- Genotype-related effects
  - All NS regions
- Evaluate rootstocks
  - Greenhouse trials
  - 3309, Riparia Gloire, Gravesac, 101-14, 5C

Image used with permission from: https://ohiograpeweb.cfaes.ohio-state.edu/ipm/insects/grape-phylloxera

Habitat Diversification - Management



- Alyssum
- Yarrow
- Buckwheat
- Fennel
- Dill
- Milkweed

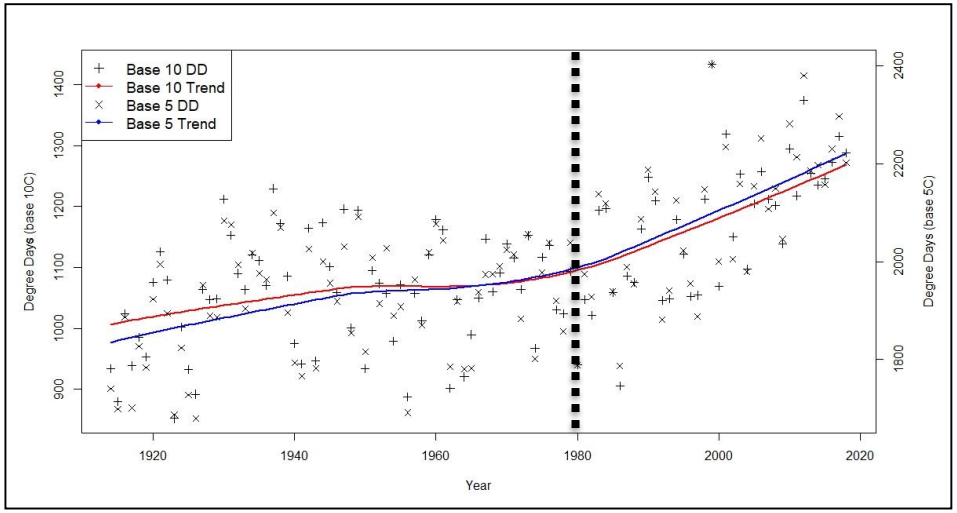
Changing climate and pests

Predicted Climate Risks to Regional Industry

- Avg. annual temps (Kentville), increased by approx. 2°C, over the past 100+ years
- Predicted increase of 1 to 2°C by 2010 to 2039 in average monthly temps during the growing season in Atlantic Canada.
- Model predicts slightly wetter springs, but drier summers by 2010 to 2039 across region.
- Maritime region could realize significant increases in GDDs by 2050
- Observed seasonal variability and frequency of extreme events (i.e., drought, frost)

Potential Risks:

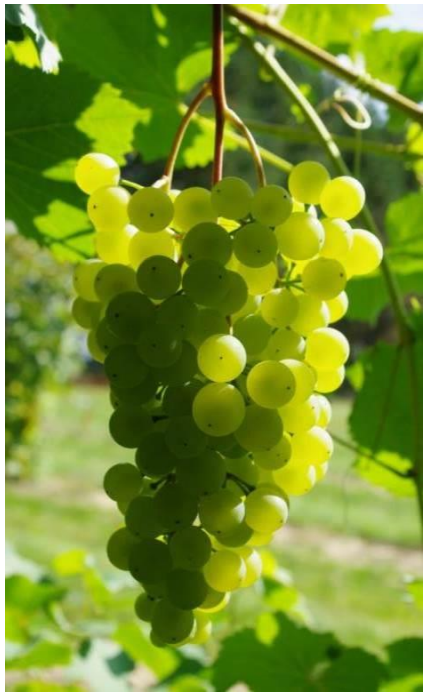
- Increased activity / greater movement
- More generations per growing season
- Reduced winter mortality
- Range expansion
- Establishment of invasive species



<u>References:</u> Temperature prediction based on The Coupled Global Climate Model (CGCM 3.1) produced by AAFC-STB.

Pest Management Strategies

- Improved IPM practices through precision ag, detection and management tools
- Close monitoring of insect and disease occurrence is critical
- Improve soil health
- Increasingly more important to assess changes in the degree /level of risk of climate change impacts
- Deterministic models need to include factors beyond temperature (pest biology, host plants, natural enemies)
- New chemistries - narrow range may demand more knowledge of pest, weed, disease



Ongoing studies at AAFC

- Vine health, hardiness, & physiology
- Soils
- Optimizing fruit maturity
- Fruit & wine chemistry
- Indigenous yeasts

Vine Health, Hardiness, & Physiology

Research Team:

Harrison Wright & Jeff Franklin

Post-frost study & Winter hardiness

Tissue culture & propagation

NSDA soil and frost project

- 'Marquette' stem necrosis trial
- Rootstock trial / repository block
- 'Chemistry sites' post-frost assessments
- KRDCV post-freeze pruning trial (LB, CH, RS, VB, PN, Mq)
- Ellslea post-freeze pruning trial (LB, CH1, CH2)

Wine and grape cluster: winter hardiness

- Bud hardiness survey
- Dormant season chemistry
- Dormant vine water relations (HPV sensors, controlled trials, water levels).
- Late hanging fruit / ice wine and bud hardiness
- Pruning timing study

Wine and grape cluster: virus

- Field-based assessment of infected vs clean virus plants.
- Controlled (from TC) infected vs clean study (hybrid focus).

Fungal endophytes II

- Identifying new endophytes from Nova Scotia and testing (identified 140 isolates).
- Trialing 3 endophytes identified by Dr. Mark Sumarah (London) in competitive assays, and on TC out-planted grapes.

Nova Scotia nematode survey

- A survey of nematode types found in Nova Scotia vineyards.

Wine grape TC / cryotherapy trials (Acadia lead)

- Wine grape TC protocol development.
- Traditionally-propagated vs TC propagation field trials.
- Cryotherapy (virus remediation) trials.

Other / aside

- Wine grapes and climate change
- Spur vs cane pruning trial (Luckett's).
- High vs low wire
- Shoot type (Primary, Secondary, Lateral) and fruitfulness in year 1 and year 2.
- Girdling study.
- Leaf removal study.
- Wine grape re-plant trials.

Soil Assessment & Vine Performance

Research Team:

Keith Fuller and Eddy St. George

- Sites for soil sampling included a subset of vine performance study locations
- Analysis of representative soil samples from each site included:
  - soil degradation index
  - particle size (texture)
  - moisture retentivity
  - internal and external drainage
  - cation exchange capacity organic carbon
  - N mineralization index
  - soil pH and fertility predetermined depths within and immediately below the principal root zone
- An index of soil health for each vineyard is also being pursued.
- Soil data to be related to site characteristics (slope, aspect, etc.)

Optimizing Fruit Maturity

Research Team:
John Delong, Dale Hebb, and Conny Bishop

- Using reflective ground covers (e.g. Extenday) to advance maturity of fruit during veraison & ripening
- Developing a non-destructive model (tool) for rapidly assessing grape berry maturity for harvest

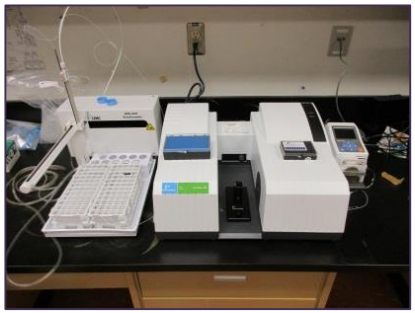
delta absorbance (DA) meter

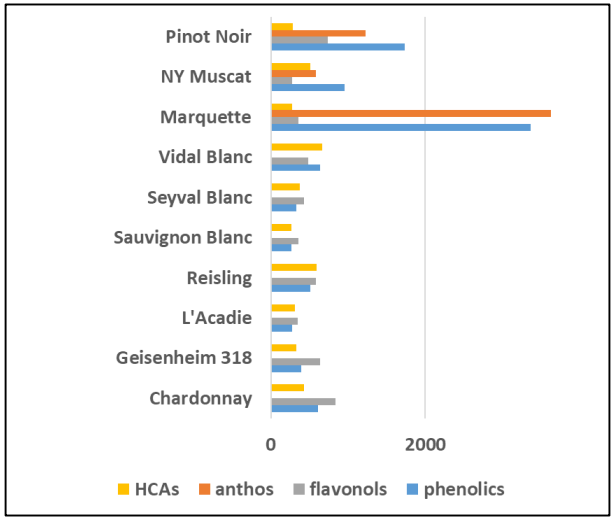
Post-harvest / Fruit & Wine Chemistry

Research Team:

Charlie Forney, Shawna MacKinnon & Jun Song
Mike Jordan, Kathleen Munro-Pennell, Mindy Vinqvist-Tymchuk, Leslie Campbell-Palmer, Ginette Pitcher, and Cherie Collins

- Effects of terroir on fruit composition & wine quality of varieties unique to NS
- Determine red fruit tannin profiles and correlate to site attributes, varietal performance, hardiness assessment, wine odour and flavour profile
- Analyse chemical composition of natural yeast and fermented wines.
- Impact of hormones and dehydrants for hardiness
- Virus effects on fruit chemistry





HPLC analysis on phenolic content of NS grapes and wines

Research Updates on Indigenous Yeasts

Research Team:
Dr. Lihua Fan (Lihua.fan@canada.ca) and Craig Doucette

- Isolation and identification of hundreds of indigenous yeast strains (belonging to 15 species);
- Characterization and selection of yeast strains through a series of tests including ethanol and SO_2 tolerance tests, β-glucosidase activity, H_2S production, and killer effect;
- Conducting lab-scale natural fermentation, and mixed fermentation using selected indigenous yeast strains;
- Chemical analysis and sensory evaluation of fermented samples;
- Research results will add new information on selected indigenous yeast strains.

Many thanks to….

Cooperating growers and winemakers collaborating in various AAFC trials

Grape Growers Association of Nova Scotia

Nova Scotia Department of Agriculture

Winery Association of Nova Scotia

AAFC Colleagues across Canada

Perennia Corporation Incorporated

Canadian Grapevine Certification Network

Cool Climate Oenology & Viticulture Institute