

Wind Machines

2007 Update on Research

The research team

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- **Helen Fisher**, U. of Guelph, Adjunct Professor Brock University
- **Ken Slingerland**, OMAFRA
- **Hugh Fraser**, OMAFRA
- Ryan Brewster, KCMS
- Lisa Hildenbrandt, KCMS
- Adam Mark – Brock 4th year Biology
- Jacqueline Stephenson – Brock 4th year Biology
- Cathy Mous
- Jenny Mous



3-Year Applied Research Project

'Evaluate grapevine & tender fruit winter hardiness & ***develop*** best environmental practices for using wind machines to reduce the effects of cold injury'

- November 2005 - 2007
- Co-sponsors
 - Grape Growers of Ontario
 - Wine Council of Ontario
- Most funds from CanAdvance
 - Agricultural Adaptation Council (AAFC)
- Additional funds from CRESTech
 - Ontario Centres of Excellence

Other Funders

- Ontario Tender Fruit Producers' Marketing Board
- Niagara Peninsula Fruit & Vegetable Growers
- KCMS Applied Research and Consulting
- Orchard-Rite WM (S. Bosc)
- Chinook WM (R. Vail)
- AGRICORP

Collaborators

- Town of NOTL
- Brock University
- Hernder Vineyards
- Funk Farms
- Weather Innovations Network
- KCMS Applied Research and Consulting



Broad Objective of Project

- Through applied field research, find the optimum timing for using wind machines so as to minimize their use, which is good for:
 - Growers, as it saves them time and money
 - Neighbours, as it reduces nuisance noise effects

Grape growers' salvation is neighbours' headache

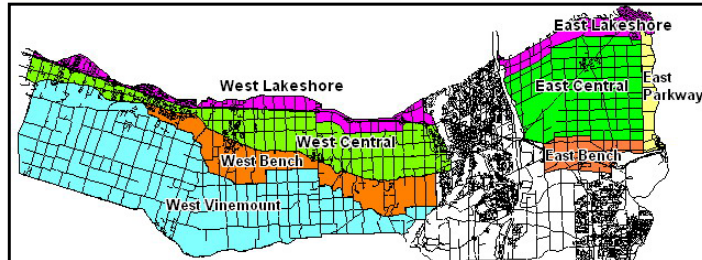
Committee seeking ways for wind machines and residents to co-exist



Bud Sampling Survey

- 20 Nov 2006 to 16 Apr 2007 (8 times)
- Follow up with live bud counts in early June
- 5 Niagara growing zones
- 28 cooperator vineyards
- 14 varieties
- With/without wind machines
- Buds checked if alive (green) or dead (black)
- Results help see if wind machines make a difference
- For bud survival rates, see www.brocku.ca/ccovi
- OMAFRA newsletters



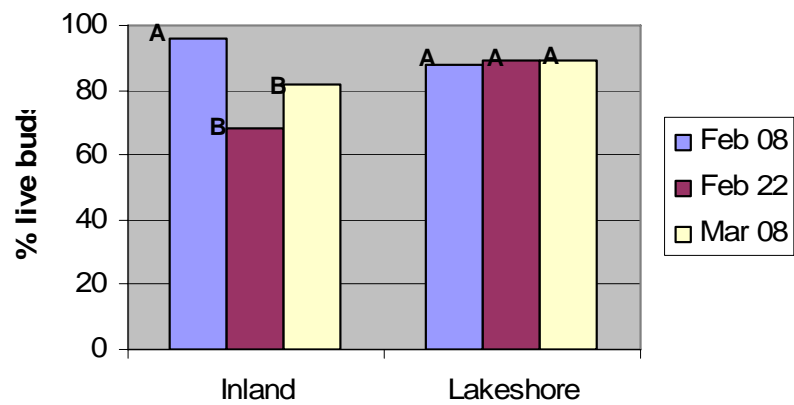
% Live Buds (Merlot) March 19, 2007

	West of Canal	East of Canal
Bench	64 – 92	80 – 99
Central	88-100	65
Lakeshore	84-85	82
Parkway	-	74-77
Vinemount	89	-

% Live Buds During Dormant Season

Variety and Location	Wind Mach	N 20	D 18	J 15	J 29	F 12	F 26	M 19
Chardonnay NOTL	Yes	99	98	97	92	81	81	74
Syrah St. Catharines	No	91	90	89	75	63	57	56
Cab. Franc Grimsby	No	98	95	100	93	72	91	80

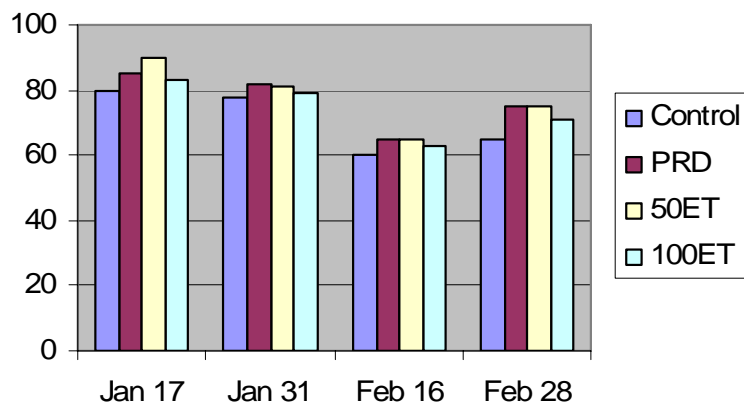
Bud Survival for Chardonnay Winter 2007



adapted from J. Stevenson, Brock University

Bud Survival for Cabernet Sauvignon Winter 2007

No significant difference at any date

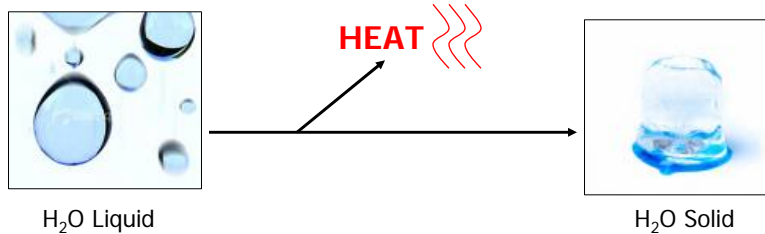


data adapted from A. Mark, Brock University

What is an Exotherm?

Definition – Amount of heat given off by a chemical reaction

- As water freezes (ice nucleation) heat is released from the system (exotherm)
- When **ice crystals form** inside buds, xylem or phloem, an **exotherm** is generated & measured with sensitive equipment

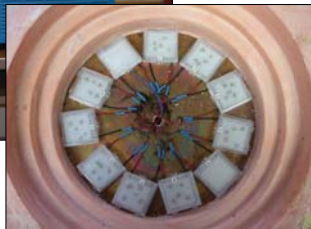


Freezer #1



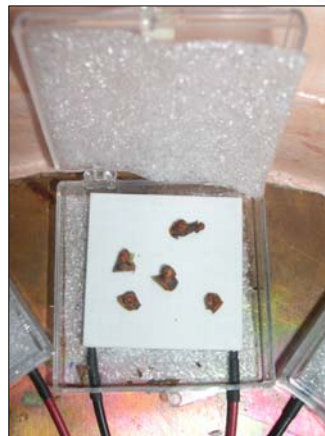
Modeled from California system (Wample)

Sample Chamber



Cooled liquid travels from chiller, through insulated tubing, into the top of the sample chamber and back to chiller

Sample Preparation

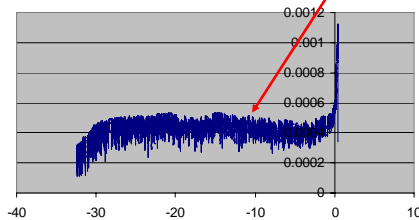
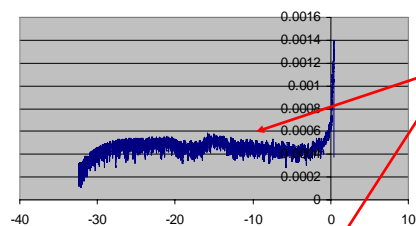


Sample Capacity

Vinifera cultivars being sampled (10)	Chardonnay, Riesling, Sauvignon Blanc, Pinot Gris, Pinot Noir, Gamay, Gewurztraminer, Cabernet Sauvignon, Cabernet Franc, Merlot
Labrusca cultivars being sampled (2)	Concord, Niagara
Hybrid cultivars being sampled (3)	Baco Noir, Foch, Vidal
# of daily samples	8 wells x 5 buds/well - 3 cultivars/day

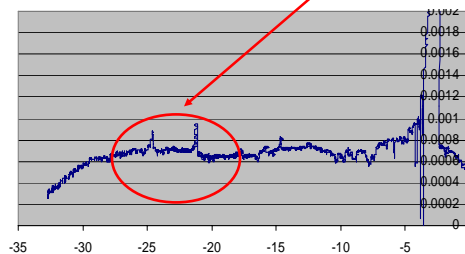
All listed cultivars are currently being sampled one time each week

Freezer #1 - Problems...



Too much
noise...

Better....



Data is still inconsistent

Require greater resolution

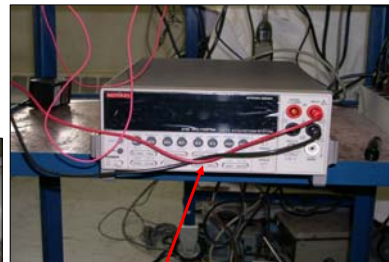
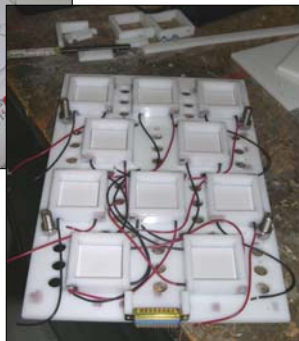
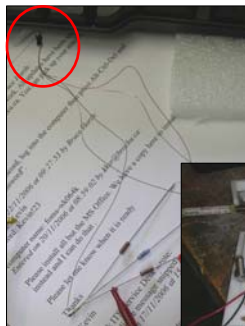
-- WORK IN PROGRESS --

Freezer #2 - Tenney Freezer Unit



Modeled from WSU system

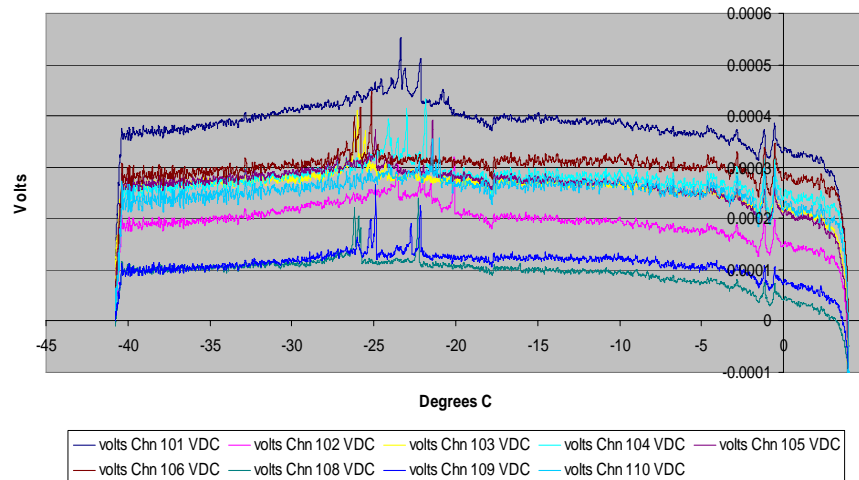
Thermistors, Trays and DAS



- 40 channel, high speed data scanning and logging system
- Scans & logs all data from freezer unit and organizes it into Excel
- 'THE BRAIN'

Data Output

Merlot – Sampled March 15, 2007



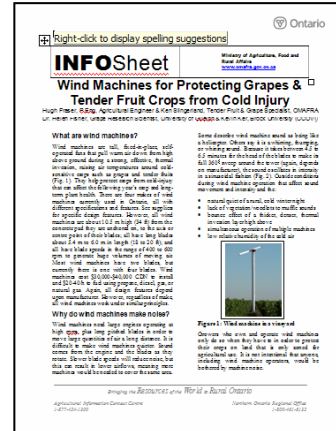
Studying sound

- Sound mainly comes from blades
 - Speed, diameter, shape
- Sound higher in homes with
 - Large rooms
 - Squarish-shape rooms
 - Large windows
 - Hard floors
 - Light construction
- More home testing planned
- **Please use extra caution with locating & operating machines near homes within influence of machine airflow (~125 m/400 ft)**



Extending Information

- > 20 presentations to 1000 people
- > 30 newspaper articles
- 3 evening information sessions for over 150 NOTL residents
- Top Q & A's put in local papers
- INFOSheet available (OMAFRA)
- Tech paper on sound study (ASABE)
- OMAFRA & Brock website info
- **Extending info continues**



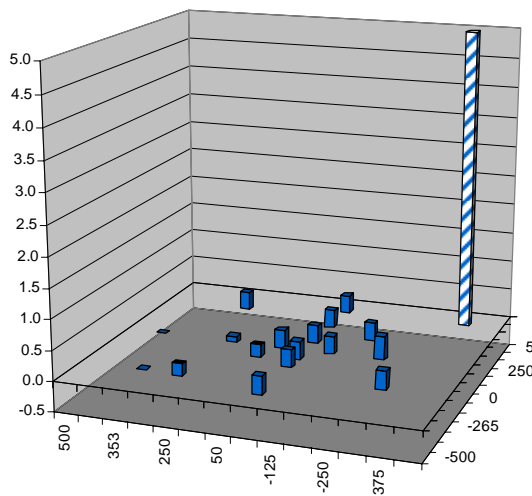
Here's the proof they work...

- Wind machine used during one of the late spring frosts early on morning of April 28, 2006
- Two graphs of temperatures
 - as machine turned on...
 - one hour after operating
- Ground temp dropped from 12°C at 5:00 pm to 0°C after midnight



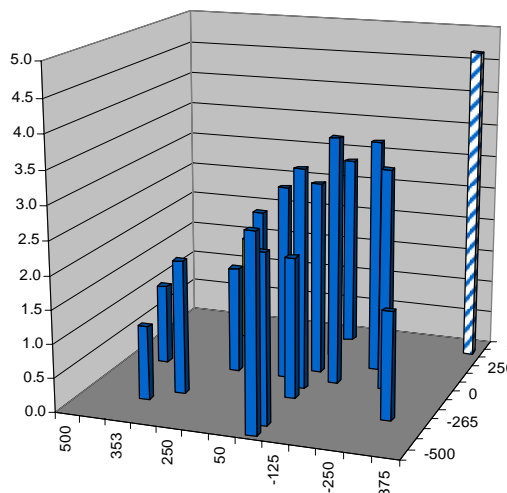
1:45 am, wind machine idling

- Vineyard 'floor' shows temp sensors at vines over about 10 acres
- Wind machine at centre
- Bars 'up' are temps at vines; -0.2°C to 0.4°C
- Dashed bar is air temp 20 m above ground, at near 5°C , so about 5°C 'thermal inversion'



2:45 am, wind machine full on

- Air temps near vines **rose to at least 3°C** , especially near wind machine in centre
- Air temp at 20 m above vineyard remained near 5°C
- Area influenced by wind machine is being studied



Finally, we've also learned that....

- There is no 'warm' air above vineyard if winds greater than ~ 7 km/h
- Thermal inversions up to 11°C have occurred
- There's a surprisingly wide range of hrs on machines out there, even in adjacent vineyards
- More localized real-time monitoring is needed as it will reduce machine use
- Machine use likely will range from 25 to 75 hours/year over time
 - Test machine ran 38 hrs, March '06 to March '07
- If our research reduces use only one 8-hour night per year, it saves growers over \$125,000/year in fuel costs & reduces complaints which is **'priceless'**

Thank you for your attention

