

Ohio Grape-Wine Electronic Newsletter

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Know Your Grape & Wine Experts

Dispatches from Kingsville

Andy Kirk, Research Specialist, Ashtabula Agricultural Research Station

From the Northeast corner of the great state of Ohio, 2.5 miles from the southern shore of Lake Erie, 'Dispatches from Kingsville' is a new periodical report which will chronicle efforts to learn the nuances of viticulture in the Lake Erie AVA.

Volume I: Frost Season in Kingsville

And you thought tax season was bad! Nothing says springtime like the thought of running the frost fan at 2am on a Saturday night. Luckily, in our local area, frost season tends not to be the months-long, caffeine-fueled helicopter ride that it is in many other grape growing regions of the world. In many parts of New Zealand, for instance, growers spend a fortune on either helicopters, frost fans, or overhead irrigation to lower their frost risk to an acceptable level. While growers in the Lake Erie and Grand River Valley AVAs are certainly not immune to frost altogether, I've been doing some investigation into what exactly makes this region less prone to damaging frosts.

From what I understood from my previous time working in the area, I was thinking that the benefits of our location, in terms of frost protection, boiled down to two main areas:

1. Delayed bud burst due to the spring cooling effect of Lake Erie
2. Northerly breezes from the lake, which decrease the likelihood of an inversion layer forming

Recently, I decided to see how these ideas stood up to the test of data from our weather station. From the digitized records of the OARDC weather system, which are freely available to the public, I was able to compile hourly readings from our weather station going back to 2001. But what good would 73,000 data points be without those from other sites for comparison? For that reason, I compiled the same data for OARDC weather stations in Wooster (*note: weather probes are at OARDC campus, not in the vineyard*) and Piketon.

The first assumption is fairly well documented and understood-even the Channel 5 meteorologists have to provide separate temperature predictions for lakeside and inland communities! Data from the weather station, to no one's surprise, supports this notion (Table 1). This year, the temperature differences have been particularly noticeable. The last OGEN newsletter had a photo of what appeared to be 1 to 2 inch shoots in Piketon, when most of our varieties here were barely to "wooly bud". Several times in my first few months here I have heard the rule of thumb that Kingsville is 2 weeks behind Wooster and a month behind Piketon.

While this is almost certainly preaching to the choir, a one month delay and bud break should hypothetically mean hardier buds in the event of a cold snap.

Table 1: Comparison of Average Springtime Temperatures
Data from OARDC weather stations, April 15-May 15 (2001-2016, 2007 excluded)

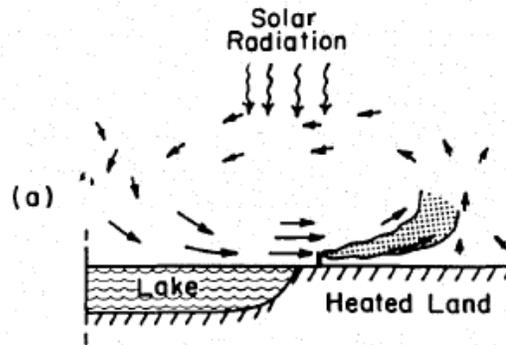
	Mean Air Temperature + Std. Error	Mean 4cm Soil Temperature + Std. Error
Kingsville	52.881 ^c ± 0.04	52.93 ^c ± 0.03
Wooster	55.522 ^b ± 0.04	55.13 ^b ± 0.02
Piketon	58.95 ^a ± 0.04	61.05 ^a ± 0.02
^{abc} Statistical Means Separation with Tukey's Method (p<0.05)		

When it comes to the second assumption I held about springtime benefits of lake proximity, it turns out I was somewhat off. I can recall stories about near-frost events in the area that were salvaged by a last second lake breeze. Collective memories such as this made it all the more perplexing when I began to analyze the night-time, frost period data from Kingsville, dating back to 2001. I found that nearly a third of the time, the prevailing winds during the night were from the Southeast. This trend registered as a significant departure from what would be expected in a situation where time of day (or night) and wind direction have no relationship. (Chi-square, p<0.05)

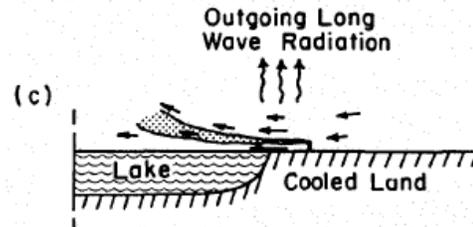
I was surprised to find this phenomenon described in several reputable sources (Kwiatowski 1987, Hewson and Olson 1967, Sills 1998). This led to a genuine light bulb moment, in which I learned the relationship, as well as difference, between a lake breeze and a land breeze. To summarize, both types of breezes are due to a temperature difference between the lake and the neighboring onshore land mass, a difference which, itself, is due to differences in how quickly water and land change temperature. On a warm spring day, the ground temperature will rise, while the lake will stay relatively cold. Warm air over the land will rise and, in essence, be replaced by the cooler lake air. Voila-you have a lake breeze! This would seem to explain the more-frequent-than-expected Noreasterly and Norwesterly winds, registered in the afternoon at Kingsville (Chi-Square, p<0.05). On the flip side, the earth cools down relatively quickly at night, compared to the lake, creating a pressure gradient in the opposite direction (Kwiatowski 1987). This fits the observed tendency for southeasterly breezes during the night at Kingsville.

Figure 1: Graphic Illustrations of Lake and Land Breeze Formation (Hewson and Olsson 1967)

Formation of a Lake Breeze



Formation of a Land Breeze



At the risk of inundating the unsuspecting OGEN reader, I have just one more climate observation to share in this edition. After a few quick glances at the data, I noticed that Kingsville tends to receive more wind at night, compared with either Wooster or Piketon (Figure 2). Hypothetically, a tendency towards breezes during the night should help prevent inversion layers from forming, and therefore radiative frost damage. In fairness to Wooster and, particularly, to Piketon, having low winds does not necessarily equate to frost risk. Likewise, a tendency towards night-time breezes is of no value in the event of an advective freeze. Furthermore, Kwitaowski (1987) makes a point to emphasize the fact that lake and land breezes are relatively minor meteorological factors in our area, compared to the air masses that dominate eastern North American weather patterns, at large. In the context of our Kingsville location, however, I find myself always on the lookout for the combination of cloudless nights, temperatures in the low to mid-30s, dew points below freezing, with low wind speeds. In these cases, a little land breeze may make a big difference.

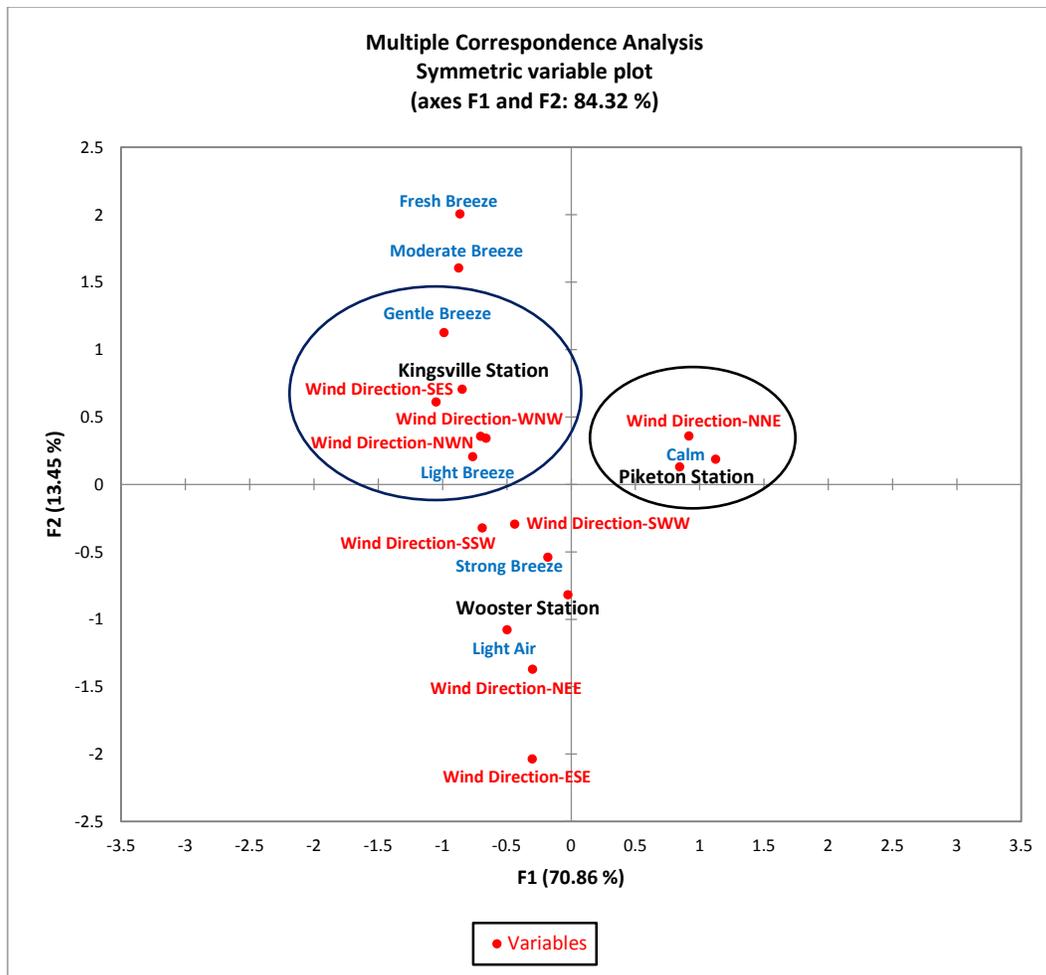


Figure 2: Night-time wind conditions during Frost Season at Kingsville, Wooster, and Piketon
Note: Multiple Correspondence Analysis is a statistical analysis which measures the interaction between categories of variables, which in this case are location, wind direction, and wind speed. Night was defined here as midnight to 6am. Wind direction here was expressed in 1/8 sections of the full 360 degree directional scale. The notation can be interpreted clockwise, meaning that “NNE” is the 1/8 section which starts at 0 degrees (directly North) and ends at 45 degrees (directly Northeast). Proximity between points in the plot map can be interpreted as an interaction, or relationship, between these categories. Note the proximity between Kingsville, as a location, and gentle, Southeasterly breezes. Likewise, Piketon exhibited a propensity to have little or no wind during the night. Wooster is harder to characterize for statistical reasons, contact me if interested!

In closing of this first volume of “Dispatches from Kingsville”, as with most investigations, I have more questions now than when I started. From here, I’d like to contact the State Climatologist, who is an OSU faculty member, to seek his input on those weather patterns that most strongly impact grape growing in Northeast Ohio. Below is a list of more general questions that have emerged out of this DIY foray into regional climatology. I’d love to hear from anyone

with thoughts as to how we can best utilize our unique climate to produce high quality wine grapes.

- How can growers maximize the benefit of the lake breeze-land breeze cycle in their site selection, planting decisions, and cultural practices?
- What wind speeds are necessary to prevent inversion layers from forming?
- How do changes in elevation interact with the lake breeze-land breeze cycle?
- How does the presence of a significant river valley, such as the Grand River Valley, affect the strength of this natural phenomenon?
- How well do moderate night-time winds correlate to frost, or lack thereof?
- How can the unique features of our climate be utilized by those involved with wine marketing?

Update: Temperatures at AARS reached a low of 35.7 degrees at 130 AM on 5/16/16. Around 1am, the westerly winds eased and shifted into a light southerly pattern. Wind speeds were steady at 3-5 mph until around 3am, when strong Westerly winds resumed.

References

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Sills, D.M.L.. 1998. Lake and land breezes in southwestern Ontario: observations, analyses and numerical modeling. PhD dissertation. York University, 338 pp. Available from the Centre for Research in Earth and Space Science, York University, 4700 Keele St., Toronto, Ontario, <Accessible at <http://www.yorku.ca/pat/research/dsills/primer.html>>

OSU Grape & Wine Research & Outreach Specialist

Please contact the following Research, Extension/Outreach Specialists, and Educators if you have any questions relating to their respective field of expertise.

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Dr. Mike Ellis, Emeritus Professor Dept. Plant Pathology 224 Selby Hall -- OARDC 1680 Madison Avenue Wooster, OH 44691	330-263-3849	E-mail: ellis.7@osu.edu *After Dec. 1 2014 Website: http://www.oardc.ohio-state.edu/fruitpathology/	Grape diseases and control. Recommendation on grape fungicides
Dr. Celeste Welty Dept. of Entomology Columbus, Ohio	614-292-2803	E-mail: welty.1@osu.edu	Fruit and vegetable Insects
Dr. Doug Doohan, Professor Dept. Horticulture & Crop Science 205 Gourley Hall – OARDC 1680 Madison Avenue Wooster, OH 44691	330-202-3593	E-mail: doohan.1@osu.edu Website: www.oardc.ohio-state.edu/weedworkshop/default.asp	Vineyard weeds and control. Recommendation on herbicides
Dr. Imed Dami, Associate Professor & Viticulture State Specialist Dept. Horticulture & Crop Science 216 Gourley Hall – OARDC 1680 Madison Avenue Wooster, OH 44691	330-263-3882	E-mail: dami.1@osu.edu Website: oardc.osu.edu/grapeweb/	Viticulture research and statewide extension & outreach programs. Recommendation on variety selection. Imed is the primary research contact of the viticulture program.

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Todd Steiner, Enology Program Manager & Outreach Specialist Dept. Horticulture & Crop Science 118 Gourley Hall – OARDC 1680 Madison Avenue Wooster, OH 44691	330-263-3881	E-mail: steiner.4@osu.edu Website: oardc.osu.edu/grapeweb/	Commercial wine production, sensory evaluation, laboratory analysis/setup and winery establishment. Todd is the primary research and extension contact of the enology program
Dr. Gary Gao , Small Fruit Specialist and Associate Professor, OSU South Centers 1864 Shyville Road, Piketon, OH 45661 OSU Campus in Columbus Room 256B, Howlett Hall, 2001 Fyffe Ct Columbus, OH 43201	740-289-2071 ext.123 Fax:740-289-4591	E-mail: gao.2@cfaes.osu.edu Website: http://southcenters.osu.edu/	Viticulture Research and Outreach, VEAP visits in southern Ohio, vineyard management practices, soil fertility and plant nutrition, fruit quality improvement, variety evaluation, table and wine grape production
Station Manager Ashtabula Agricultural Research Station 2625 South Ridge Road Kingsville, OH 44048	440-224-0273	E-mail: Website: www.oardc.ohio-state.edu/branches/branchinfo.asp?id=1	Winegrape production in Northeast Ohio, especially <i>vinifera</i> varieties

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