Drainage and Water Management for Small Scale Vineyards

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2016 Northeastern NY and VT Grape School
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Northeast Annual Precip.: +4.15"/century
(1895-2013)

Last 30 yrs:
Northeastern VT: 9"
Western VT: 7"
Southeastern VT: 5"
Direct and Obvious Impacts…

Why Vermont Crops Fail (2001-10)
Since 1988, Crop Ins. provided
$213 Bil. of Protection and Paid $15 Million
in Loss Payments to VT Farmers

- Hail, 26%
- Drought, 7%
- Frost, 2%
- Wind, 1%
- Cold Wet, 1%
- All Other, 2%

Excess Moisture, 60%

RMA, 2012
Benefits of Drainage: The Big 2

1. Improve crop production and less year-to-year variability
2. Allows earlier and later field operations

Average of 30% yield increase in corn and soybeans due to drainage over 25 years in Ohio (Reeder et al., 2011)

Sources: The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), and the National Crop Insurance Services (NCIS) program
Impacts in Vineyards

(Brown et al., 2001)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pruning(^z)</th>
<th>Avg cluster</th>
<th>Berry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live wt (lb)</td>
<td>Dead wt (lb)</td>
<td>Yield (lb/vine)</td>
</tr>
<tr>
<td>Nontile</td>
<td>1.04</td>
<td>0.07</td>
<td>37.2 a</td>
</tr>
<tr>
<td>Tile</td>
<td>1.62</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27.3 b</td>
<td>1.90 b</td>
<td></td>
</tr>
<tr>
<td>‘Chambourcin’</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nontile</td>
<td>0.53b</td>
<td>0.03 b</td>
<td>19.9</td>
</tr>
<tr>
<td>Tile</td>
<td>1.04a</td>
<td>0.07 a</td>
<td>22.3</td>
</tr>
<tr>
<td>‘Pinot Gris’</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Brown et al., 2001)
Impacts in Vineyards…

“…In Ontario, only a 1.2 ton/acre improvement in yield of Concord would pay for tile, while only 0.22 ton/acre improvement would pay for tile in higher value grapes (e.g., Chardonnay, Cabernet franc)…”

ALSO:

“…stress due to wet soils also results in excessive winter injury.”

K.H. Fisher, University of Guelph, 2013, eXtension.org
Wet years, and dry years

Does not remove plant available water
Reduce Compaction

Especially tough-to-remedy deep compaction
‘The question then is not whether one can afford to drain, but whether one can afford not to drain’ – Annual Report of the Vermont Ag Experiment Station, 1912

Plate III. Cyclone Ditcher, drawn by six horses. (Courtesy Hon. E. S. Brigham, St. Albans.)
Where is that water coming from? (and why won’t it leave me alone?!)

- Up-slope? Rising river/lake? On-site?
- True or perched water table? Compacted layer?
- Will a surface drainage approach work?
  - Fine textured soil, low permeability
  - Water originating on-site

Land Leveling

Ditching

(Source: bae.ncsu.edu)
Ag Drainage: Interceptor

- Surface water or groundwater (a.k.a. diversion drains)
- Water originating off-site in sloping terrain
Ag Drainage: Subsurface, i.e. ‘Tile’

Drainage pipes or “tile”

Flow to main or ditch

Water table

Saturated soil

(a) Parallel
(b) Herringbone
(c) Double Main
(a) Random

(Source: G. Sands, UMN)
How to determine spacing?

- NY/VT Drainage Guide
- Calculate based on soil
- Local knowledge
- Contractor’s advice
- Personal financials
  - Degree of yield loss
  - Land tenure
  - Land value
  - Economic analysis
Ag Drainage: Subsurface – Misc.

- Ensure adequate outlet!
- Depth: at least 2.5’
- Pipe material: double/single wall
- Slope: at least 0.2%
- Main pipe size
- Rodent guard
- Filter needed?
- Surface inlets?
Ag Drainage: Installation

Backhoe vs. Tile plow vs. Trencher

Maintaining grade line is critical

Timing matters
Ag Drainage – Precision Technology

**GPS – RTK**
- Sub-inch accuracy
- Fast
- Good for
  - Bigger jobs
  - Any length run
  - Large grade change
- Precise map produced
- Software supported

**Laser Transit**
- Slower
- Good for
  - Small jobs
  - Short runs
  - Limited grade change

RTK Video
Drainage: Cost? DIY?

Should I invest in drainage?

• Is drainage a problem on regular basis? Will it be in future?
• Economics very favorable for high-value crops
• Don’t forget benefit of improved trafficability on yield
• Do the worst, first.

DIY?

• Small jobs, random layouts
• For big jobs, contractors are cheap or cheaper than self-installation
• Experience and design know-how is valuable
<table>
<thead>
<tr>
<th>Description (Soil Survey)</th>
<th>Suitability for Grapes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Excessively Well Drained</strong></td>
<td>Excellent soil aeration for root growth. If too light, such soil may hold too little water unless the soil is very deep. Irrigation may be needed. The course texture (gravel or sand) soils may also have low fertility.</td>
</tr>
<tr>
<td><strong>Somewhat Excessively Drained</strong></td>
<td>Generally excellent for grapes although may be droughty and/or low in nutrients. Excellent, if irrigation is available. Such soils tend to be preferred for red varieties that do best with some water stress.</td>
</tr>
<tr>
<td><strong>Well Drained</strong></td>
<td>Good soil for grapes as it has a good balance of drainage for good aeration for root growth with adequate water and nutrient-holding capacity. Due to water holding capacity they provide plenty of water and tend to be better for white varieties.</td>
</tr>
<tr>
<td><strong>Moderately Well Drained</strong></td>
<td>Generally acceptable, but may have poor soil aeration during wet periods. Tile drainage is likely needed.</td>
</tr>
<tr>
<td><strong>Somewhat Poorly Drained</strong></td>
<td>Not recommended except with tile drainage at close spacing. Not recommended due to general soil limitations and cost of drainage.</td>
</tr>
<tr>
<td><strong>Poorly Drained</strong></td>
<td>Not acceptable for grapes.</td>
</tr>
<tr>
<td><strong>Very Poorly Drained</strong></td>
<td>Not acceptable for grapes.</td>
</tr>
</tbody>
</table>
Regulatory Issues

USDA

• Federal farm program benefits withheld from anyone who:
  • plants an agricultural commodity on a converted wetland that was converted by drainage, dredging, leveling, or any other means after December 23, 1985
  • converts a wetland for the purpose of or to make agricultural commodity production possible after November 28, 1990

EPA and USACE

• Section 404 regulates discharge of dredged or fill material in waters of US, including wetlands
  • Most routine farming activities exempt, but bringing wetlands into production may require permit

Be in touch with USDA before draining or clearing wet areas
Environmental Issues – Nutrient Loss

Ahead Of New Rules, Environmental Groups Seek To Halt New Tile Drainage System

By MELODY BODETTE • FEB 5, 2016

In-field and edge-of-field BMPs

bee.cornell.edu
# Drainage Contractors

<table>
<thead>
<tr>
<th>Location</th>
<th>Contractor</th>
<th>Phone Number</th>
<th>Services/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altona, NY</td>
<td>Steve Mahoney</td>
<td>518-569-6441</td>
<td>Very Experienced, Will travel, Small farms and diversified crops</td>
</tr>
<tr>
<td>Medina, NY</td>
<td>BCA Ag Technologies</td>
<td>802-870-0850</td>
<td><a href="http://www.bcagtech.com">www.bcagtech.com</a>, RTK, tile plow, Experience with tiling in orchards</td>
</tr>
<tr>
<td>Morrisville</td>
<td>HA Manosh</td>
<td>802-888-5722</td>
<td>GPS-guided, Will travel, On-site pricing</td>
</tr>
<tr>
<td>West Chazy, NY</td>
<td>Redline Drainage</td>
<td>518-578-2738</td>
<td>RTK, tile plow, Will travel, On-site pricing</td>
</tr>
<tr>
<td>Ferrisburgh</td>
<td>Van Wyck Bros.</td>
<td>802-870-0850</td>
<td><a href="http://www.vwdrainage.com">www.vwdrainage.com</a>, RTK, tile plow, Travel for 50 acres or many farms, $1000/acre @ 40' ($1/ft), Interested in serving fruit and veg producers</td>
</tr>
<tr>
<td>Randolph</td>
<td>Larry Pickett</td>
<td>802-685-4455</td>
<td>Backhoe installation, Travel 50 miles, On-site pricing</td>
</tr>
</tbody>
</table>