

# Drainage and Water Management for Small Scale Vineyards

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The University  
of Vermont  
EXTENSION

Image: Tom Cherveney, West-Central Tribune



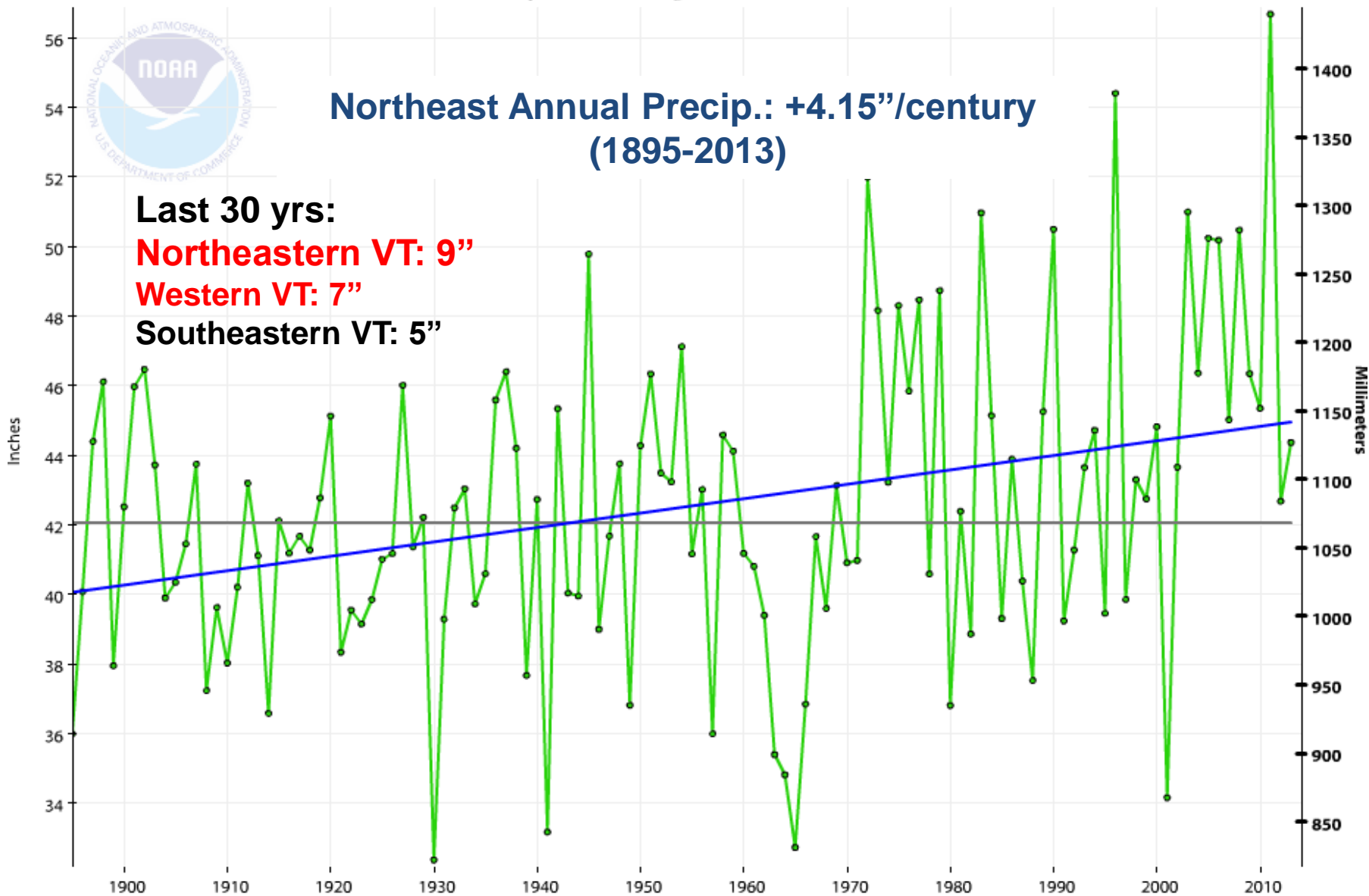
Center for  
Sustainable  
Agriculture

# Northeast, Precipitation, January-December

1895-2013 Trend +4.15"/Century      1901-2000 Avg: 42.04"      Precip

## Northeast Annual Precip.: +4.15"/century (1895-2013)

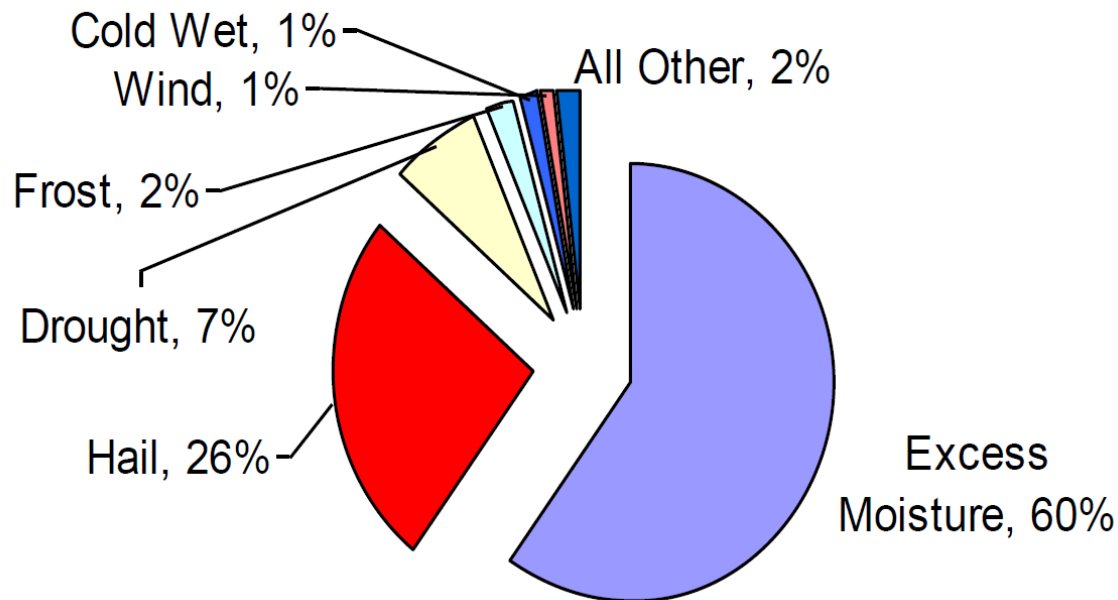
Last 30 yrs:  
**Northeastern VT: 9"**  
**Western VT: 7"**  
**Southeastern VT: 5"**



# Direct and Obvious Impacts...

## Why Vermont Crops Fail (2001-10)

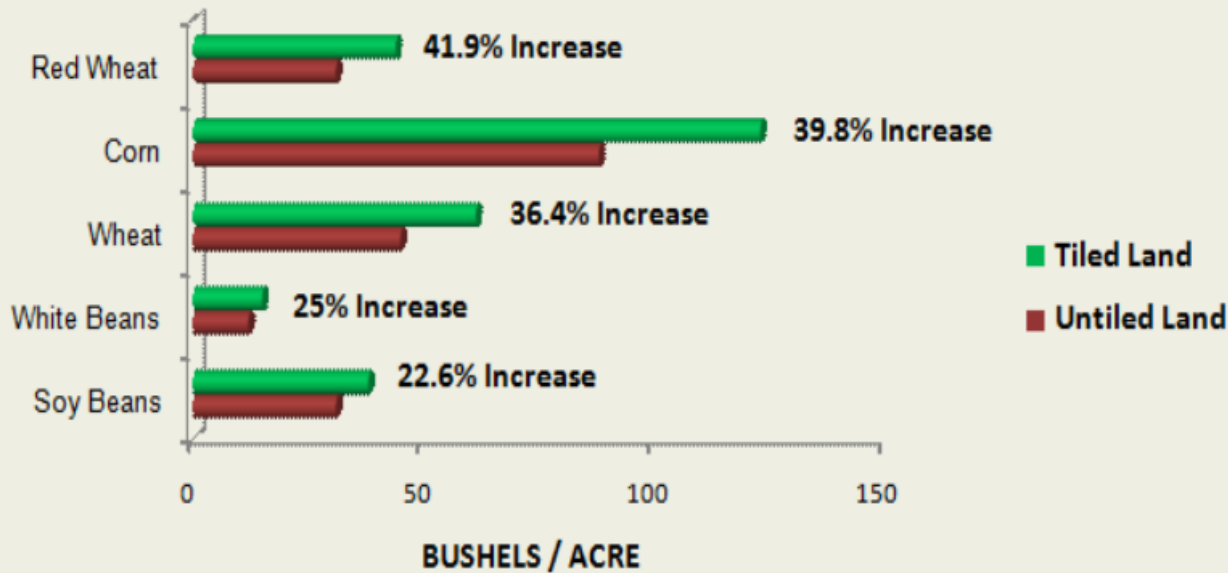
Since 1988, Crop Ins. provided  
**\$213 Bil. of Protection and Paid \$15 Million**  
in Loss Payments to VT Farmers



# Benefits of Drainage: The Big 2

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

Crop Yield Increase Measured in Bushels/Acre



*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)

Treatment	Pruning <sup>z</sup>		Avg cluster wt (lb)	Yield (lb/vine)	Berry wt (g)
	Live wt (lb)	Dead wt (lb)			
	‘Chambourcin’				
Nontile	1.04	0.07	0.37	27.3 b	1.90 b
Tile	1.62	0.10	0.42	37.2 a	2.10 a
	‘Pinot Gris’				
Nontile	0.53b	0.03 b	0.20	19.9	1.45
Tile	1.04a	0.07 a	0.20	22.3	1.50



(Brown et al., 2001)

## Impacts in Vineyards...

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**“...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:**



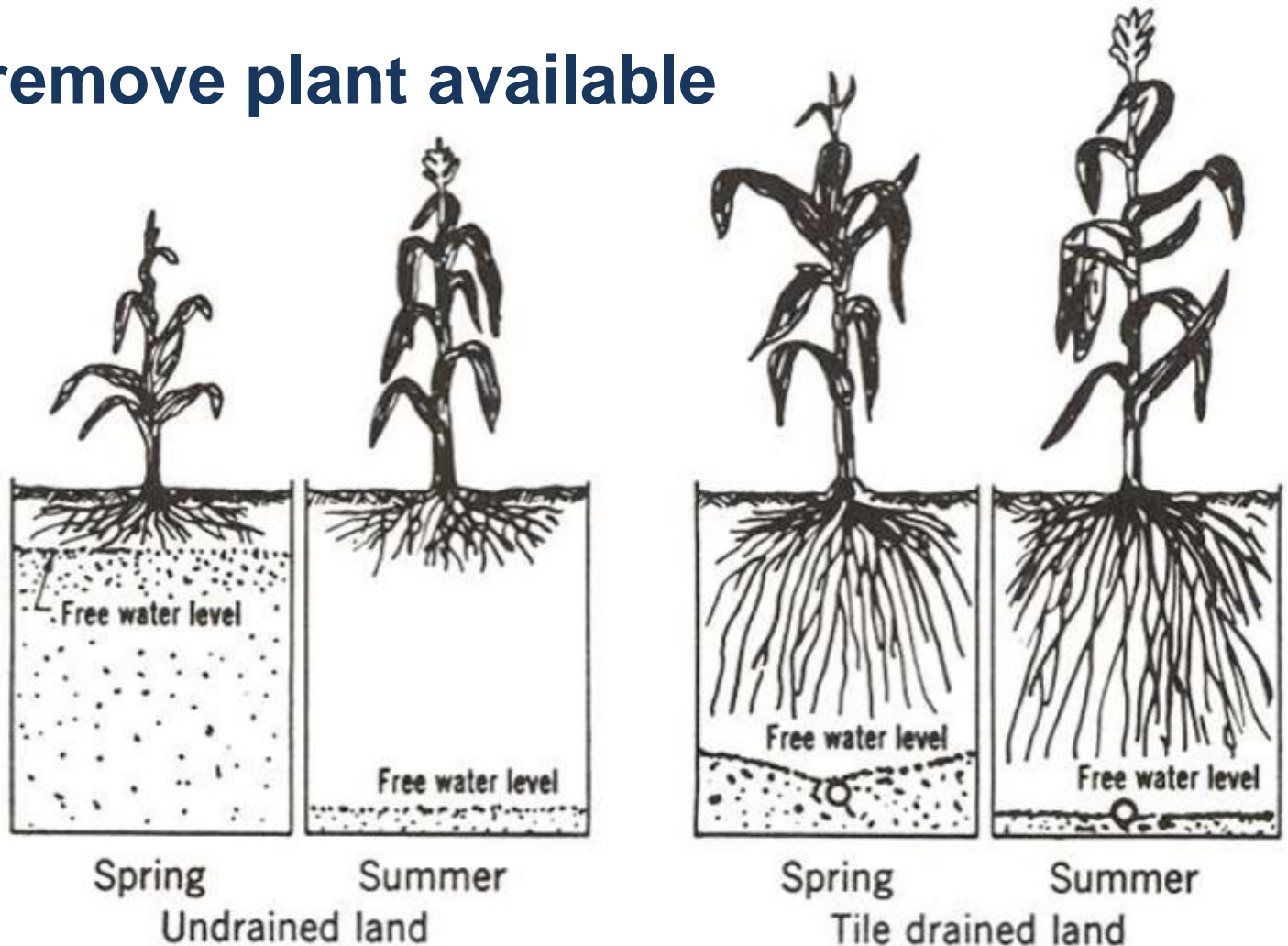
**“...stress due to wet soils also results in excessive winter injury.”**

K.H. Fisher, University of Guelph, 2013, eXtension.org

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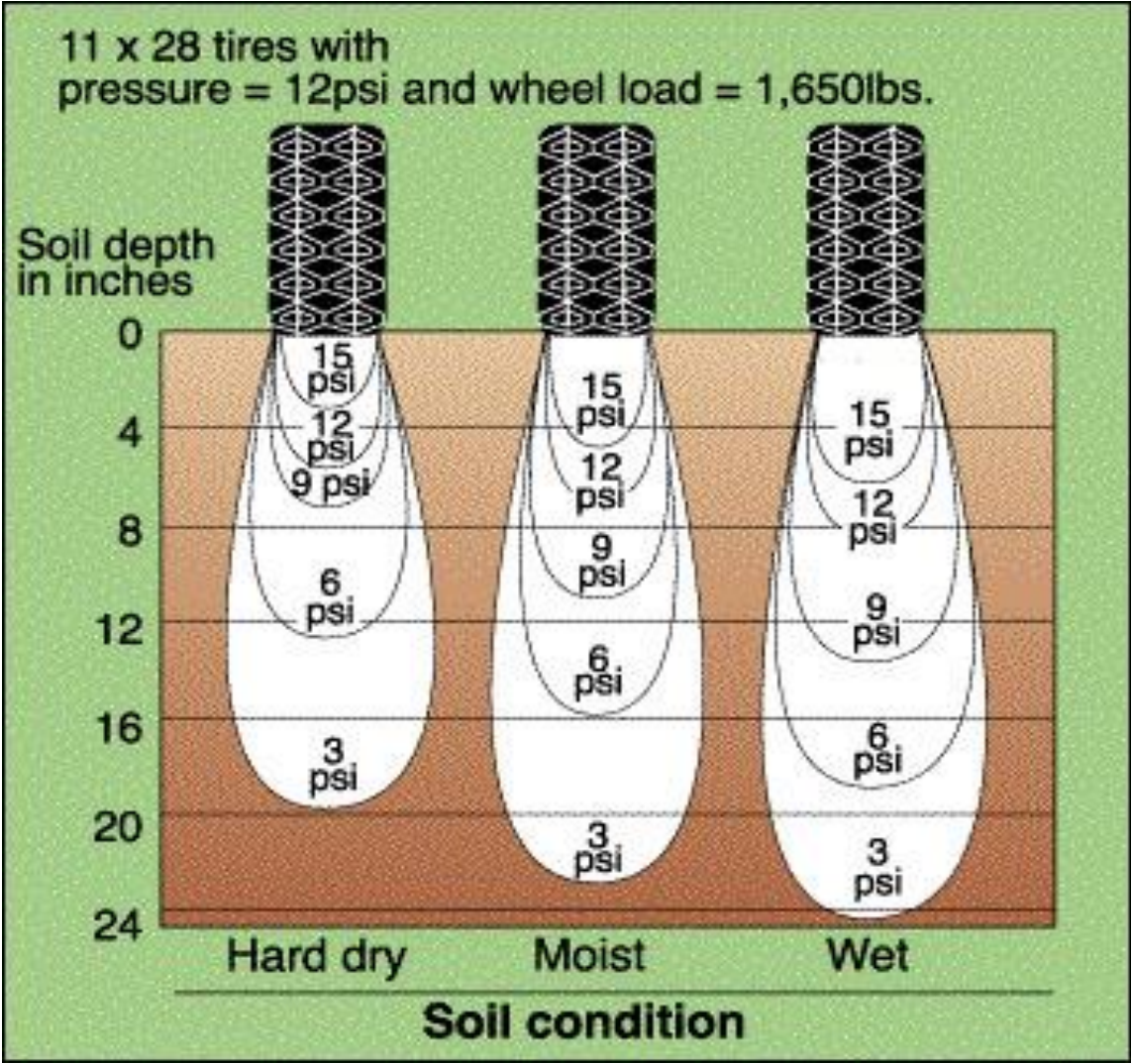
# Wet years, and dry years

Does not remove plant available water

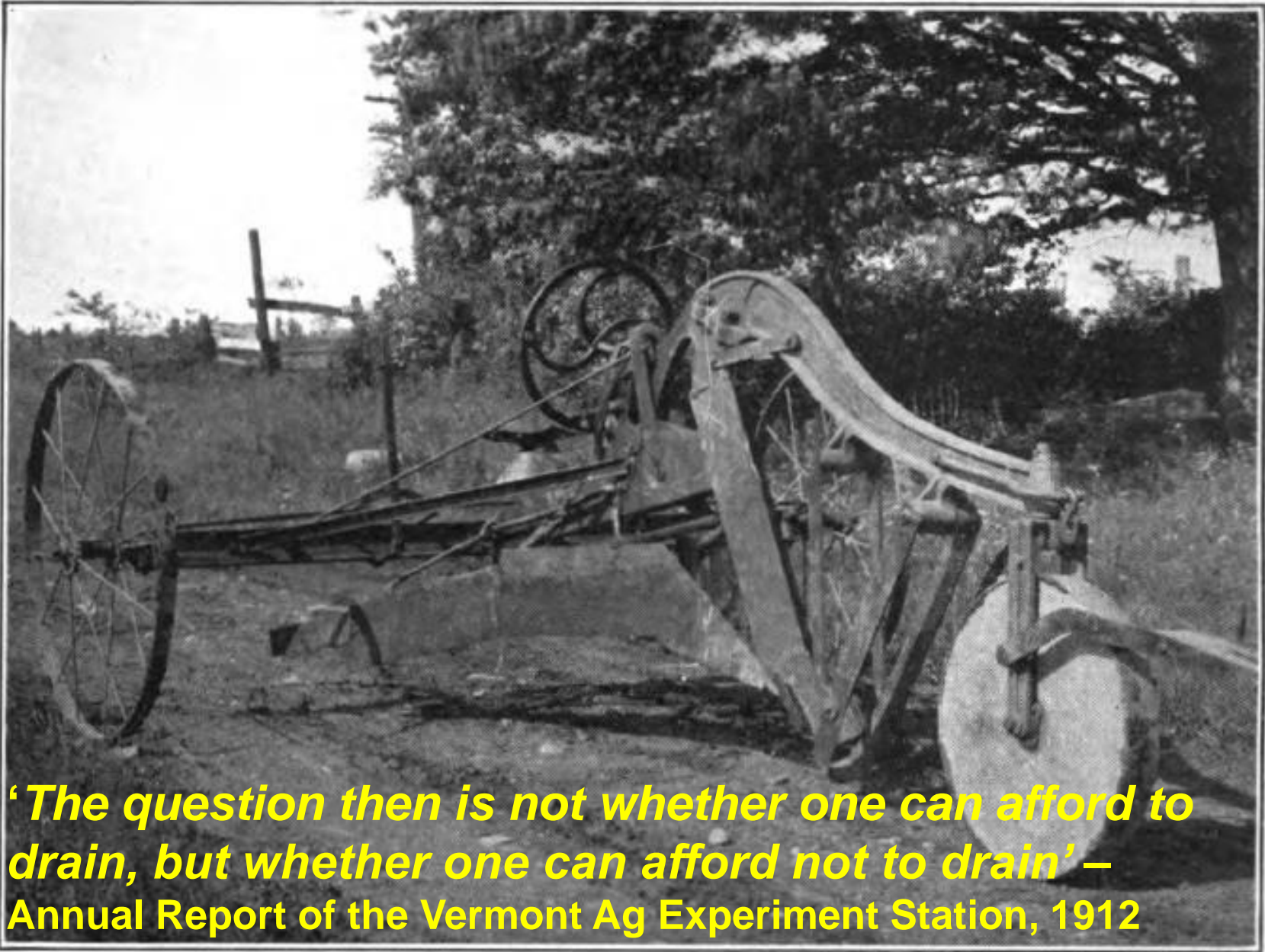


# Reduce Compaction

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**



(gpsontario.ca)

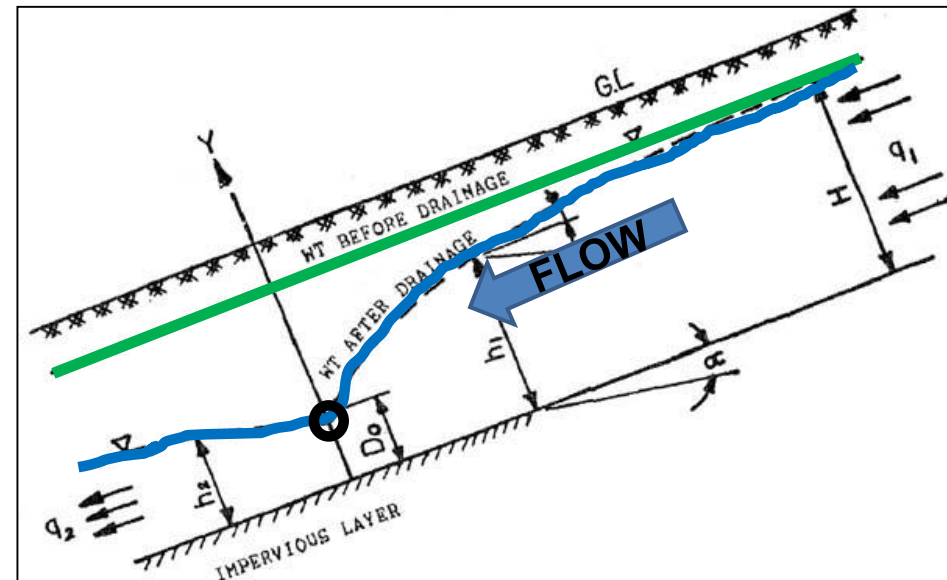
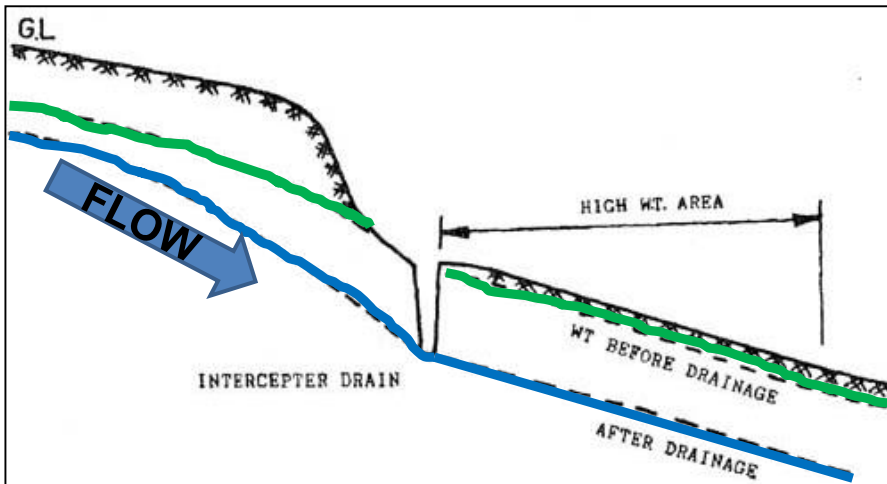
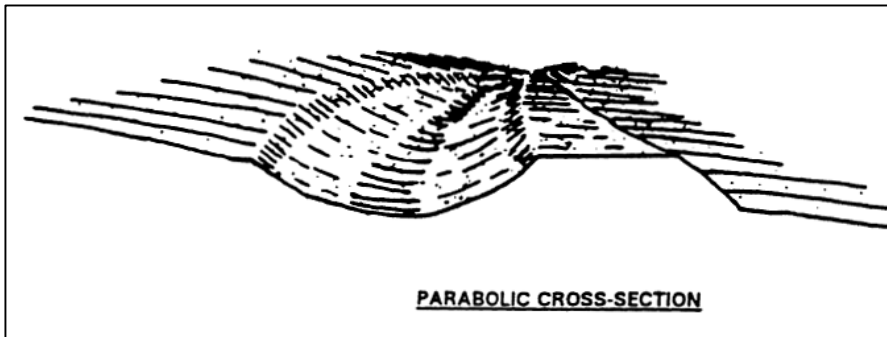
**Ditching**



(Source: bae.ncsu.edu)

# Ag Drainage: Interceptor

- Surface water or groundwater (a.k.a. diversion drains)
- Water originating off-site in sloping terrain

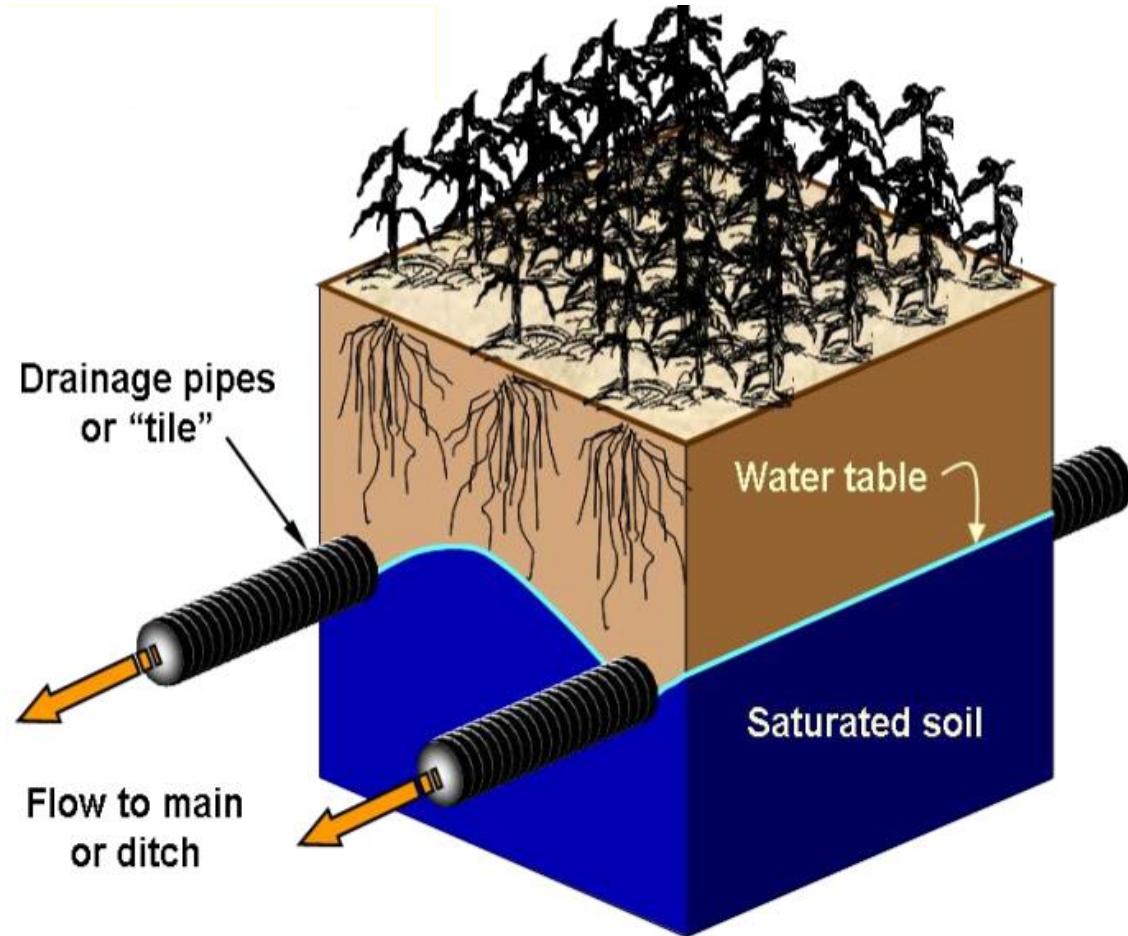
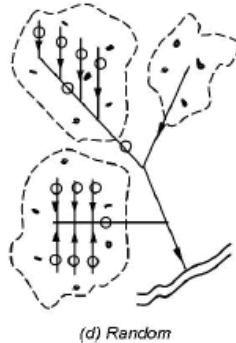
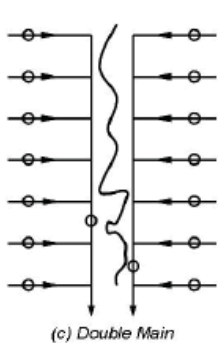
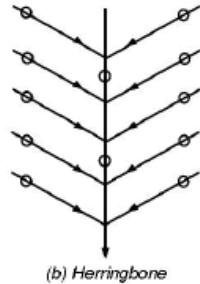
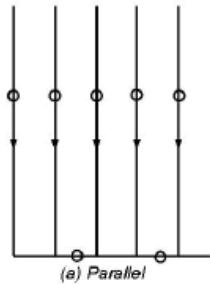


(Source: law.resource.org)

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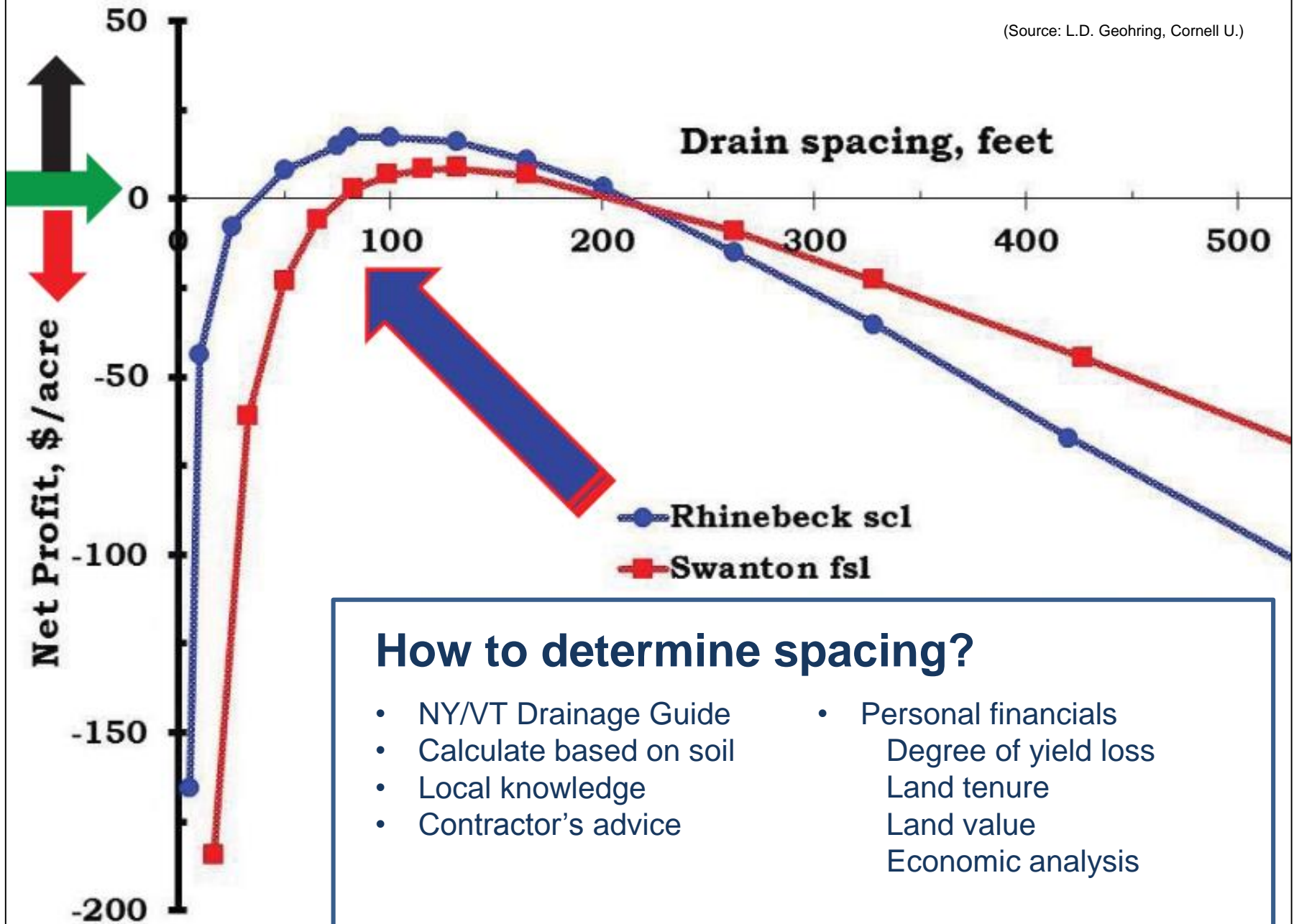


# Ag Drainage: Subsurface, i.e. 'Tile'



(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

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Backhoe vs. Tile plow vs. Trencher



**Maintaining  
grade line is  
critical**



**Timing  
matters**





# Ag Drainage – Precision Technology

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## GPS – RTK

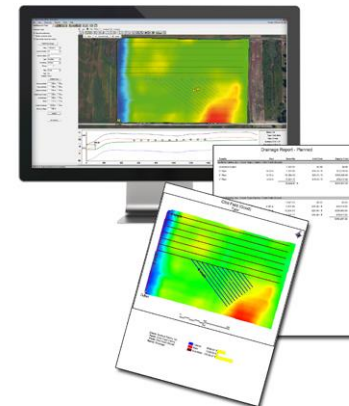
- ▶ Sub-inch accuracy
- ▶ Fast
- ▶ Good for
  - ▶ Bigger jobs
  - ▶ Any length run
  - ▶ Large grade change
- ▶ Precise map produced
- ▶ Software supported

**RTK Video**

Tile Drainage Installation (Tile Drainage Installation.webm)

## Laser Transit

- ▶ Slower
- ▶ Good for
  - ▶ Small jobs
  - ▶ Short runs
  - ▶ Limited grade change





# Drainage: Cost? DIY?

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## 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
- 



<b>Description (Soil Survey)</b>	<b>Suitability for Grapes</b> (per Dr. Lakso and Dr. Martinson, Cornell-Geneva: <a href="http://arcserver2.iagt.org/vll/learnmore.aspx#SoilDrainage">http://arcserver2.iagt.org/vll/learnmore.aspx#SoilDrainage</a> )
Excessively Well Drained	<p>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 coarse texture (gravel or sand) soils may also have low fertility.</p>
Somewhat Excessively Drained	<p>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.</p>
Well Drained	<p>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.</p>
Moderately Well Drained	<p>Generally acceptable, but may have poor soil aeration during wet periods. Tile drainage is likely needed.</p>
Somewhat Poorly Drained	<p>Not recommended except with tile drainage at close spacing. Not recommended due to general soil limitations and cost of drainage.</p>
Poorly Drained	<p>Not acceptable for grapes.</p>
Very Poorly Drained	<p>Not acceptable for grapes.</p>

# 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

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## In-field and edge-of-field BMPs

(bee.cornell.edu)



# Drainage Contractors

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## Altona, NY

- ▶ Steve Mahoney
  - ▶ 518-569-6441
  - ▶ Very Experienced
  - ▶ Will travel
  - ▶ Small farms and diversified crops

## Medina, NY

- ▶ BCA Ag Technologies
  - ▶ 802-870-0850
  - ▶ [www.bcagtech.com](http://www.bcagtech.com)
  - ▶ RTK, tile plow
  - ▶ Experience with tiling in orchards

## Morrisville

- ▶ HA Manosh
  - ▶ 802-888-5722
  - ▶ GPS-guided
  - ▶ Will travel;
  - ▶ On-site pricing

## West Chazy, NY

- ▶ Redline Drainage
  - ▶ 518-578-2738
  - ▶ RTK, tile plow
  - ▶ Will travel
  - ▶ On-site pricing

## Ferrisburgh

- ▶ Van Wyck Bros.
    - ▶ 802-870-0850
    - ▶ [www.vwdrainage.com](http://www.vwdrainage.com)
    - ▶ RTK, tile plow
    - ▶ Travel for 50 acres or many farms
    - ▶ \$1000/acre @ 40' (\$1/ft)
    - ▶ Interested in serving fruit and veg producers
- 

## Randolph

- ▶ Larry Pickett
  - ▶ 802-685-4455
  - ▶ Backhoe installation
  - ▶ Travel 50 miles
  - ▶ On-site pricing

