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Hops: Soils and Site Selection

Rob Sirrine
MSU Extension
Leelanau County, MI

MSU IPM Academy
February, 2014



MICHIGAN STATE
UNIVERSITY

Extension



Site and Soil Requirements

- Hops require long day lengths
- Specific chilling requirements (winter temperatures below 40 °F for 1-2 months) -rarely satisfied below 35 degrees latitude.
- Climate: minimum of 120 frost free days
- Full day sun (13+ hours)
- Good air circulation and drainage to avoid mildew problems
- Sandy loam or well-drained loamy soil
- Poorly drained, strongly alkaline or saline soils should be avoided
- Very shallow bedrock and very shallow water tables to be avoided



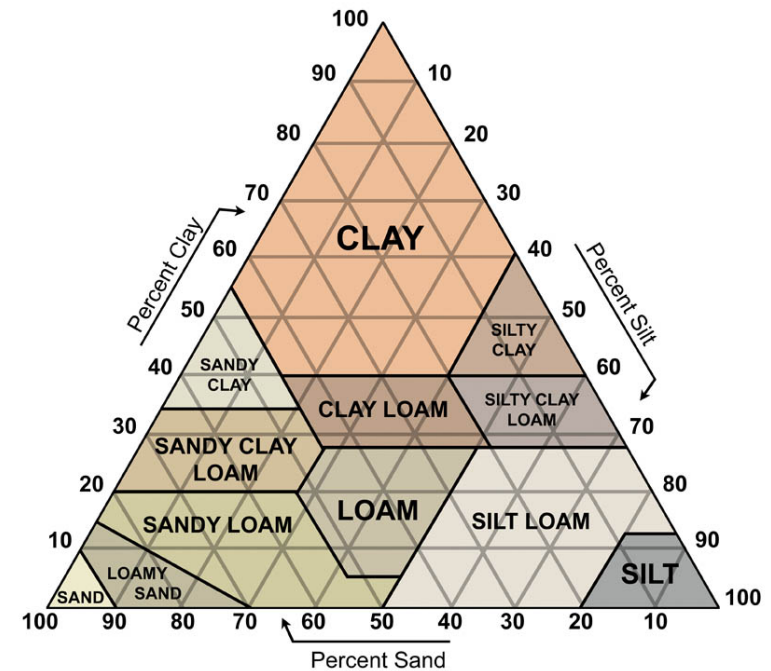
Factors that can impact hop production (growth, yield, and quality)

- Environment (temp, day length, soil texture, weather)
- Production Practices
 - Cultivar
 - Soil fertility
 - Disease, pest, and weed pressure and control
 - Training and timing of training
 - Harvest and harvest timing
 - Irrigation
 - Post-harvest processing and storage



Environment

- Grow in a variety of soils from clay to sand
- Prefer well-drained soils
 - Sandy loam or silt loam
- Problem with heavy, poorly drained soils
 - May delay getting into field
 - Increase disease issues/rotting
- Problem with overly sandy soils
 - Hi input costs



Source: Neve, R.A. Hops. 1991



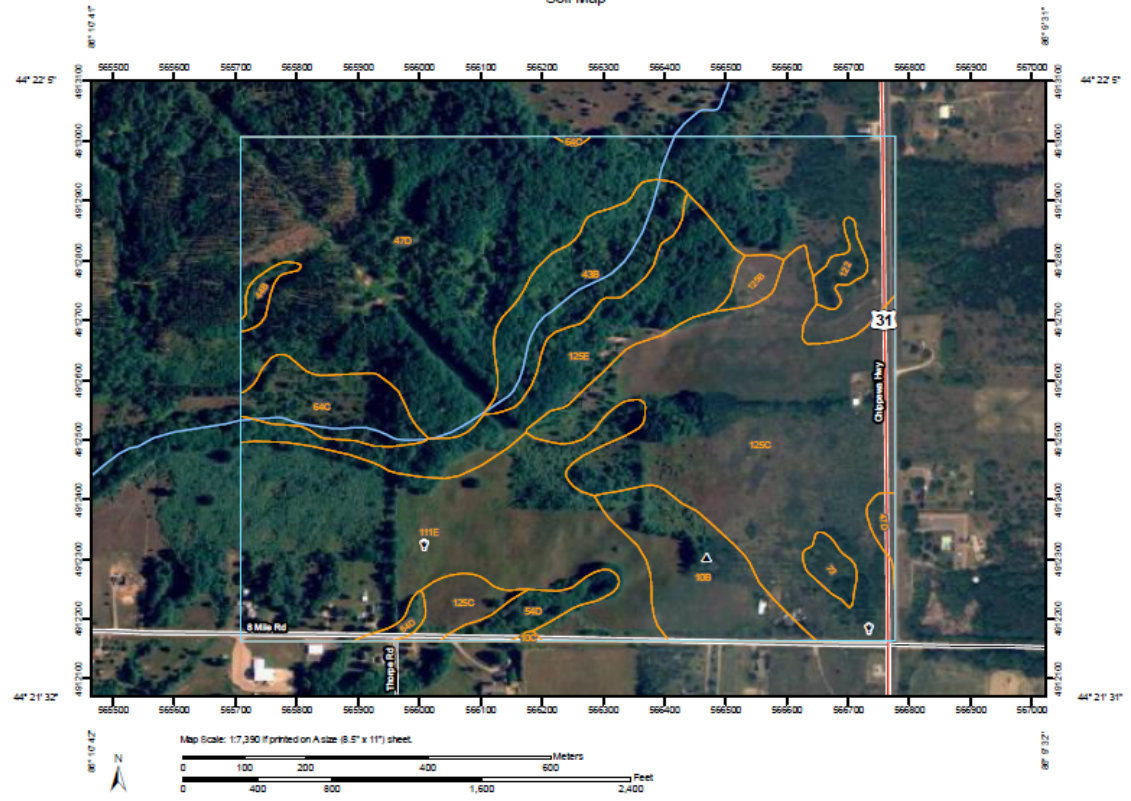
Web Soil Survey



A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Benzie and Manistee Counties, Michigan

Custom Soil Resource Report
Soil Map





10B—Perrinton loam, 2 to 6 percent slopes

Map Unit Setting

Elevation: 580 to 1,120 feet

Mean annual precipitation: 28 to 38 inches

Mean annual air temperature: 37 to 55 degrees F

Frost-free period: 113 to 185 days

Map Unit Composition

Perrinton and similar soils: 90 percent

Description of Perrinton

Setting

Landform: Moraines, till plains

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: 24 to 36 inches of loamy and clayey material over calcareous loamy and clayey till

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 30 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water capacity: Moderate (about 7.9 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 9 inches: Loam

9 to 13 inches: Clay loam, fine sandy loam

13 to 28 inches: Clay

28 to 38 inches: Clay

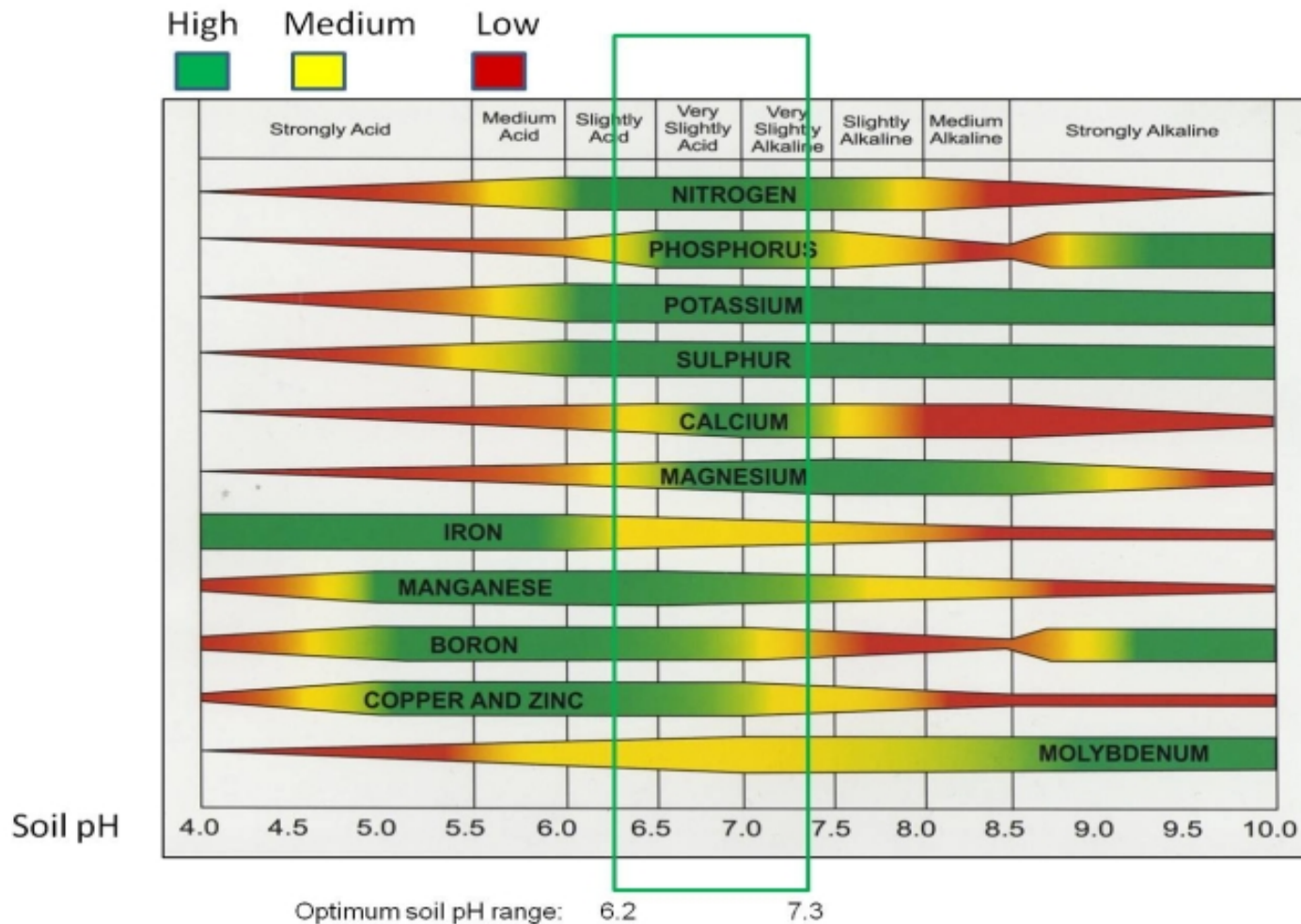
38 to 80 inches: Clay

Benzie and Manistee Counties, Michigan (M1614)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10B	Perrinton loam, 2 to 6 percent slopes	11.2	5.0%
10C	Perrinton loam, 6 to 12 percent slopes	0.1	0.1%
43B	Thompsonville fine sand, 0 to 6 percent slopes	11.1	5.0%
44B	Milnichol fine sand, 0 to 4 percent slopes	1.0	0.5%
47D	Spinks-Coloma sands, 12 to 18 percent slopes	74.5	33.4%
54D	Kaleva sand, 12 to 18 percent slopes	3.9	1.8%
64C	Benona sand, 6 to 12 percent slopes	7.1	3.2%
73	Houghton-Adrian mucks	1.6	0.7%
111E	Onekama loam, 18 to 35 percent slopes	42.5	19.0%
122	Dair-Adrian mucks	1.5	0.7%
125B	Spinks-Tekenink, sandy substratum, complex, 0 to 6 percent slopes	1.5	0.7%
125C	Spinks-Tekenink, sandy substratum, complex, 6 to 12 percent slopes	51.2	23.0%
125E	Spinks-Tekenink, sandy substratum, complex, 18 to 35 percent slopes	16.0	7.2%
Totals for Area of Interest		223.2	100.0%

Hops and pH

- pH optimum(6.2-6.5)
- Lime if too low

How soil pH affects availability of plant nutrients



Kinsey Agricultural Services, Inc.

297 County Highway 357 - Charleston, MO 63834
 Phone 573-683-3880 Fax 573-683-6227 e-mail cas@kinseyag.com

Client: MICHIGAN STATE UNIVERSITY EXTENS

City: SUTTONS BAY , MI

Date : 12-Sep-12

Location			HORT STATION		Previous Analyses & Applications						
Crop Field / Sample Lab No.			HOPS / HOPS N B0103								
Total Exchange Capacity (M.E.)			7.58								
Desired Ca - Mg, Percent			66 : 14								
pH of Soil Sample			7.0								
Humus Content, Percent			1.9								
BASE SATURATION PERCENT					%		%		%		
Calcium (60 to 70%)			76.15								
Magnesium (10 to 20%) } 80%			15.67								
Potassium (2 to 5%)			2.88								
Sodium (.5 to 3%)			0.92								
Other Bases (Variable)			4.38								
EXCHANGEABLE HYDROGEN (10 to 15%)			0.00								
					FOR ORGANIC		FOR CONVENTIONAL				
					RECOMMENDATIONS						
S N O I D I N G	NITROGEN		Amendment		Lbs/Acre						
	Lbs/Acre	ENR Value	58	FEATHER MEAL 13-0-0 (a)	450	UREA 46-0-0 (c)				40	
				FEATHER MEAL 13-0-0 (b)	375	AMSULF 21-0-0-24 (d)				125	
				COMPOST	(See Note Below)	CAN 17 N (e)				50	
						LIQUID N 32% (f)				125	
S U L F A T E - S	SULFATE - S		Sulfur 90-92% (g)		Sulfur 90-92% (g)						
	p.p.m.	Value Found	16		75						
	PHOSPHATES		Desired Value								
	as (P2O5)	Value Found	750	NONE							
C A L C I U M	CALCIUM		Value Found								
	Lbs/Acre	Deficit/Surplus	2062	NONE							
	MAGNESIUM		Value Found								
	Lbs/Acre	Deficit/Surplus	250	NONE							
P O T A S S I U M	POTASSIUM		Value Found		POT SULFATE 0-0-50 (h)		POT SULFATE 0-0-50 (h)				
	Lbs/Acre	Deficit/Surplus	443		250		250				
	SODIUM		Value Found								
	Lbs/Acre	Deficit/Surplus	35	NONE							
T R A C E S	Boron		0.88		BORAX 11%		BORON 14.3%				
	p.p.m.		411								
	Manganese		83		MANG SULF 28%		MANG SULF 28%				
	p.p.m.		1.40	CU SULFATE 23%		20					
	p.p.m.		8.50	ZINC SULFATE 36%		35					
N O T E	(a) Apply 1 week or so before spring growth begins.										
	(b) Apply 1 week or so before bloom.										
(c) Work into soil immediately or water in with a minimum of 1/2 inch of water.											
(d) Apply in early spring.											
(e) Apply at bloom.											
(f) Apply at bloom.											
(g) Sulfur applications including the sulfate form of 50 lbs/acre or more need to be applied at least 6 months prior to next soil sampling.											
(h) Apply an additional 250 lbs/acre of Potassium Sulfate (0-0-50) during the growing season.											
NOTE: Could use compost here if Ca & Mg levels in the compost are not too high. Should not be applied though without an analysis first to determine the effects this would have on soil nutrient content.											

Topography



- Photo credit: Maggie Hoffman



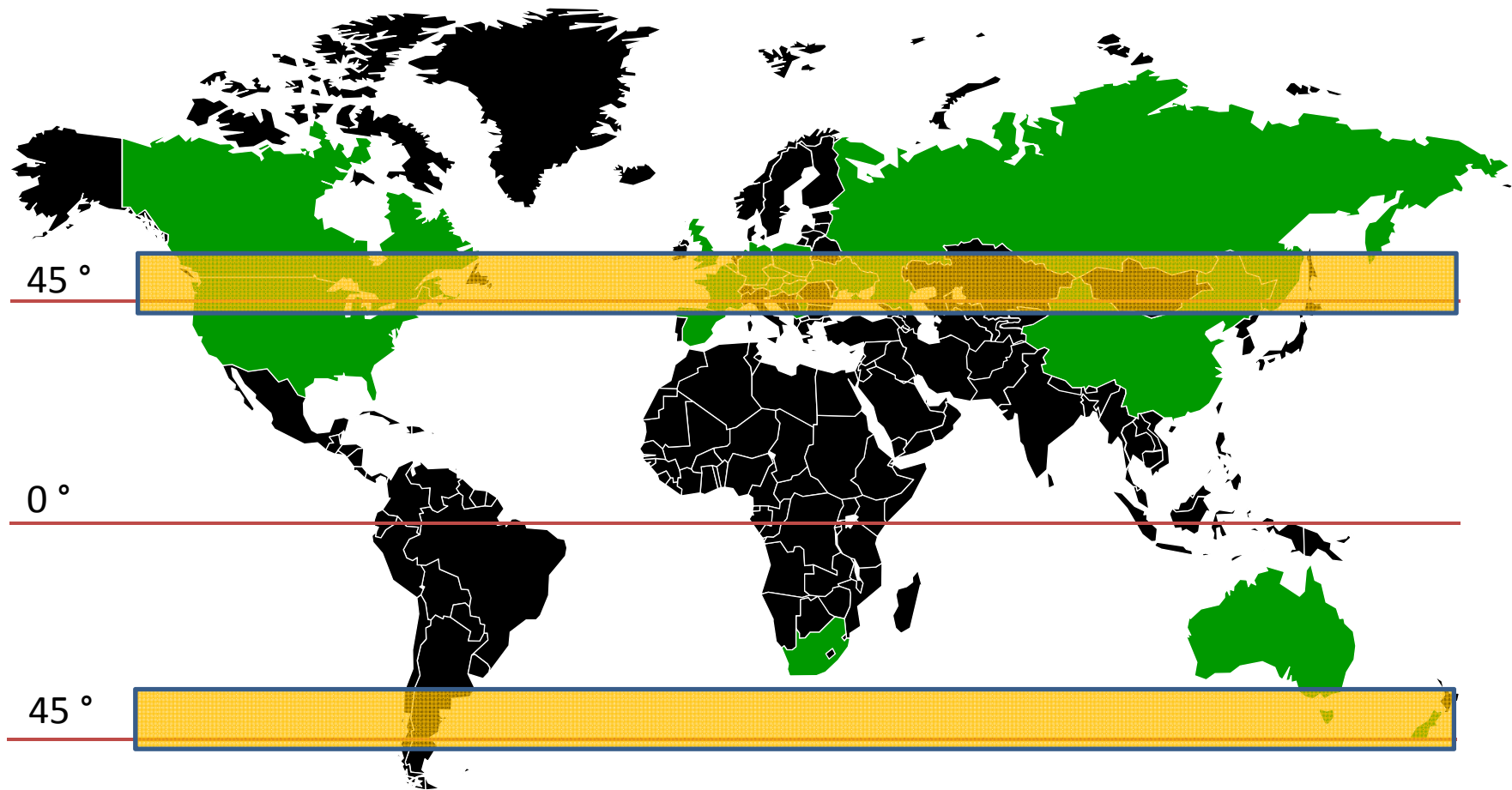
Photo: David Warren



Wind Direction and speed ?



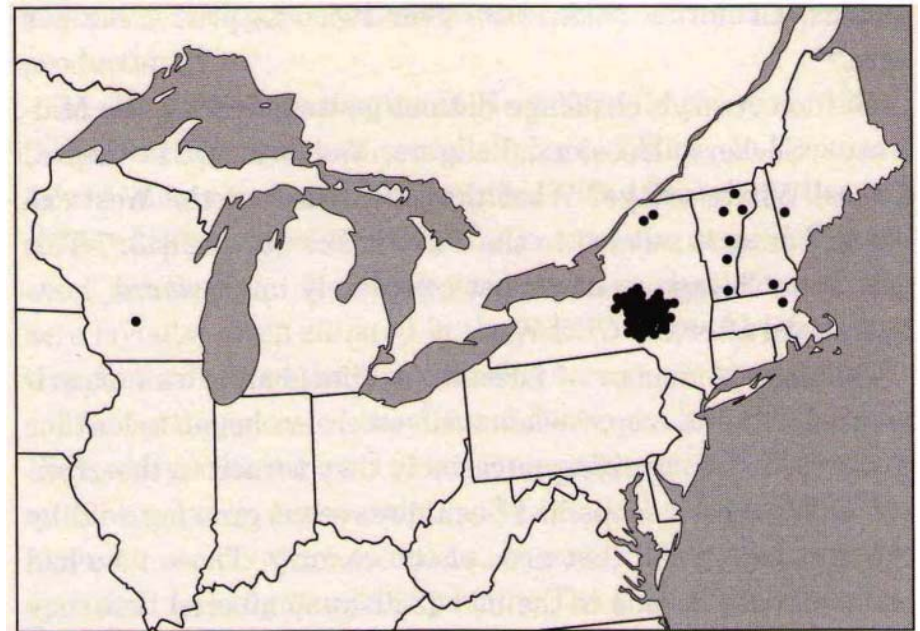
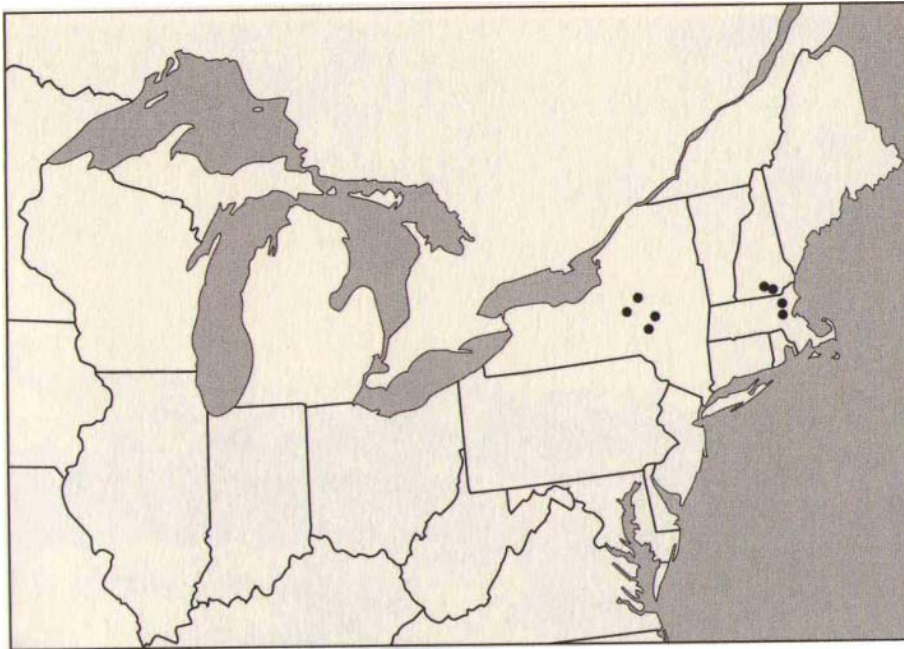
Latitude and Daylength



Hops Gain a U.S. Foothold

1839

1859



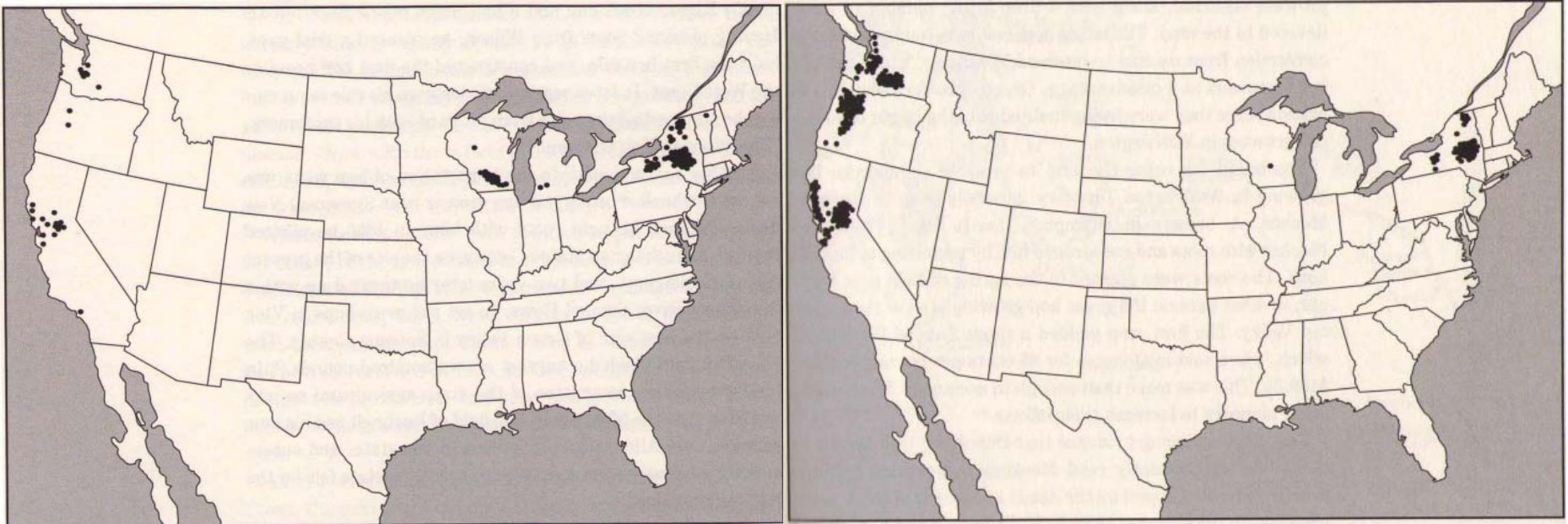
Each dot represents 100,000 bales (1 bale = 200 lbs. dried hops)

Source: Tinged With Gold, Tomlan, 1992

Hops Gain a U.S. Foothold

1879

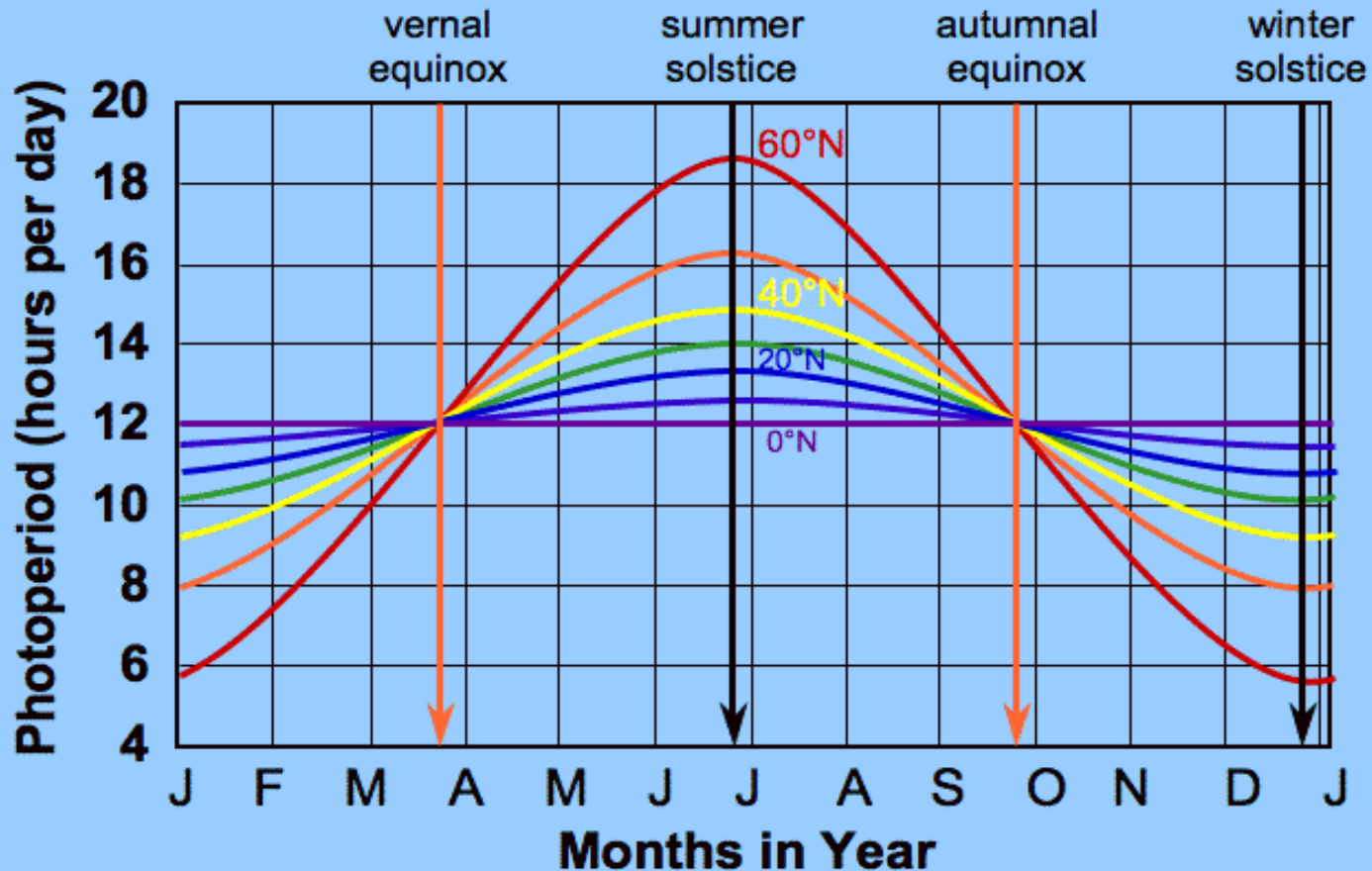
1899



By 1920's majority of production had moved west

Source: *Tinged With Gold, Tomlan, 1992*

Photoperiod Sensitivity (why latitude matters)



Lake Leelanau, MI, 44.9808° N, 85.7150° W



International Hop Variety Trial III

R.A. Neve 1983

Goals

1. Compare performance of 3 new cultivars all seedlings of N. Brewer
2. Determine extent to which they were adapted to the environment where they were selected

Methods

- All bred and selected in different countries at different latitudes
- All planted at 4 different latitudes: 46 ° N, 47 ° N, 48 ° N, 51 ° N

Results

- “Marked adaptation to the conditions under which they were selected....related to flowering dates and yield”
- “Significant reduction in yield as the cultivars were moved away from their place of origin”



To Sum

- Hop cultivars will generally do well in regions that are similar to where they were developed
- Soils
 - Will do well in most soils, but consider management costs
- Latitude (sunlight, day-length)
- Climate
- Topography