3rd Annual Hops Conference
Thank you to our sponsors!!

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Organic Hop Yield and Quality in the Northeast

Heather Darby and Rosalie Madden

March 19, 2012
Building the hop yard

[YouTube video thumbnail showing construction of a hop yard]

As Seen On YouTube
Site Selection & Preparation

- Well drained soils
- Well structured clay – ok
- Sandy soils – will be expensive
- Silty/Loamy soils
Influence of Soil Type
- Cascade
- Centennial
- Chinook
- Cluster
- Crystal
- Fuggle
- Galena
- Glacier
- Liberty

- Mt Hood 074
- Newport 055
- Nugget Teamaker
- Perle Mt Hood
- Saaz Mt Rainier
- Santiam
- Sterling
- Tettnang
- Vanguard
- Willamette

Plus some exciting new varieties from the USDA – ARS breeding program, courtesy of Dr. John Henning!!!
Planting timing

Late August, 2010

Spring, 2011: Root rot
Fertility Management

- Take soil sample
- Correct major issues before planting
- pH 6.2 to 6.5
- Lime season before if necessary
- Make sure all nutrients in optimum range
# Soil pH and Nutrient Availability

<table>
<thead>
<tr>
<th>pH</th>
<th>Interpretation</th>
<th>Best Range for Most Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>Strongly Acid</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>Medium Acid</td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>Slightly Acid</td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>Slightly Acid</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>Neutral</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>Mildly Alkaline</td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>Moderately Alkaline</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Soil pH and Interpretation
Liming the Hop Yard

- Add in fall
- Add prior to planting of yard if possible
- Mix into soil will react faster
Hop Requirements

VARIES SLIGHTLY BY VARIETY

- 3% Nitrogen
- 2% Potassium
- 0.50% Phosphorus

- Other important nutrients
  - Boron
  - Zinc
Hop Requirements

PRODUCE 5000 LBS DM/acre

- 3.0% Nitrogen = 150 Lbs
- 2.0% Potassium = 100 Lbs
- 0.50% Phosphorus = 25 lbs

CONES 1/3 to 1/2 of DM/acre

- 3.0% Nitrogen = 75 Lbs
- 2.0% Potassium = 50 Lbs
- 0.50% Phosphorus = 12.5 lbs
First Year Hop Requirements

PRODUCE 1750 LBS DM/acre

- 3.0% Nitrogen = 55 Lbs
- 2.0% Potassium = 35 Lbs
- 0.50% Phosphorus = 9 lbs
You Should Know Cone Yields

1000 lbs dry cones per acre

30 to 50% of total weight

2000 to 3000 lbs total

60 to 90 lbs of N removed
Weed control
Mulch

- Expensive
  - $1200 for 110 yards of hardwood mulch (including delivery)
  - Covered ½ acre, 6” deep, 4’ wide

- Fertility trade offs

- Moisture retention
Training

• Easier to do earlier in the season before bines twist around weeds
  – Risk breaking off growing point

• Later training can affect maturity and yields
Watering/Irrigation

[YouTube video thumbnail]

[Webpage screenshot with links to resources]

$1,200 to $1,500 per acre
Wet season, above average rainfall, but irrigation still improved yields dramatically.

Irrigated 3-year old Nugget yielded 3 times more than non-irrigated 3-year old Nuggets.
About a one month window of harvest depending on variety

<table>
<thead>
<tr>
<th>Variety</th>
<th>Date harvested</th>
<th>Dry matter %</th>
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</thead>
<tbody>
<tr>
<td>Cluster</td>
<td>11-Aug-11</td>
<td>19.1</td>
</tr>
<tr>
<td>Cluster</td>
<td>12-Aug-11</td>
<td>18.9</td>
</tr>
<tr>
<td>Cascade</td>
<td>24-Aug-11</td>
<td>22</td>
</tr>
<tr>
<td>Fuggle</td>
<td>24-Aug-11</td>
<td>23.6</td>
</tr>
<tr>
<td>Saaz</td>
<td>24-Aug-11</td>
<td>23.7</td>
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<tr>
<td>Cascade</td>
<td>26-Aug-11</td>
<td>22.6</td>
</tr>
<tr>
<td>Galena</td>
<td>31-Aug-11</td>
<td>24</td>
</tr>
<tr>
<td>Tettnang</td>
<td>31-Aug-11</td>
<td>24.3</td>
</tr>
<tr>
<td>Vanguard</td>
<td>31-Aug-11</td>
<td>26.5</td>
</tr>
<tr>
<td>Willamette</td>
<td>31-Aug-11</td>
<td>25.6</td>
</tr>
<tr>
<td>Centennial</td>
<td>2-Sep-11</td>
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</tr>
<tr>
<td>Chinook</td>
<td>2-Sep-11</td>
<td>23.3</td>
</tr>
<tr>
<td>Liberty</td>
<td>2-Sep-11</td>
<td>*</td>
</tr>
<tr>
<td>Mt. Hood</td>
<td>2-Sep-11</td>
<td>21.4</td>
</tr>
<tr>
<td>Perle</td>
<td>2-Sep-11</td>
<td>25.3</td>
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<td>Tettnang</td>
<td>2-Sep-11</td>
<td>23.2</td>
</tr>
<tr>
<td>Vanguard</td>
<td>2-Sep-11</td>
<td>21.9</td>
</tr>
<tr>
<td>Chinook</td>
<td>6-Sep-11</td>
<td>23.5</td>
</tr>
<tr>
<td>Fuggle</td>
<td>6-Sep-11</td>
<td>22</td>
</tr>
<tr>
<td>Glacier</td>
<td>6-Sep-11</td>
<td>22.1</td>
</tr>
<tr>
<td>Nugget</td>
<td>6-Sep-11</td>
<td>22.7</td>
</tr>
<tr>
<td>Santiam</td>
<td>6-Sep-11</td>
<td>19.2</td>
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<tr>
<td>Glacier</td>
<td>8-Sep-11</td>
<td>23.1</td>
</tr>
<tr>
<td>Crystal</td>
<td>12-Sep-11</td>
<td>21.2</td>
</tr>
<tr>
<td>Sterling</td>
<td>13-Sep-11</td>
<td>21.4</td>
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<td>21.4</td>
</tr>
<tr>
<td>Glacier</td>
<td>14-Sep-11</td>
<td>25.8</td>
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<tr>
<td>Newport</td>
<td>14-Sep-11</td>
<td>25.1</td>
</tr>
<tr>
<td>Santiam</td>
<td>14-Sep-11</td>
<td>22.5</td>
</tr>
<tr>
<td>Sterling</td>
<td>14-Sep-11</td>
<td>23.6</td>
</tr>
</tbody>
</table>
**First Year Yields**

Can expect 2 to 4 x more yield

<table>
<thead>
<tr>
<th>Variety</th>
<th>Wet Yield (lb/acre)</th>
<th>Dry Yield (lb/acre)</th>
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</thead>
<tbody>
<tr>
<td>Cascade</td>
<td>1,061</td>
<td>254</td>
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<tr>
<td>Chinook</td>
<td>747</td>
<td>189</td>
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<tr>
<td>Cluster</td>
<td>2230</td>
<td>459</td>
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<tr>
<td>Galena</td>
<td>1170</td>
<td>303</td>
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<tr>
<td>Glacier</td>
<td>539</td>
<td>138</td>
</tr>
<tr>
<td>Newport</td>
<td>959</td>
<td>257</td>
</tr>
<tr>
<td>Nugget</td>
<td>870</td>
<td>217</td>
</tr>
<tr>
<td>Willamette</td>
<td>993</td>
<td>256</td>
</tr>
</tbody>
</table>
Hop Oast = 80% to 8-12%

- Proper drying moisture
- Loss of quality during and after drying
- Proper packaging
Downy Mildew

- Most difficult to control
- Promoted by wet conditions
- Obligate parasite specific to hops
- Attacks leaves and cones
- In the wood of the plant
  - Persists in crown from year to year
Powdery Mildew
Did not observe

• Good sanitation
• Prune bottom 3 – 4’ of bine
• Good airflow
• Resistant varieties
• Make sure to scout
Eastern Comma Butterfly
Pests

Japanese beetle

Aphids

Potato leafhoppers

Corn borer

Green cloverworm
Potato leafhoppers

[Diagram showing leafhopper counts for different potato varieties, with labels for Willamette, Centennial, Cluster, Chinook, Fuggle, Tettnang, Perle, Sterling, Nugget, Galena, Glacier, Cascade, Santiam, Vanguard, Liberty, Mt. Hood, Crystal, Saz, Newport, with data points marked with 'a', 'b', 'c', and 'abc' for comparison.]

[Image of potato leaf with leafhopper damage.]

[Image of green field with potato plants.]
Two-spotted spider mites, spider mite destroyer lady beetles

Two-spotted spider mites
Mite destroyer larva
Mite destroyer adult
Mite destroyer pupa
## Pest control

<table>
<thead>
<tr>
<th>Date</th>
<th>Downy mildew control</th>
<th>Potato leafhopper control</th>
<th>TSSM control</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Regalia</td>
<td>Sonata</td>
<td>Pyganic</td>
</tr>
<tr>
<td>17-Jun</td>
<td>All</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-Jun</td>
<td>All</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14-Jul</td>
<td>All</td>
<td>Select plots</td>
<td>Select plots</td>
</tr>
<tr>
<td>20-Jul</td>
<td>All</td>
<td>Select plots</td>
<td>Select plots</td>
</tr>
<tr>
<td>2-Aug</td>
<td>Select plots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-Aug</td>
<td>Select plots</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Beneficial Insects

- Spined soldier bug
- Ladybird beetle/Lady bugs
- Syrphid fly
Cover crops
Mechanization – interactive website coming soon!

Small-scale harvester

Small-scale baler

Small-scale oast
What’s next??

UVM Extension Crops and Soils website  
www.uvm.edu/extension/cropsoil

UVM Extension Crops and Soils blog “What’s Hoppening”  
http://www.uvm.edu/extension/cropsoil/whats-hoppening

cropsoilsvteam

UVM Extension Crops & Soils Team

UVMExtcropsoil