The Effectiveness of Irrigation and Cover Cropping to Produce Sustainable Hops

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www.aroostookhops.com & facebook
Where is Aroostook Hops?
We now have 4 acres @ 46.5° North
One-acre hopyard established 2009-’10
2012-2013 three-acre expansion
350 certified spruce poles
Setting the poles
“You don’t meet many first generation hops farmers” (For the Love of Hops, Hieronymymus, 2012)
Our thanks to:

- USDA SARE (funding)
- Steve Johnson, UM Cooperative Extension
- Marcus Flewelling, Crop Production Services
- Kate and Larry Fisher
- NEHA
- Rosalie, Heather, the UVM team and collaborators
- Steve Miller et. al.
- Crannog Ales Hops Manual
- Family, friends & volunteers
Weeds, yield, and cowpeas...
### Hopyard Map and Treatments

#### Row #
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#### Growth Year
- 2
- 2
- 2
- 2
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- 3
- 3
- 2
- 3
- 3
- 3
- 3
- 3

#### Cover Method
- A
- S
- A
- S
- A
- S
- A
- S
- mix
- A
- S
- A
- S

#### Irrigation
- Y
- N
- N
- Y
- Y
- N
- N
- Y
- Y
- Y
- Y

#### # hills
- 71
- 71
- 57
- 57
- 57
- 14
- 14
- 43
- 57
- 57
- 57
- 57

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**KEY:**
- A: alfalfa
- S: straw
- Y: yes - will be irrigated
- N: no - will not be irrigated
- Ct: Centennial
- Ng: Nugget

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**Diagram:**
- 50' Centennial
- 50' Ct
- 100' Nugget
- 50' Cascade
- 50' Willamette
Drip tape (inexpensive setup)
2011 Rainfall: *(what a year to study irrigation...)*
Mid-late April...Shoots!
Flowers: beauty is in the eye of the beholder...!
Cones!!! (Cascade)
4-year Nugget, ready to harvest
Harvest can be fun!...
...But, it’s A LOT of work!
...we need a harvester!
Marking 3rd-year Nugget for Yield Data
Irrigated Nugget bines (foreground)
Wet Mass per Bine, varieties pooled
Wet Mass per Bine, by Variety
Recall 2011 Rainfall

![Bar chart showing rainfall in June, July, and August. The chart includes data for ArHops, PQI, and mean.]
However, only 0.37” of rain fell between 10 and 20 July
Yield Increase Factor

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Extrapolated yield/acre (pounds)

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<td>Cascade, 2</td>
<td>144.9 ± 34.4</td>
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<td>123.9 ± 14.9</td>
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<td>Nugget, 2</td>
<td>66 ± 10.3</td>
<td>36.5 ± 4.2</td>
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<td>Nugget, 3</td>
<td>707.6 ± 48.1</td>
<td>431.4 ± 58.8</td>
<td>233.1 ± 44.8</td>
<td>348.2 ± 31</td>
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Irrigation Costs ~ $193/acre/year

**Irrigation Installation Costs**
21 X 200 feet rows (@ 10' row spacing, plants spaced 3.5")
4200 l.f. driptape

- $39.00 spigot timer
- $82.00 head setup (regulator, filter, guage, etc.)
- $232.00 mainline ($1/ft. * 220)
- $184.39 drip tape
  - $2.10 endsleevens
- $10.00 repair
- $53.60 freight

$603.09 Total Installation costs/acre
$120.62 Ammortized cost (assumes 5 year life)
$48.07 annual operating costs (water free)

$168.68 total annual material cost/acre

$120 estim. Installation labor costs/acre
$24 annual cost (assume 5 year grub/dripline replacement)

$192.68 total ann. Material + labor cost/acre over 5 years
## Net Financial Gain from Irrigation

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<td>Wet yield plant(^{-1})</td>
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<td>Wet yield (kg) acre(^{-1})</td>
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Alfalfa made only minor increase in nitrates by first fall

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Can rapeseed cover-cropping make a 1-year planting delay worth it?
Year 1: with straw mulch
Year 1: no mulch or tilling
What we’ve learned (so far!)

- Irrigation significantly increased yield
- Irrigation is cost-effective (at current scale)
- Summer alfalfa as ‘green manure’ may actually reduce yield
- Straw is the best mulch (of what we’ve tried)
- Previously established perennial weeds hard to eliminate
Current cultivation strategy
Current cultivation strategy

• Start with as weed-free intrarow as possible in early spring (grub, hand-tiller, new planting, etc.)
• Till interrow
• Apply lime, fertilizer, etc.
• Straw mulch intrarow when bine shoots are 6-12”
• Plant interrow with perennial (clover) or annual (e.g. rapeseed) as green manure and/or nitrogen source
• We would really like to know what others do!
Thanks to UVM!
Thanks to Northeast Hops community!
# Soil Test Differentials (Fall ‘10 → Fall ‘11)

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