



## Early Use and Production

- Hops used as medicinal early on
- Evidence suggests early use in brewing ~ 3000 yrs ago
- Early use gathered wild hops for brewing
- First recorded "hopyard" ~ 750 AD
- Early hop varieties: Noted location and obtained seed or cuttings.
- Landraces ("Noble Hops") derived from these lines

## Pre-Mechanized Harvest

- Hops were grown on tall poles
- End of season poles taken down
- Picked by hand
- Large influx from city and immigrant labor

## Early Mechanization

- Hop production moved to trellis rather than poles
- Experimented with low and high trellis
- Both stationary and mechanical pickers

## Early Low Trellis Designs

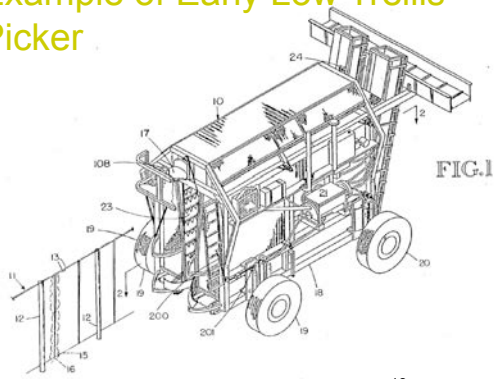
## Early Tall Trellis Designs

## Early Mechanization

- Self-propelled and towed conventional pickers designed in 1930's and 40's
- Self-propelled and towed low trellis pickers designed in 80's and early 90's.
- Hops grown on low trellis at that time were conventional hop varieties
- Most efforts in USA abandoned



## Example of Early Low Trellis Picker



U.S. Patent Apr. 3, 1990 Sheet 1 of 5 4,913,680

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## Moving into 21<sup>st</sup> Century

- First commercial dwarf hop, 'First Gold' released 1997 by Great Britain.
- Revived interest in low trellis production
- Why were folks interested in low trellis?
- New studies w/ conventional hops

## The Tall Trellis Hop Season

- Spring labor and mechanical activities
  - Land preparation or spraying cover crop
  - Pruning-established yards
  - Stringing
  - Training
  - Spraying
- Early Summer
  - Arching
  - Irrigation
  - Cultivation and/or spraying
- Mid-Summer
  - Irrigation
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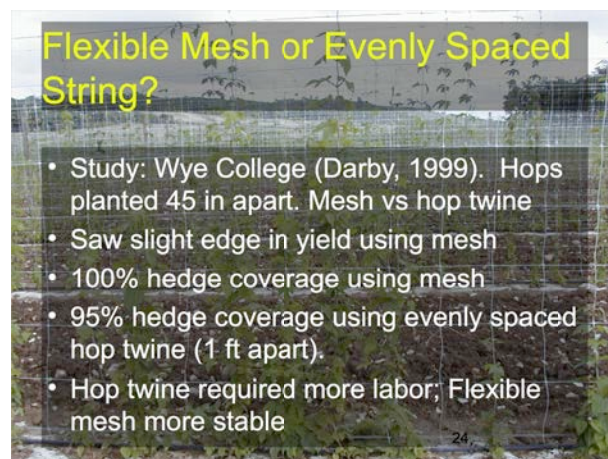
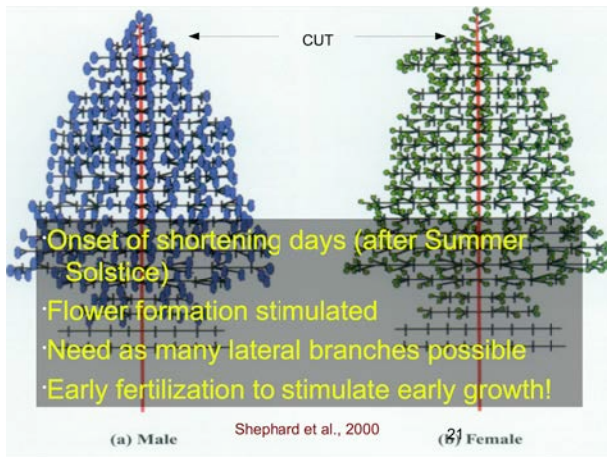
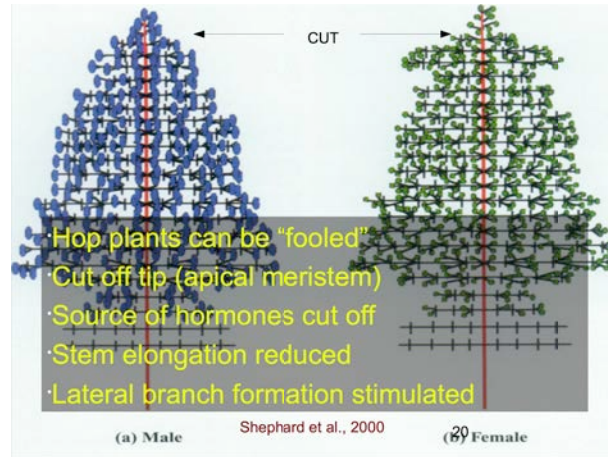
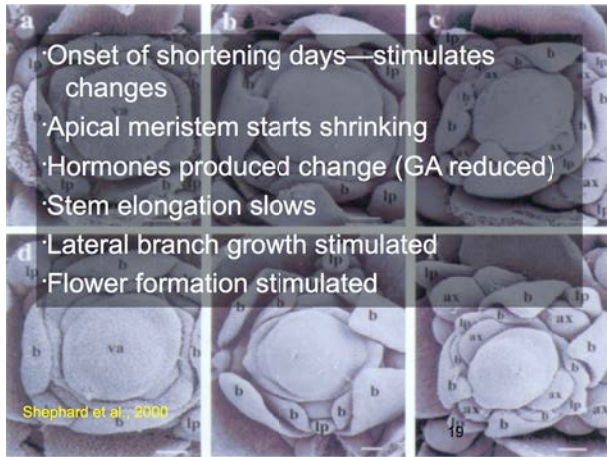
## New Studies on Low Trellis Hop Production.....OR

## How to Trick a Conventional Hop into Thinking it's a Dwarf

## Plant Physiology 101

- Top growth point = apical meristem
- Apical meristem makes plant hormones
- Hormones stimulate stem elongation
- Hormones also stimulate flowering
- Hops need approximately 22 -25 nodes before flowering initiated







**LOW TRELLIS ESTABLISHMENT COST PER ACRE (9')**  
Roy Farms & Jason Perrault

Item	Comment	Cost/Acre
Poles	162 at \$8.80/pole	\$ 1,426
Top cable	5000 ft	\$ 375
Bottom wire	5000 ft	\$ 100
Top staple	175 (top) 162 (bottom)	\$ 16
Cable clamps	15	\$ 5
Anchors	\$20 (steel, cable, concrete, labor)- 4.5/acre	\$ 90
Netting	4840 ft	\$ 980
TOTAL MATERIALS		\$ 2,992
Ground prep		\$ 125
Potted plants	\$.065 / plant / 1614 pots per acre	\$ 1,050
Irrigation		\$ 1,000
Fuel		\$ 20
Labor		\$ 823

**TOTAL ESTABLISHMENT COST PER ACRE \$ 6,010**

## Hints for Growing Conventional Hops on Low Trellis

- Train plants first year
- Get plants growing to top fast and early (Timely N application, Early pruning)
- Once at top, trim off apical growth pts.
- Forces lateral stem development
- After harvest, leave dry stems on mesh
- Provides means for "self-training"

## Yield Comparisons Low vs Tall Trellis



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- Bottom line?
- Yields using conventional hops on low trellis always lower than tall trellis
- Yield loss ranged from 80% (Willamette) to 26% (Cascade)
- Highly dependent upon variety!
- Highly dependent upon environment!

## Dwarf Hops on Low Trellis

## Dwarf Hops on Low Trellis

- Grown on same trellis
- Do not need trimming at tops
- Shorter internodes, greater lower laterals
- Evenly placed cones from top to bottom
- Significantly higher yields
- Some newer varieties = conventional hop yields
- No true dwarf hop varieties available--yet!



### Dwarf Hops on Low Trellis

- Only true dwarf hop varieties "controlled" by English Hop Association
- Private breeding—American Dwarf Hop Association (Based on 'First Gold') Licensed
- USDA-ARS—Public breeding program (Based on 'Pioneer')...Germplasm Exchange

### USDA-ARS Dwarf Breeding

- 2006 Germplasm Exchange
- Provided "pollen" from zero-alpha males
- "Teamaker" roots
- Pioneer x 25/95/15M seeds

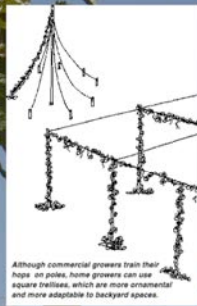
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- 150 Seedlings planted 2009. Evaluated 2010
- Approximately 60% true "dwarf" plants
- Short internode length
- Lateral branches form along length of plant
- Apical meristem stops growing ~ 2/3rds up
- Collected seed off of each female dwarf
- Each collection represents new dwarf family

### Low Trellis Designs

- Many designs possible
- Dependent upon space
- Conventional hops grow ~ 18ft
- 18ft long growth for each hill
- Best designs don't force plant to grow down



### Short Trellis Production Summary

- Reduced yields with "Conventional hops"
- Significant labor reductions & cost
- No stringing
- No training
- Precise pesticide application—lower cost
- Easier to pick by hand!

