Hop Farm Management and Trellis Construction
Green House

- Rhizomes are potted in our greenhouse in early March.
- They will remain in the greenhouse until planting which is usually in July.
- Rhizomes are tested for disease by the nursery we purchase them from.
Planting

- Planting is done manually
- The plants are spaced at 3.5’ from the post and then 7’ after that.
- This comes into play when stringing in the spring.
- Planting is labor intensive but moves quickly with a crew of 10 planting 10-12 acres a day.
Crop and Plant Spacing
Stringing

- Stringing

- String begins as soon as the ground has thawed.

- Two people in the tower tie two strings each moving across the drive rows.

- A team on the ground pushes the strings through the hop plant and into the ground.

- The string is held in the ground with “W” Clips.

- The spacing of the plants matches the spacing of the strings.
Training

- Training begins June 1st.
- 2-4 Vines are wrapped clockwise around the string. The number depends on variety.
- The vines have a month to grow to the top of the string.
- Training is labor intensive with crews of 8-15 people.
- A crew of 10 can train about 10 acres a day.
Fertilizer and Spray Plans

- Fertilizer is put on plants through a fertigation system as well as granular fertilizer.
- Sprays are used to control weeds and disease.
Harvest

- **Top Cutter**
- **Stripper**

- Harvest Starts around the 20th of August.
- Top Cutter cuts top of vines which drop into a trailer.
- The vines are loaded into a stripping machine to remove cones.
- Different varieties will be ready at different times.
Top Cutter and String Tower Specs

- Twining tower
  - 10' X 10' platform
  - 9' to platform floor
  - Built in ladder for easy access to platform
  - Telescopes to 15'
  - Lower platform for string storage
  - Two or Four wheel axles
  - Hydraulic lift is controlled by foot from the platform
  - Custom sizes available

- Top cutter specs
  - Drive options - Hydraulic driven from tractor PTO
  - Self contained Honda engine powered unit
  - Telescopes up and down 5 feet
  - Electric over hydraulic controls
  - Head pitches up and down
  - Optional left and right angle
  - Cuts both sides of a row at one time
  - Can be mounted to most wheel loaders, telehandlers, tractors (need 10,000# 4 X 4 machine)
  - Custom options available
Processing

- Once the hop vines are cut they are taken to the stripping machines.
- Cones are extracted and taken to drying floors.
- Once dried the cones are compressed into bales.
- Bales go through a pellet mill to become the hop pellets most commonly used in brewing.
Trellis Construction
Required Materials

- Southern Yellow Pine (Anchor Poles)
- Red Pine (Interior Poles)
- 5/16” Cable (Bridle, Crosswire, Ribbon, and Anchor Cable)
- 1/4” Cable (Vine Line)
- 5’ Anchor Pins (5’ Steel rod with an eye hole at the top and a shepherds hook on the bottom)
- 5/16” Clamps
- 1/4” Clamps
- 3” Staples (Attaching Cross wires to Interior Poles)
- 1 ¾” Staples (wrapping cables to Anchor Poles)
- 6” Nails (Establishing wrap on Anchor Poles)
- Wiggle Wire
Require Tools and Machinery

- Skid Steer with auger (14” and 18”)
- Telehandler (forks and man basket)
- Tractor
- Shovels
- Come-alongs
- Cable pullers
- 1/2” Sockets
- Hammers
- T-post (metal fence posts)

- Field Marker
- Cable Spooler
- Water Wagon
- Tampers
- 90 Degree Level
- Large Flat Bed Trailer
- Disc
**Terminology**

- **Anchor Poles**: Poles at the exterior or trellis and attached to anchor pins.
- **Field Poles**: Interior poles that hold cross wire.
- **Anchor Pin**: Steel rods concreted into the ground to which anchor cable is secured.
- **Cross Wire**: Steel cable that runs from anchor poles over field poles to support vine line.
- **Vine Line**: Steel cable that runs over cross wire and attaches to bridle on each side of trellis. This is the cable strings are attached to.
- **Bridle**: Doubled up steel cable that runs on exterior of trellis along two opposite sides (ideally North and South) that vine lines attach to.
- **Ribbon**: Steel cable that runs on exterior of trellis opposite of bridle.
- **Wiggle Wire**: 18” long 9 gauge wire to hold vine line in place.
Assessing the Build Site

- **Well**- Is there a well on site? If not where is a logical site.
- **Overhead Power**- For both well hook up and interference with trellis.
- **Terrain Changes**- The flatter the better
- **Determine Drive Rows**- Ideally drive rows run North-South.
Field Prep

- Clearing Land - Removal of any unwanted trees and under brush
- Disc Field - Field must be leveled and soil softened to allow for marking with GPS tractor.
- Fumigation - Easiest if done at this point. (Can be done later).
GPS Marking

- Measure 30’ off of property line to mark anchor pin line on all sides of trellis site.
- The marker is pulled by a GPS driven tractor to create a grid of intersecting lines in the dirt.
- Drive Rows are 14’ apart
- Cross rows are 28’ apart
Drilling Field Pole Holes

- Drill opposite of drive rows
- Drill on every other drag line.
- When starting a new row drill on the drag line skipped in the previous row. This will produce a diamond pattern in the field poles.
- The spacing of the field poles is 56’ following the direction of the drive row but only 28’ feet following the cross wire row.
- Hole Depth 4’.
Laying out and Standing Field Poles

- Bunks of poles are loaded on trailers and rolled off next to drilled field pole holes.
- Telehandlers are then used to stand the poles using a lifting strap.
- Poles will have some play in the holes until tamped in.
Tamping Field Poles

- Field poles will be tamped in by one or multiple crews of 2 to 3 people.
- One person holds the pole straight in the hole and makes adjustments called out by the other worker who is standing back to sight the pole in.
- Poles have to be sighted in both North-South and East-West.
- Once the poles are in line and straight dirt is added and tamped solid.
Drilling Anchor Pole Holes

- Anchor poles will be every 14’ along the Bridle.
- Every 28’ along the Ribbon
- Drilled to a depth of 3’
Drilling Anchor Pin Holes

- Anchor pins will be 14’ from base of anchor pole.
- Pin holes re-drilled to a depth of about 5’. Use the anchor pin to mark depth. Only the eye hole should be above the surface of the ground.
- After anchor pin holes are drilled the bottom will be tamped flat and solid.
Concrete

- Have anchor rods placed loosely in anchor pin holes with the shepherds hook in the bottom.
- Enough concrete is added to the hole to cover the top of the shepherds hook.
- Make sure the eye hole is perpendicular to the anchor pole and centered in the hole.
- As the concrete is added the anchor pin should be lifted slightly to make sure the shepherds hook is suspended in the concrete.
- 1 yard of concrete = 20 holes.
Back Filling and Watering in Anchor Pins

- After the concrete has set back fill the holes completely.
- Add water to the holes to force any air pockets out.
- Back fill and smooth holes over.
- Air pockets will cause the anchor pins to pull up slightly which will weaken trellis.
Wrapping Anchor Poles

- Precut sections of 5/16 cable at 45’ lengths will be attached to each anchor pole.
- A 6” Nail is pounded 3” into the anchor pole at 18’ above the ground.
- The anchor cable is center on the nail, wrapped around the pole, and secured with 1 ¾” staples.
- The two tag ends should be equal in length and hang on the ground.
Pitching Anchors

- Once the anchor cables are attached to the anchor poles the poles will be pitched.
- A hole is dug about 2’ deep in front of the anchor pole facing the anchor pin.
- A crew of 3-4 will then pitch the pole.
- One person will pull on the tag ends of the anchor cable in the direction of the pin.
- Using a level attached to a 90 degree square a worker levels the pole to a 45 degree angle.
- When the pole is level another worker inserts a metal fence post to hold the pole in place while the others back fill and tamp the pole in place.
Corner Poles

- Corner poles receive two anchor cables cut to 50’.
- Each corner also receives two anchor pins to hold tension in each direction (bridle and ribbon).
- The corners are pitched to split the difference between the two pulling directions.
Locking Anchors

- With the anchor poles pitched, a crew will then pull tag ends of anchor cable to the pins and make a crimp on the cable where it meets the pin.

- Two 5/16” cable clamps are attached to both tag ends after they are run through the eye of the pin.
Laying Out Cable

- Cable is layout on the ground using a cable spooler.
- The cross wire (5/16”) is ran first followed by the vine line (1/4”). (VINE LINE MUST BE ON TOP OF CROSS WIRE)
- The cable needs to be ran from one anchor pin to the anchor pin on the opposite end of the field.
- Bridle and ribbon will be ran on the exterior of trellis.
Attaching Bridle

- Bridle Cable (two 5/16” cables) are attached at the corner anchor pole at one end of the trellis. The bridle is wrapped, stapled, and clamped.
- The bridle is loosely stapled above the anchor wraps on each post going to the opposite corner anchor pole.
- The bridle is then stretched to desired tension.
- After stretching the staples along each anchor pole are driven in completely.
- The same is repeated on opposite side of trellis.
Attaching Vine Line

- Each vine line is attached on one side of the field to the bridle cable.
- The 1/4” vine line attached to the bridle using a “crows foot” knot and clamped to itself with 1/4” clamps.
- The spacing for the vine line is 3.5’ from the anchor pole leaving a space of 7’ between the two vine lines.
Stretching Vine Line

- Once all vine lines attached to one side of the trellis they will be stretched from the opposite side.
- The vine line is stretched using come-alongs and cable pullers.
- The come-along is attached to the bridle and pulls the vine line tight.
- At the desired tension the vine line is attached to the bridle using a “crows foot” knot and clamps.
- The trellis must be stretched evenly. Start in the middle and move out. Stretch 3 rows and then skip 6. Repeat in each direction to corners and then come back and attach skipped rows.
Attaching and Stretching Cross Wire

- Cross wires are attached to each anchor pole on one side of the trellis first.
- The cable is wrapped around the anchor pole above the anchor wraps and secured to itself using 5/16” clamps.
- The cross wire is stretched from the opposite side of the field. Starting from the middle and working out.
- The cross wire will be stretched twice.
Lifting and Stapling Cross Wire

- The cross wire needs to be raised and set on top of the field poles.
- This can be done with a boom arm or with workers in a man basket.
- Once the tensioned cross wire is placed on top of the field poles a 3” staple is hammered in to hold the cable in place.
- Large fields may require two stretches on both cross wire and vine line.
Wiggle Wire

- Wiggle wire are 18” long 9 gauge wire that is used to hold vine line in place.
- The vine line can be blow off of its spacing in high winds
- The wiggle wire is wrapped around the vine line to the cross wire to hold it in place.
- Wiggle wire is attached on each vine line on every third cross wire.
Irrigation

- Drip line irrigation is rolled out and placed along the planted hops.
- The drip connects to the main irrigation line.
- We use .26 emitters spaced 12” apart.
- The drip is clamped at the end of the trellis to hold pressure.
Resources

- **Empire Hops** - Trellis Construction and Farm Management. Dan Wiesen (231) 645-4557
- **Empire Orchards** - Hop Plants Dan Wiesen (231) 645-4557
- **Herman Mobile Service** - Implements and Tractor Sales. Phone: (231) 256-0065
- **Pine River Group** - Trellis Materials Ron Grunwall (616) 548-1541