



# Mobile Hop Harvester

## Introduction

The development of the small-scale, mobile hop harvester was a project of University of Vermont Extension with funding provided by the Vermont Agency of Agriculture, Food and Markets and Massachusetts Department of Agricultural Resources USDA Specialty Crops Block Grants Program. The support of these organizations is greatly appreciated.

The intent of this project was to demonstrate the feasibility of a mobile hop harvester with sufficient capacity to harvest one acre of hops per day. A machine like this one is needed since relatively few hop growers in the northeast can justify the expense of a larger, stationary harvester given the limited scale of their hop production yet hand picking is labor intense and slow. All design documents from this project have been made available to the public in a "wiki" format that allows the public to review, replicate, and improve upon the design through a discussion forum.



Roger Rainville (Alburgh, VT) operating the harvester during its trial run.

A team of hop growers, brewers, and UVM Extension faculty and staff teamed with an engineer and a fabricator to design and develop a functional prototype of a mobile hop harvester. The team decided on development of a horizontal machine



Gene L'Etoile (Northfield, MA) feeds the harvester a bine of Cascade.

since it lends itself to being mobile due to its lower height. Power supply was another consideration, with the main options being electrical or hydraulic. The overall power demand estimate and need for speed control suggested that if electrical power was selected, three-phase service would be required. The fact that most of the hopyards in the group are somewhat remote combined with the fact that most growers would have a reasonably sized tractor with a PTO, the group chose hydraulic power.

## Specifications

|                   |   |
|-------------------|---|
| Capacity .....    | 2 bine/min<br>8 hr/acre<br>10,000 lbs/day wet {2,000 lbs/day dry} |
| Portability ..... | over road with standard tow hitch                                 |
| Safety .....      | similar to farm equipment<br>training req'd                       |
| Power .....       | PTO / direct hydraulic  |
| Cone Damage ..... | <5% by volume   |
| Operation .....   | team of two trained operators                                     |



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## How It Works

The hop bine is attached to a specially designed hook and is fed into the harvester using a chain drive. As the bine is pulled through the stripping section, stripping fingers remove leaves and hop cones from the bine. These are dropped to a main conveyor as the stripped bine is pulled out the back of the harvester. The leaves and cones are dropped into a section of dribble belts which are inclined and rolling upward. The rough top of the dribble belts grabs leaves which lay flat on the belt while cones roll “downhill.” This is how the leaves are separated from the cones.



A side view of the harvester showing the main sections and their function. A video of the harvester is available at <http://www.youtube.com/watch?v=2iZlkdozeXo>

A series of conveyor belts direct the leaves one way and the cones another.

## Lessons Learned

During the first season the harvester processed up to 45 two year old plants per hour. Separation of cones from leaves was reasonable following some adjustment of the dribble belts. The team learned a great deal after one harvest season and is in the process of making slight modifications to improve the harvester. Some of the challenges being addressed include:

- Addition of a radiator to better cool the hydraulic fluid
- Use of V-groove belts and additional support rollers to prevent conveyor “walking”
- Installation of directional chutes and paneling to better di-

rect materials and to prevent personnel exposure to moving parts.

- Removal of trailer planks to enable cleaning between uses.
- Documenting the operating settings of the harvester and standard operating procedures.

Plans for the UVM Mobile Hop Harvester including design drawings, a bill of materials and description of the machine are available for download from <http://farmhack.org/tools/mobile-mechanized-hops-harvester>.



Hop cones coming off the harvester ready to be dried, packaged and stored.

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