Project Final Report
Commercial Organic Hops Production Trial
FNE98-195

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Introduction

In 1998 Basic Farm, located in Westerlo, New York, received a SARE grant to study small-scale hops production in the Northeast. The farm is about 15 miles southwest of Albany in the Helderberg Mountains, at an elevation of 1480 feet. The climate is cool and very windy. This area was among the chief hops-producing regions in the late 1800s, until labor unrest and downy mildew forced the industry west. We wanted to determine whether small-scale producers can once again profitably raise, harvest and market hops in this area.

Due to extremely erratic weather in 1998, establishing the crop was difficult and not entirely successful. Since we are a very diversified small organic farm, there were times when more immediate demands reduced the time we could spend nurturing the hops planting. In spite of this most of the rhizomes grew and survived last winter, and this year (1999) we were able to harvest our first crop. The SARE administrators were very supportive and enabled us to extend the project into the second year. A summary of our results follows.

Infrastructure

Hops have traditionally been grown on tall poles (as high as *25* feet) or on overhead wires from 15 to 20 feet high, depending on harvest methods. Since we are an organic farm, we were limited to untreated poles. Conventional farms can use telephone poles or treated pole barn timbers for posts. Since we were planning to hand-harvest the crop, we wanted to grow the vines on 12-foot high wires, which would be a convenient height to pick from a pickup truck bed. Our first choice for poles was 15-17 foot locust, but we were unable to locate any longer than 9 to 10 feet. We ended up settling for 14-foot, newly milled, white oak timbers from our local mill. By charring the buried end, we expect at least a 10-year lifetime. Coincidentally, this is the effective productive period of a hops planting, so at some point in the future we will just dig up the whole thing and start over. Five 200-foot trellises were built, with the poles on 20-foot centers and the ends braced with diagonally set poles. Over the top we ran 12 gauge high-tensile wire, stapled loosely to the top of each pole (to allow movement) and anchored at the ends with turnbuckles. So far this has worked well with very little sagging. Untreated binder twine provides the hops support as they climb towards the wires.

Soil Preparation

The area we chose for the hops is a partially wind-sheltered northwest corner of an old hayfield. The soil tested low in all three major nutrients (N, P, and K), but calcium was high, pH was 6.9 and organic matter exceeded 6 percent. Soil type is Nunda B, a heavy clay loam with many stones. The summer before planting the area was turned over with a moldboard plow, disced, summer-fallowed for 3 months, then amended and planted to rye. Amendments included approximately 15 tons/acre of composted dairy manure, 800 pounds/acre of black rock phosphate, and 500 pounds/acre of sulpomag. In spite of these amendments, Cornell soil tests continue to report very low P and K, although we know these elements are there. A high fencerow (over 60') made up of mixed deciduous hardwoods about 50 feet away provides some shelter from our nearly continuous westerly winds.

Rhizomes

Just as the project began, Washington state instituted a hops quarantine due to outbreaks of downy mildew. We had been in touch with researchers in Washington and had arranged to obtain several new, mildew-resistant and dwarf cultivars from them. Once the quarantine began, we were limited to purchasing rhizomes from commercial sources in Oregon and elsewhere (see appendix for sources). Many of the cultivars we originally wanted were reported to have natural mildew resistance. With the limited choices available once the quarantine was in effect, we ended up ordering these cultivars based on University of Vermont recommendations:

Willamette	Fuggles (resistant)	Brewers Gold
Kent Golding	Nugget	Cascade
Saaz	Perle	Liberty (resistant)
Bullion	Tettenger	Mt. Hood

Ten rhizomes of each variety were ordered. All but the Mt. Hood arrived in good condition, and all were immediately planted in organic potting soil in 1-gallon pots in our greenhouse. From mid-March until early May they were watered as needed, trimmed to one vine and trained. By mid-May they were getting unmanageably long and, in spite of potential frosts, we planted them out. (We were told that hops vines are frost sensitive, but as early as April they emerge from the mulch.) Once planted out, they were watered weekly for the first 2 months, topdressed after the vines started running with 1 pound of soybean meal per plant (7-1-2 typical analysis), and trained onto vertical twine.

Other growers have told us that in later years the trick will be to keep the rhizomes and vines from taking over the world. We plan to propagate our most successful plants and slowly expand the operation. Healthy rhizomes can be separated in early spring, or vines can be trimmed, bruised and buried to root along their length for sectioning and transplanting the following year.

Growing on

As the first season progressed, differences in vigor quickly became apparent. The German varieties (Saaz, Perle, Tettenger) and Fuggles were extremely slow to grow. The "Gold" varieties (Brewers Gold, Kent Golding, Bullion) were uniformly quick and healthy. (We're trying to determine if these are actually one variety with different names.) Willamette and Cascade were nearly as robust, while the Nugget and Liberty plants were at best average. Fuggles and Liberty are alleged to have some natural resistance to mildew, so their lack of vigor was a disappointment. By way of comparison, the "Gold" varieties had 3' vines by June, while at the other end of the spectrum the German varieties had barely reached 3", and their growth was weak and spindly.

During the summers of 1998 and 1999 our area experienced severe droughts. The hops yard was a long distance from our other fields and required watering by hand from a tank on our pickup. For this reason it only got watered every 2 weeks after July 1998, and rain showers were few and light. To help conserve moisture, row middles were kept fallow with a rototiller and each plant was heavily mulched with compost and straw. As the plants have matured, they appear to be much less drought-sensitive. Their performance in 1999 with virtually no irrigation far exceeded their 1998 growth, when they were watered regularly. This bodes well for hops as a low-maintenance crop, we feel.

Each hops plant wants to put out new vines continuously. Traditional methods call for trimming the earliest vines off, as they are not as vigorous as later vines. We let all vines grow for about the first month, until the largest were 18" or more. At that time (early June) we picked the strongest vine, trained it to the trellis, and trimmed the rest. Training time over the season amounted to about 5 minutes per plant. During the growing season the plants continued to put out new vines, which we trimmed off weekly. This was an unexpected labor input — 15 minutes per plant per season. The "gold" varieties were so vigorous that we experimented with training 2 or 3 vines on some plants. Production on these increased by about 60% over single-stemmed plants. (3-stemmed plants yielded less than 2-stemmed plants.) Weaker plants were limited to one vine. The German varieties did not put out enough vine to train until late-July, and Fuggles never put out vines longer than about one foot. These we left sprawled on the mulch. Plant spacing was 7 to 10 feet, depending on how close the poles were. Rows were spaced about 7 feet apart to accommodate our 50" mounted tiller.

We had severe losses over the first winter (1998-99) for certain varieties, Of 120 rhizomes planted out (10 of each variety), survival rates into 1999 were:

Willamette — 9	Fuggles — 10	Brewers Gold — 9
Kent Golding — 5	Nuggett— 8	Cascade — 6
Saaz— 9	Perle— 6	Liberty— 8
Bullion— 4	Tettenger — 10	Mt. Hood — 1

. . . or 85 survivors out of 120 planted. It is interesting to note that plant vigor did not always correlate with our first winter's survival. The soil across the site is pretty uniform,

and we were careful to mix up varieties to limit disease spread and also to assure that soil, water and fertility effects would be spread equitably. We will continue to look at vigor and variety versus winter survival for any useful information. Winter preparation consisted of removing dead vines and mulching with clean oat straw.

Pests and Diseases

Two drought years back to back do wonders to limit disease problems. At no point did we ever see any signs of downy mildew, and powdery mildew infestations were light and scattered, never impacting production. In 1999 we tried a new powdery mildew spray, "AQ-1O", which is a parasitic fungus which preys on P.M. and which we were using on our cucurbits. Those vines we inoculated with AQ-1O (it requires 2 sprays a week apart) did not show any P.M. at all, although much of that may be attributable to the weather. (AQ-1O did not help the cucurbits, and we have since found out this is typical.)

At the end of the 1999 season some leaves showed brown and mottled margins. Terry Lavigne, our Cornell Cooperative extension agent, took samples and had them analyzed. The results came back inconclusive; most people said it looked like water stress. Maybe the isolated and windy location contributed to our good disease record. Later seasons will tell...

We never saw any hops aphids. Aphids were present late in the season on our lettuce, so we know the weather was not a factor. Hops plantings in Vermont experienced a very bad aphid year. The only visible insect pest during the 1999 season was a mild infestation of what we think were white-marked tussock moths, which we found on the leaves and occasionally on the cones. They were easily visible and dropped off the cones when disturbed. Feeding damage was minimal.

In future years we will continue to spray AQ-1O late in the season, and perhaps a foliar feed such as seaweed extract if we see any potential midseason nutrient problems. If our summers continue dry and windy, we feel disease problems will be minimal.

Harvest

In spite of a lot of research and discussions with other growers, we were not sure until the very end when to harvest the crop. Suggestions about "springy feel" and "dry but not brittle" did not help when the texture differed from cone to cone, as well as from one end of the vines to the other. Cones nearest the growing ends of the vines ripened first, while those nearer the roots ripened as much as 2 weeks later. This was a problem and caused some inefficiencies in harvesting. We had originally planned to cut down the vines and then pick them (the traditional 19th Century method), but this would have left the unripe lower cones lying on the ground. We ended up picking the crop from the wires. (Tall employees can be very useful for this, we found out!) The earliest ripening variety (Nugget) was ready about September 15th. The latest ripening variety (Saaz) was not ready until October 1st, perhaps because its cones were smaller and more dense.

At our scale, we were limited to picking by hand. The most effective way, we found, was to hang a 5-gallon pail on one's belt and pick into that. A fast picker can fill a pail (about 4 pounds wet weight) in about 30 minutes, depending on cultivar and cone size. Here again, the more robust varieties had the largest cones, and the German varieties the smallest. If the grower cannot get a premium for the smaller cone varieties, selling by weight probably requires sticking with the larger varieties. We will look more into getting varietal premiums in later years. We also plan to experiment with different trellis heights to see if we can better regulate crop maturity. Once some of the new experimental dwarf varieties become available, we would also like to try them out—the idea of picking off a chest-height trellis is attractive.

Cones were picked, leaves and stems removed by hand, and then dried on ¼" galvanized hardware cloth in a hot attic over our garage. With good air circulation and September heat (never over 90 °F), we found the cones would dry in 4 to 7 days, although one day of cool humid weather added two days to the process. We also learned never to allow more than about 1½ inches of cones to stack up, or the ones in the middle mildewed quickly. Another important point—don't let cats in the drying area, since they love to scratch around in the drying crop. We learned this the hard way.

After the crop was dry we packaged it in ziplock bags with the air pressed out and stored these in a household freezer. Compressing the cones in the bags reduced their volume by about 75 percent, although we heard that this could damage the cones if they were too brittle.

In 1999, our first harvest year, average yields per vine were:

Brewers Gold, Kent Golding, Bullion: 2.1 pounds wet, 5 ounces dry
Cascade: 1.9 pounds wet, 4 ounces dry
Nugget: 1.3 pounds wet, 3 ounces dry
Willamette: 1.5 pounds wet, 3 ounces dry
German varieties: less than ½ pound wet
Fuggles: no crop
Mt. Hood: no crop

Marketing

One of the things that started us looking at hops production was the high value of certified organic hops, most of which are currently imported from New Zealand. Conventionally grown hops sell for as little as $2/ounce in small quantities, while imported organic hops are going for $9-14 per ounce, even in wholesale quantities. Therefore, harvest returns of over $100 per hour of labor are attainable. Once the trellis is up and the plants are trained, harvest labor is the biggest expense for the small-scale hops grower. Hops are sensitive to climate and soil, and the craft grower can easily establish a reputation for a certain variety, quality and flavor. Our customers remarked on the cleanliness of our hops which, since they are not machine harvested, are free of leaves, stems, dirt and insects.

Hops are divided into two general classes: aroma and bittering, based on the amount of

alpha acid found in the yellow lupulin glands under each flap of the cones. The larger cone varieties tend to fall into the aroma class. Wholesale buyers are specific as to the variety they want, and they also expect the grower to test for and certify the alpha acid content of each variety sold. Several labs on the West Coast provide this service. Our homebrew customers were content to nibble a sample prior to purchase. Our one large customer was so pleased to help establish a domestic source of organic hops that they bought the crop sight-unseen and have continued to provide encouragement and hopefully a reliable market.

Our first crop was sold mainly by word of mouth. About 50% went to hobby-brewers who were excited to find a locally grown, organic product. When we increase production, we expect that a few classified advertisements in the many homebrew magazines will provide a larger market. The other half of our production went to a homeopathic medicine manufacturer on the West Coast. We have also been approached by many organic breweries, and at this point the market for organic or "craft" hops looks promising. Non-organic growers equipped with a hops harvester ($30 K used) could still compete by providing fresh, local hops to their regional breweries for $3 per ounce. We know of one grower who receives a premium by having the brewery add a small surcharge to each bottle made with local hops. So far the brewery's customers have been happy to oblige. Certified organic growers have added opportunities in medicinal and food products, where rates currently range from $9 to $14 per ounce. If the vine-training and harvest labor requirements mesh well with other farm enterprises, hops may be a worthwhile small farm enterprise for Northeast farms.

Appendix

Sources: Freshops
36180 Kings Valley Highway
Philomath, Oregon 97370
541-929-2736
www.freshops.com

Weeks Berry Nursery
6494 Windsor Island Rd. North
Keizer, Oregon 97303
503-393-8112

Advice: Dr.Leonard Perry
University of Vermont
www.uvm.edu/~pass/perry/hopsne.html, hopsvars.html, faqhops.html

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