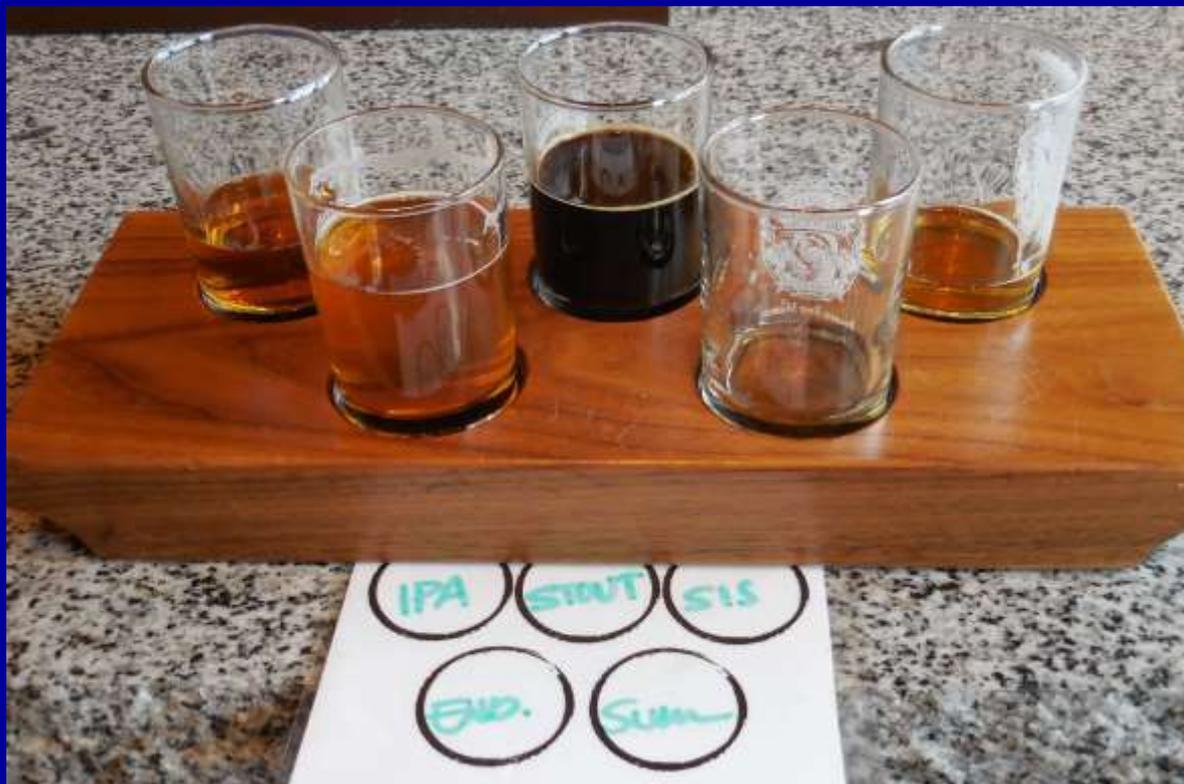


Growing Hops on the North Coast of California

Overview - History – Economics - Feasibility



*March 26, 2016
Shone Farm*



*Paul Vossen
UC Cooperative Extension*



About Us Blogs by UCCE Sonoma Newsletters Links Calendars

Home

Specialty Crops and OLIVES

- Food Safety for Small Scale Farmers
- Olives
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- Vegetables & Herbs
- Irrigation & Climate
- Soil & Fertility
- Cut Flowers & Christmas Trees
- Horticulture Publications



Specialty Crops



Paul Vossen, Farm Advisor

Paul Vossen has been a Farm Advisor in Sonoma County for over 25 years. He works with the county's 800 small-scale commercial farmers who grow olives, tree fruits, nuts, berries, vegetables, herbs, cut flowers, and other specialty crops on about 8,000 acres. His goal is to help farmers, processors, and marketers make a profit in local agriculture while promoting sustainable practices. His research and educational program emphasizes crop diversity.

He also manages the 200 volunteers in the Master Gardener Program who help educate home gardeners about pest management and good cultural practices.

Specialty Crops Advisor



Hop Culture Publication 1985

Gordon Morehead & Paul Vossen

HOP CULTURE IN CALIFORNIA

The Hop plant (*Humulus lupulus*) is a vigorous growing perennial of climbing habit, with a root system of deep penetrating feeder roots, shallow underground roots or stems, and with large roots for the storage of food. The vine is deciduous, drying each fall and producing a new growth each spring. The hop is dioecious, the male and female blossoms produced on separate plants, the hop of commerce being the pistillate or female flower. These flowers, commonly called cones, consist of a number of scales or bracts borne in clusters around a short stem or axis. At the base of each bract is the flower which, if fertilized, produces a seed. It is the common practice in California to produce unfertilized hops. "On each side of the flower or seed and on stem and sides of each petal is secreted a yellow granular substance somewhat resembling pollen, known as lupulin, sometimes called hop flour or hop meal, which is largely responsible for the commercial value of hops."

VARIETIES

Brewer's Gold - Mildew resistant. Ripens August-September. Shoots can be eaten like asparagus.

Bullion - English bittering hop; 7-8% bitterness. Good yielding.

Cascade - Fuggles X Serebrianka. Ornamental type with variegated leaves. Excellent taste. Adds flavor and aroma to light lagers; 4-6% bitterness. Hardy in Zone 4. Bred at

**USDA
Hop
Production
Ag Bulletin
1961**

Retiring after 36 years (6-2016)

www.paulvossen.com
paulmvossen@gmail.com



UNIVERSITY OF CALIFORNIA

Division of Agriculture & Natural Resources



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— of —
CALIFORNIA



N A T U R A L
R E S E R V E
S Y S T E M



Wine and Brewing Courses

**UC DAVIS
EXTENSION**

Continuing and Professional Education

TRY OUR WINEMAKING CERTIFICATE PROGRAM FOR FREE!



Learn the Science Behind the Art of Winemaking

UC Davis Extension's internationally acclaimed online Winemaking Certificate program gives you the knowledge, confidence and practical skills to pursue your passion for winemaking. Fill out this form and we'll

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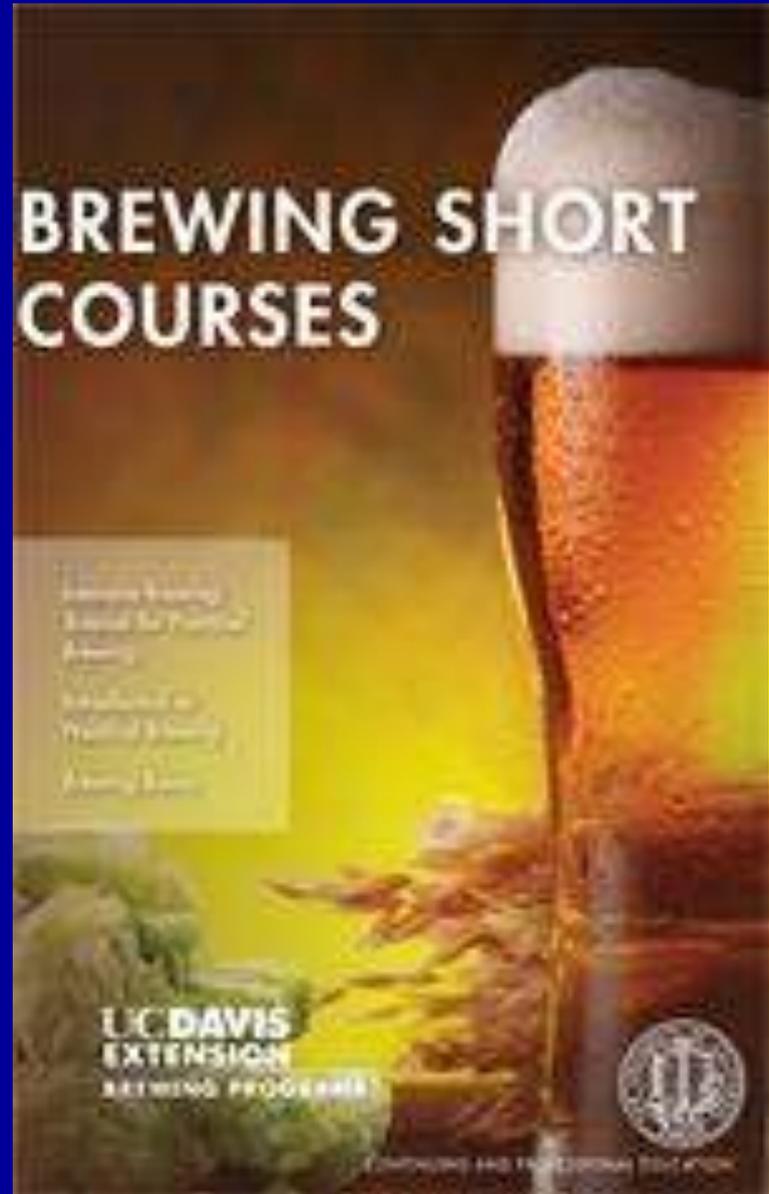
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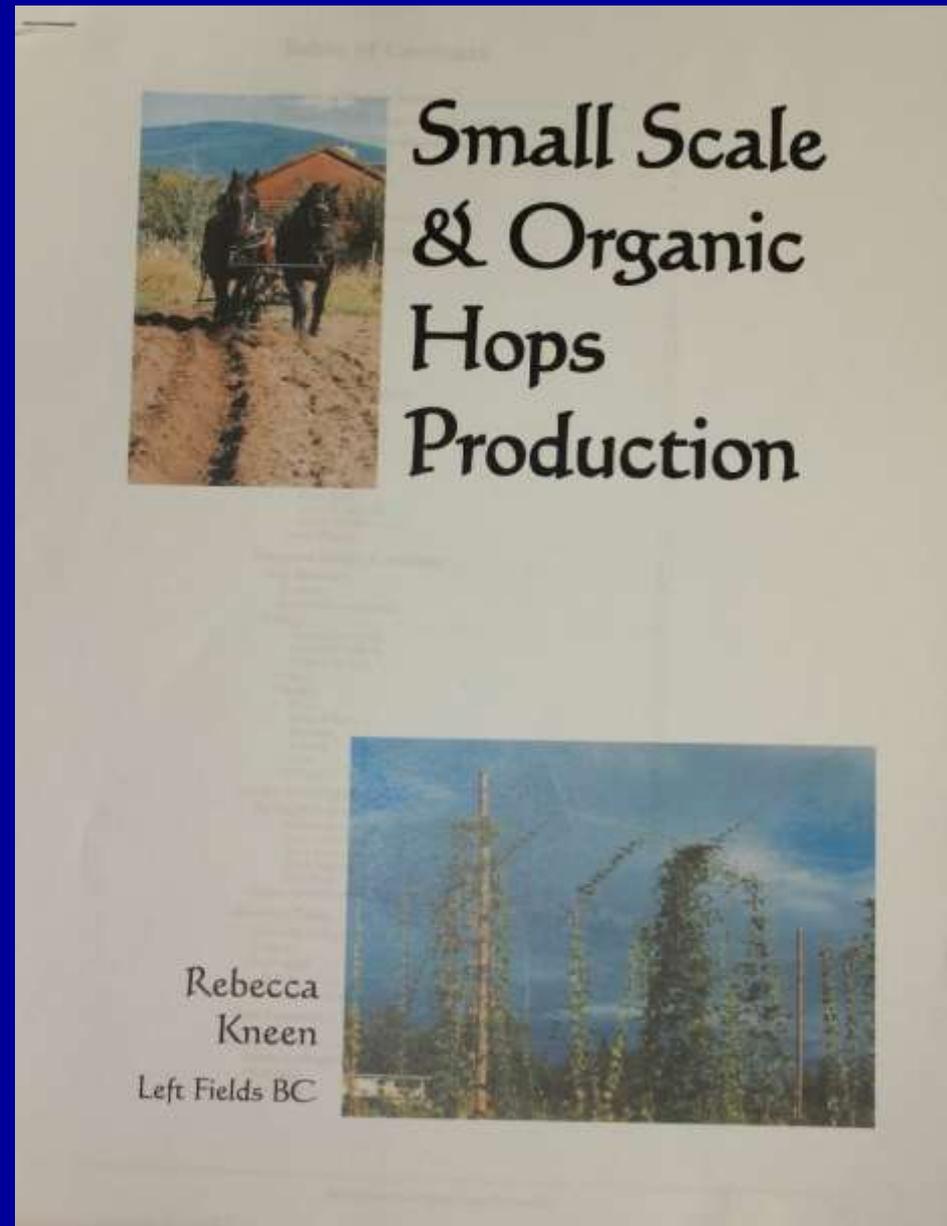
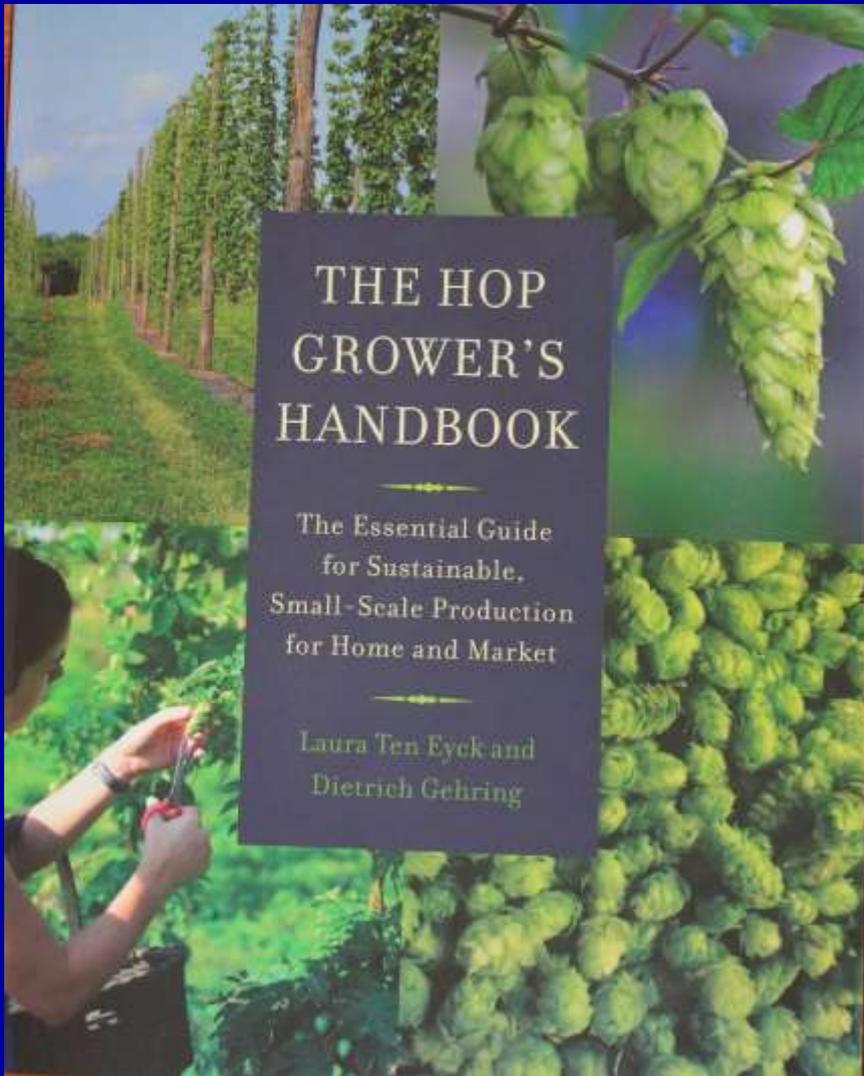
BREWING SHORT COURSES

Homebrewing
Brewing for Professionals
Beer
Wine & Beer
Wine & Beer
Beer & Wine

**UC DAVIS
EXTENSION**
BREWING PROGRAMS



More Information



WSU – OSU Information

2010 ESTIMATED COST OF PRODUCING HOPS IN THE YAKIMA VALLEY, WASHINGTON STATE

-producer version-

Suzette Galinato, Arri George and Herbert Hirman¹

Introduction

Commercial hop acreage in Washington with a value of \$263.8 million.



2010 Estimated Cost of Producing Hops in the Yakima Valley, Washington

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS028E

Introduction

Commercial hop acreage within Washington is located in the Yakima Valley. In 2008, with a value of \$263.8 million, hops ranked 9th in agricultural commodity value in Washington. In 2009, 74.95 million pounds of hops from 29,500 acres were harvested in the state, accounting for 79% of the U.S. production. Washington hop acreage is expected to decline 30% in the next few years, a consequence of a worldwide oversupply. As a result, the economic climate for Washington hop producers is currently in chaos.

In previous times, growers could generally count on putting in a trellis, along with a drip irrigation system, and leaving it in place for its useful life of approximately 20 years. This assured that the grower would sign a 5-year contract, and renew it for 3 additional cycles on the same piece of ground. (The plant variety might need to be changed and replanted, but the trellis and irrigation system would remain in service.) However, the current market is so volatile that growers can no longer count on being able to amortize the costs of planting along with installing a new trellis and drip irrigation system over more than a few years. Under the current situation, some growers who thought they had a 5-year contract to amortize establishment costs are being asked to sell back or roll forward those contracts in as little as 2 years. Other growers may see their plantings and trellis and irrigation system remaining longer.

In light of these circumstances, it is important to have a good estimate of establishment and production costs to help producers assess the profitability of their hop production in the future.

Objectives of Study

- The primary objectives of this study are:
- To provide a representative estimate of capital requirements and production costs of a well-managed hop enterprise grown under drip irrigation.
 - To provide producers with a procedure and a tool for analyzing the profitability of their own hop enterprise.
 - To develop an Excel workbook that allows the user to estimate production costs of producing hops and that has the flexibility to examine the impact of changing input assumptions.

Sources of Information

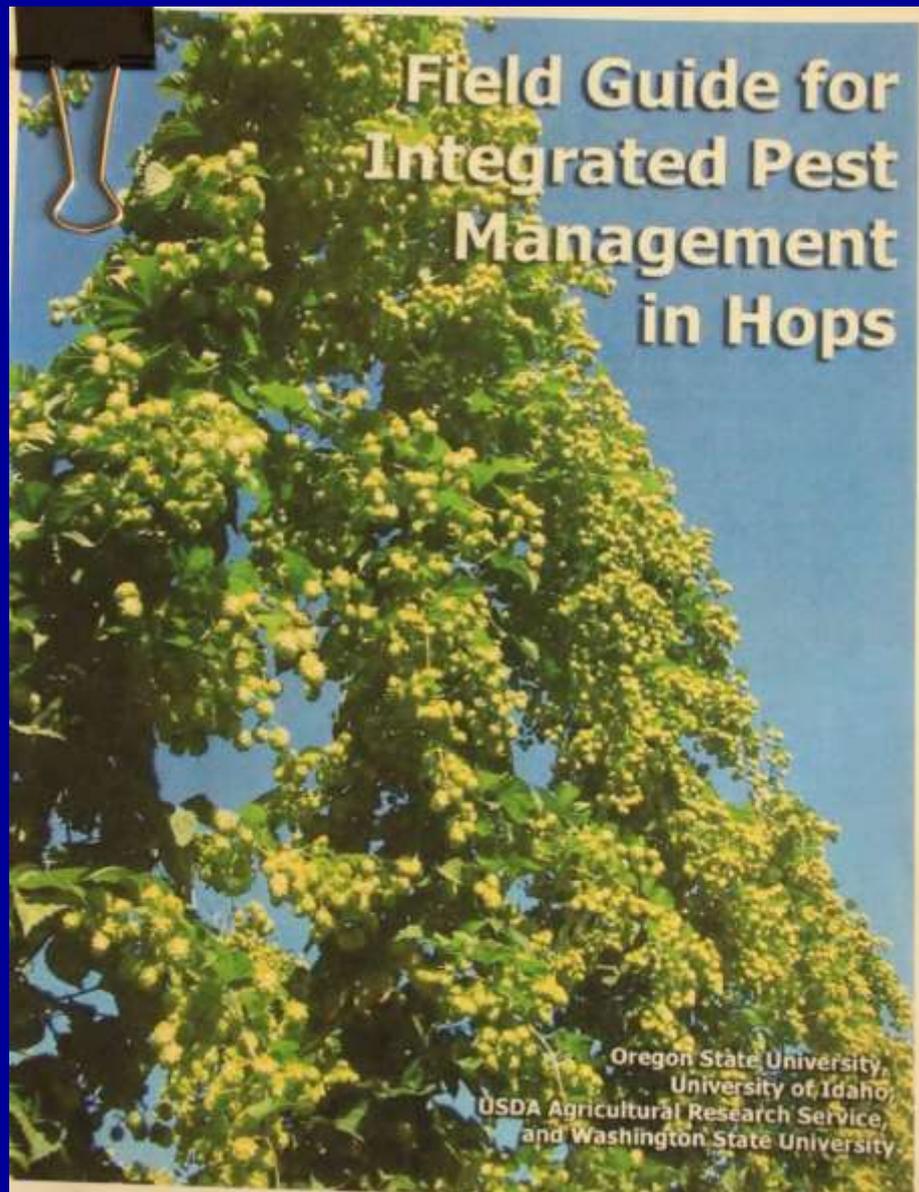
In putting together this study, a committee of area producers identified the inputs, yields, and assumptions under which the budgets for the representative hop situation were developed. These producers are considered to represent well-managed hop farms. The quantities and types of materials (plants, fertilizers, herbicides, insecticides, etc.) used in the budgets were based on widely used practices. Building and machinery costs were based on what the producer committee deemed typical of an average-size hop farm in the Yakima Valley.

Basic Assumptions

Following are the general assumptions made in developing the enterprise budget for hops grown in the Yakima Valley:

1. The representative farm has 660 acres devoted to hop production, with 660 acres in hops currently being established or currently producing. It takes 1.1 acres of land to establish 1 acre of hops. Thus, on this representative farm approximately 660 acres are used for roads, buildings, picking, and production.

Field Guide for Integrated Pest Management in Hops



Oregon State University,
University of Idaho,
USDA Agricultural Research Service,
and Washington State University

North-East Information

Cornell University
Cooperative Extension
Madison County

Northeast Hops News

Inside this issue:

- 1. **Maturity Dates of Hop Varieties**
- 2. **Beet The Musical**
- 3. **Hop Downy Mildew**

2015 Cornell Integrated Hops Production Guide Now Available

The Pesticide Management Education Program (PMEP) at Cornell University is pleased to announce the availability of the **2015 Cornell Integrated Hops Production Guide**.

May 2015

Northeast Hops News

Northeast Hops News is brought to you each month by Steve Miller, Hops Specialist, Madison County Cooperative Extension. Steve researches, writes, and finds articles that would be useful and interesting to the hops community. If you have questions regarding content or would like to contribute to this newsletter, please contact Steve Miller at agm10@cornell.edu.

Crowning, Pruning, and Training The Art of Growing Hops

By Steve Miller

Hops are easy to grow. At least that is what everyone says. But to obtain good

June 2015

Northeast Hops News

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Downy Mildew is Widespread

Weather conditions last Fall and this Spring have produced ideal conditions for Downy Mildew. Here are a collection of resources for growers:

From Michigan State University Extension:

Typically, downy mildew appears early in the season on the emerging basal spikes. Spikes then appear stunted, brittle and distorted. Infected leaves have angular water-soaked lesions that follow leaf venation. Eventually, the water-soaked lesions turn brown and necrotic (Photo 1) with fuzzy and gray-black necrotic spore masses developing on the underside of infected leaf lesions (Photos 2-3). As lesions continue to expand, new tissue becomes infected and fails to climb the stem. Growers can attempt to retain new shoots, but often incur yield loss as a result.

Cultural practices alone are not enough to manage downy mildew. Well-timed fungicide applications just after the

Photo 1
Cindy Eise-Lewis, MSU Extension

Photo 2

Photo 3

Funding for this publication is provided by grants from USDA Ag Markets, Specialty Crop Block Grant, and the NY Farm Viability Initiative.

Inside this issue:

- 1. **Downy Mildew**
- 2. **Beet The Musical**
- 3. **Hop Production in the Lake Erie Region**

Hop Downy Mildew | NC State University

Page 1 of 6

Hop Downy Mildew

Vegetable Pathology Fact Sheets

NC STATE UNIVERSITY

NC COOPERATIVE EXTENSION

Pathogen

Hop downy mildew is caused by the fungus-like oomycete pathogen *Pseudoperonospora humuli* (Figure 1). *P. humuli* is a specialized pathogen on hops and an obligate parasite that only can grow in living host tissue.



Figure 1: Sporangiophore and sporangia of *Pseudoperonospora humuli*

Attribution: Saunia Withers, NCSU Vegetable Pathology Lab

Host crops and plants

The host is *Humulus lupulus* also known as hop (Figure 2). *P. humuli* can also infect Japanese hop (*Humulus japonicus*). The pathogen is very closely related to *Pseudoperonospora cubensis*, the cucurbit downy mildew pathogen, but *P. humuli* will not infect cucurbit crops and *P. cubensis* will not infect hop. Downy mildew pathogens are highly host-specific.



HOP GROWERS OF AMERICA

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301 W. Prospect Place
Moxee, WA 98936 USA
Phone: +1 509 453 4749
Fax: +1 509 457 8561
Email: info@usahops.org

Hop Research Council

PO Box 298
Hubbard, OR 97032 USA
Phone: +1 503 982 7600
Email: info@hopresearchcouncil.org

Washington Hop Commission

PO Box 1207
Moxee, WA 98936 USA
Phone: +1 509 453 4749
Fax: +1 509 457 8561
Email: ageorge@wahops.org

Oregon Hop Commission

PO Box 298
Hubbard, OR 97032 USA
Phone: +1 503 982 7600
Fax: +1 503 982 7602
Email: nancy@oregonhops.org



USA Hops Assn. Varieties

USAHOPS.ORG

Home



USA

HOP INFO

HOP FARMING

STATISTICS

NCPN HOPS

RESEARCH

Aroma Varieties...

For a complete copy of the USA Hop Variety Manual (updated July 2013), please click [HERE](#).

Amarillo® VGXP01 c.v.

Amarillo® is an aroma variety of recent origin, discovered and introduced by Vigil Gamache Farms Inc. in Washington State. It is used for its aromatic qualities, as well as its bittering properties due to its lower cohumulone content.

Yield (kilos per hectare)	1350 - 1800
Yield (lbs per acre)	1200 - 1600
Alpha Acids	8 - 11%
Beta Acids	6 - 7%
Alpha-Beta Ratio	1.6
Cohumulone (% of alpha acids):	21 - 24%
Total Oils (Mls. per 100 grams dried hops)	1.5 - 1.9
Myrcene (as % of total oils)	68-70%
Caryophyllene (as % of total oils)	2 - 4%
Humulene (as % of total oils)	9 - 11%
Farnesene (as % of total oils)	2 - 4%
Storage (% alpha acids remaining after 6 months storage at 20° C)	Good (above average %)
Possible Substitutions	Cascade, Centennial

Sonoma Hops - 2,800 acres

Early 1900's to 1950's



**Windsor Museum
Sonoma State Library**

Eight stack hop kiln on the Wobler Ranch (later owned by the Chisholm family, then Peterson Family). This was probably the largest drying kiln in the area.

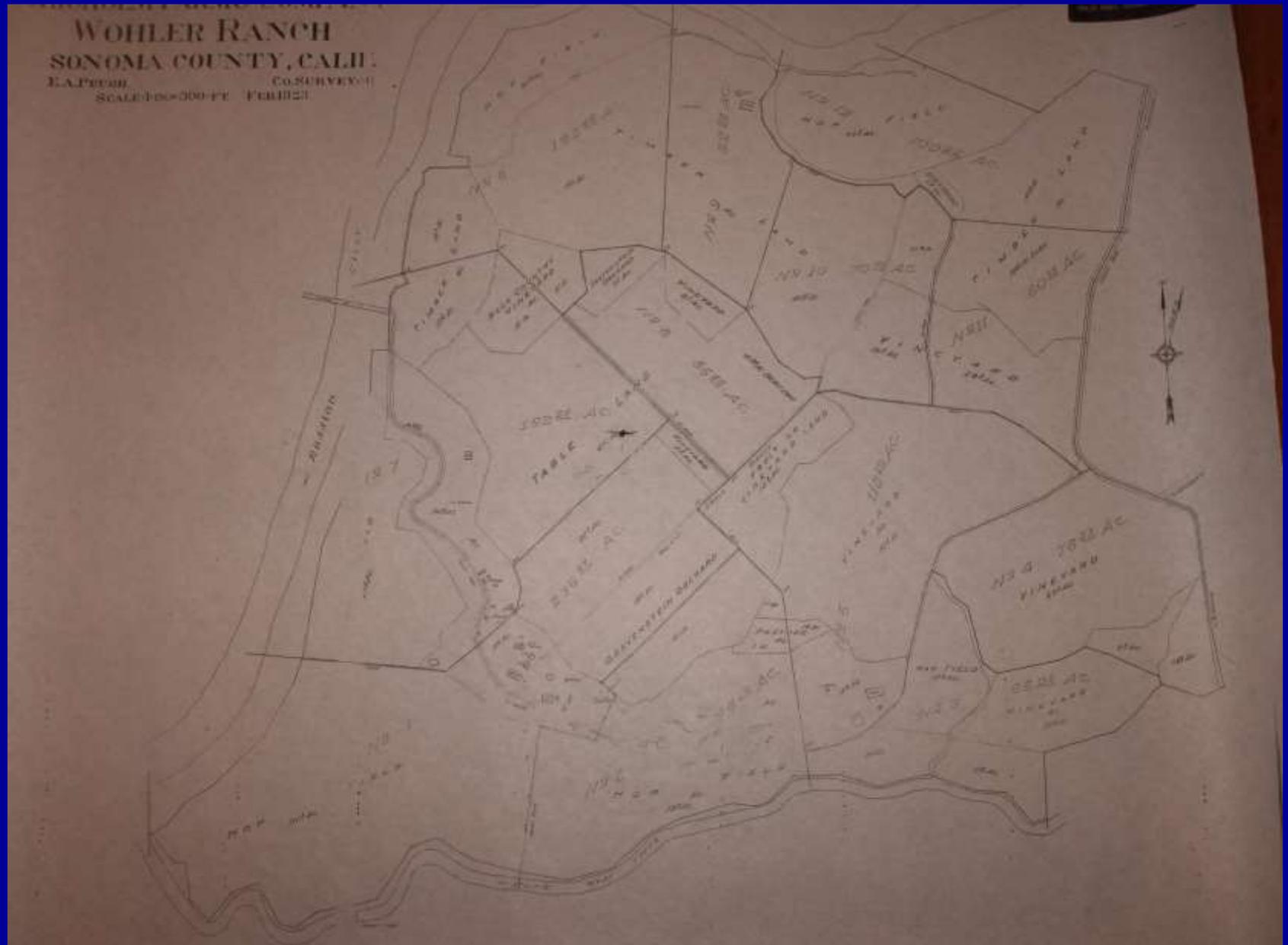
A later fire reduced it to a six stack kiln.

Courtesy of Sonoma County Local History and Genealogy Library

Why the hop industry worked

- Deep soils that could be “dry farmed”
- Some irrigation water was available
 - Russian River & Mark West Creek and . . .
- Cool climate lowered water demand
- Less diseases than Midwest or N. Europe
- Available hand labor from nearby cities
- World market during prohibition
 - Dried product that was not perishable
 - Sonoma County recognized for quality hops

SRJC Shone Farm



SRJC Farm surrounded by hops

**Wohler
Ranch
1923**

31 acres
hops

43 acres
hops

41 acres
hops

111 acres
hops

39 acres
hops

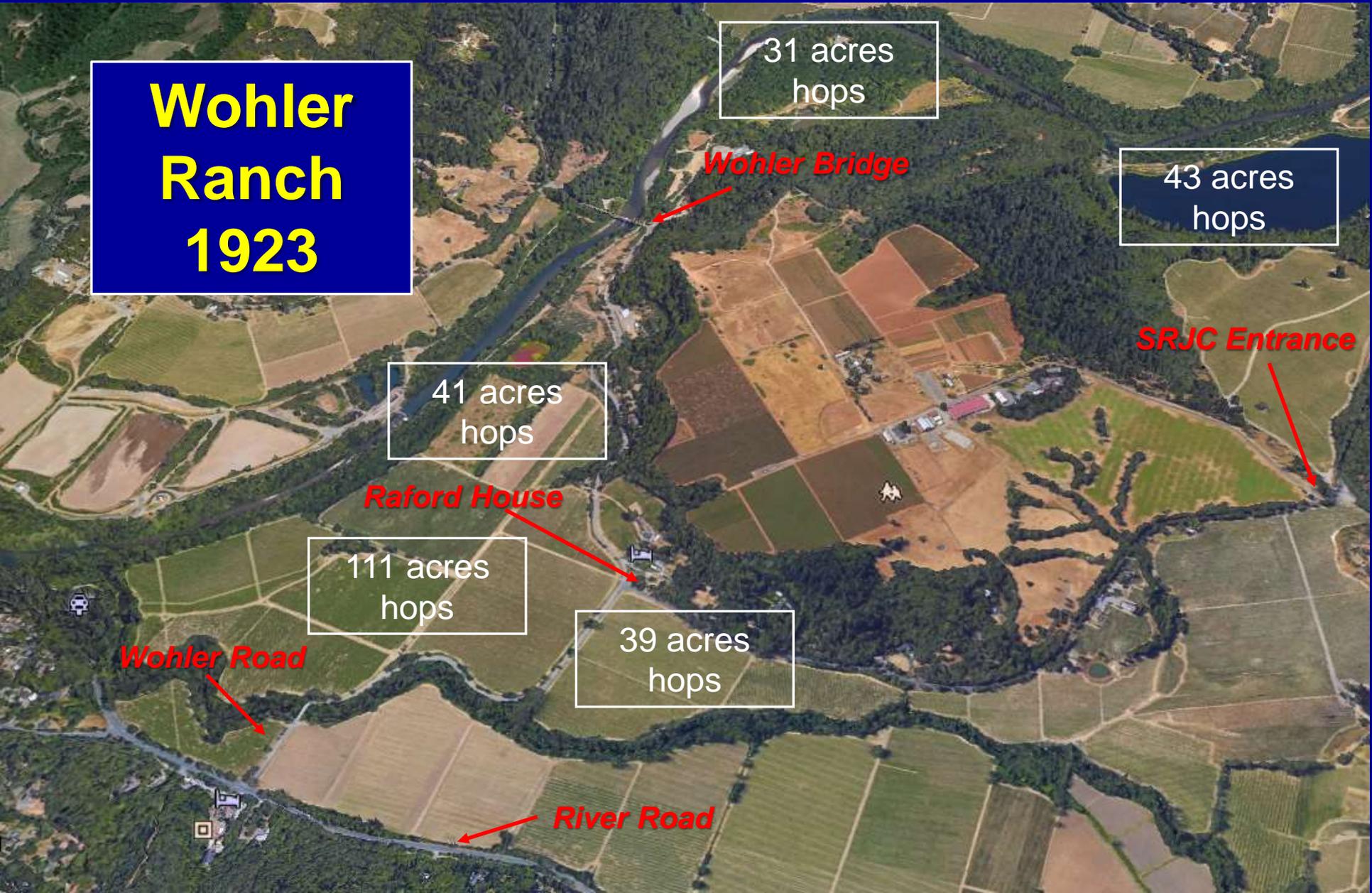
Wohler Bridge

SRJC Entrance

Raford House

Wohler Road

River Road



Wohler Road (*Windsor Creek*)



Windsor Museum – Steve Lehmann

- Book and slide show by W. L. Beedie
- Video: hop growing Raford Jones Sr.
- Photos of hop growing and harvest Harvest baskets – etc. Lorraine Kimes Owens & W. L. Beedie & Raford Jones

Windsor Herald.

VOL. 1. WINDSOR, HODGOMA CO., CAL., SATURDAY, JANUARY 14, 1906. NO. 31

IN THE SUPERIOR COURT. TO SAIL FOR AFRICA. PIONEER SAID TO REST. IN V. COURTESY DEARD.

When charged on being for fact. Judge Houghton granted a writ of habeas corpus in favor of the defendant. The court held that the defendant was not in custody of a justice of the peace, and that the writ should be granted. The court also held that the defendant was not in custody of a justice of the peace, and that the writ should be granted.

WINDSOR

History and Happenings

William L. Beedie

Windsor

Shoe Shop

U. F. HARRIS, Proprietor.
All work promptly and neatly done.
Best work used.
All work guaranteed.
Windsor, Cal.

Watch This Space and You will Save Money and Time.

Bar Drug Store,

W. L. COLLIER, Proprietor.

G. E. Hewitt,

Tin, Copper and

Wheat-ironing

W. L. COLLIER, Proprietor.

A Specialty.

Windsor, Cal.



Sonoma County History

- **1858: Amasa Bushnell - 1st hop plants (Green Valley)**
- **1880-1889: Luther Burbank – Gravenstein Apple industry**
 - **Petaluma has one bar for every 15 voters**
 - **Kroncke’s Park & beer garden = major Santa Rosa hangout**
- **1897: Grace Brothers Brewery – to the 1960’s**
- **1900-1909: Hot springs resort era (Sonoma)**
- **1900: Sonoma County - 10 large operating hop ranches**
- **1909: Healdsburg main crops – grapes, hops, prunes**
- **1920: Sonoma County ranks 8th nationally in farm production (eggs, prunes, hops, apples, dairy, livestock)**
- **1920-1933: Prohibition – Hops sold to Europe**
- **1930: hops production at 15,000 bales (3 million lbs.)**
- **1939: Florian Dauenhauer invents hop picking machine**
- **1940-1955: Profits declined - No more hops in 1960**

Historical “Facts and Figures”

William L. Beedie

- 1st hops in Sonoma County ~ 1880
- Peak ~ 1915-1920 = 2,800 acres
 - *Santa Rosa creek, Mark West Creek, Russian River, Larkfield, Oakmont, Sonoma*
- Mendocino County 1920 ~8,000 acres
- Lake County & Sacramento area
- CA ~12,000 A (10,500 tons – 105,000 bales)
- Good yield was 8 bales/A (dried hops)
- Yield Range: 3.5-12 bales/A (19 = record)
- 150-1,000 pickers per ranch (hand harvest)

Historical Cultural Practices

Video by Raford Jones

- Winter: Trellis system & planting
- April: shoots emerge = trim & weed control
- June 1: training onto twine & weed control
- June 21: trim lower leaves (plants 8-10')
- July 1: plants 15' – flood irrigation (sulfur dusting)
- July 11: trim lower laterals & weeding
- July 21: plants 18' – mildew & aphid control
- August 1: laterals & flowering - trim lower shoots
- August 15: cones showing & developing
- September 1: ready for harvest

Weed Control in Old Hop Yards



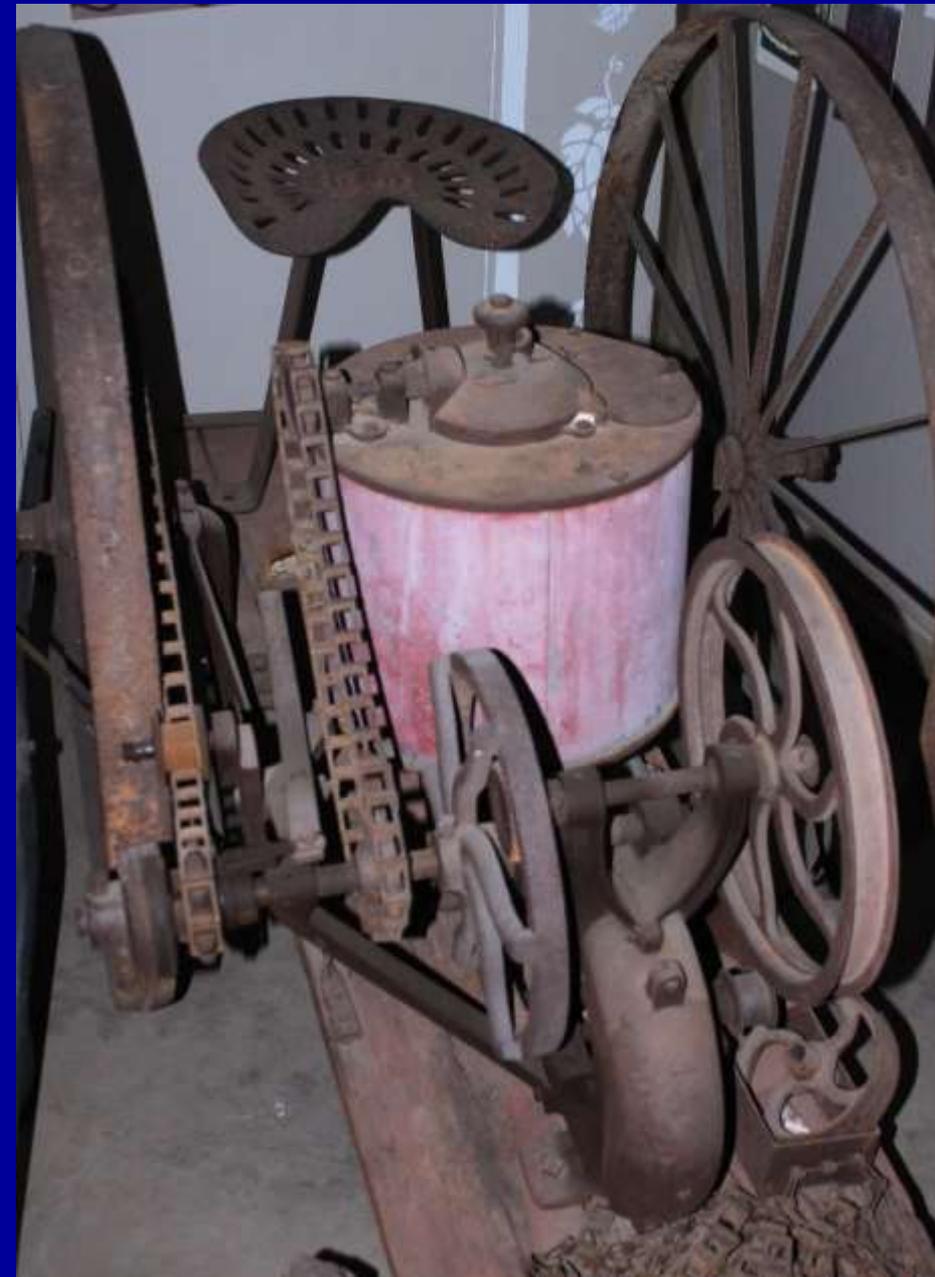
Training & trimming





**Old Manure
Spreader
20-30
tons/acre**

Old sulfur duster and sprayer



For control of:

- Powdery Mildew
- Downy Mildew
- Mites
- Aphids

Dusting Hops (sulfur)



Old sulfur duster



Hops

1000 HOP PICKERS WANTED

245 ACRES OF HOPS

TO PICK IN
THE YARDS OF

WOHLER RANCH

ON THE
RUSSIAN RIVER

Butcher Shop, Grocery Store, Ice
Cream Stand, Lunch Room at the Camp

FREE TENTS, WOOD AND WATER

CHISHOLM FARMS CO.

Phones: Santa Rosa 2F 15
Windsor 6F 24

ROUTE 1, BOX 109
Healdsburg, California

“Whole families” harvest

The crop is a little backward this year, but it will be immense, and pickers, who will receive \$1 per 100 pounds for picking, have an opportunity to make good money and at the same time enjoy an outing in camps provided for the pickers,” says Flint. “Whole families are headed for the hop fields and picking begins Monday. Where the heads of families do not accompany we will see that the wives and children are properly cared for and protected. There will also be need for High School students in the fields.”

Accommodations Provided.

This colony of pickers will be as-



Sonoma County Hand Harvest

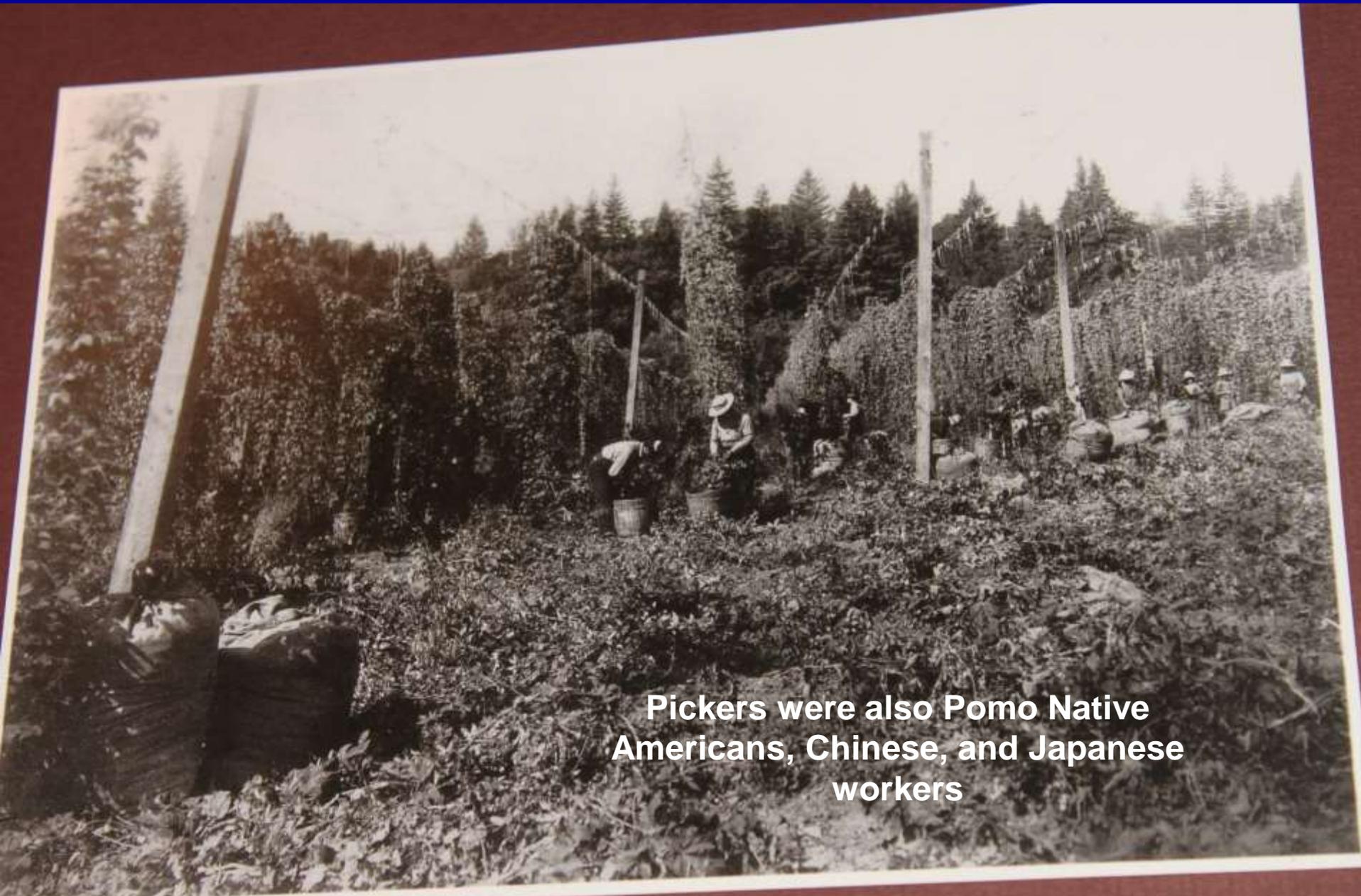


Windsor Museum – *Steve Lehmann*



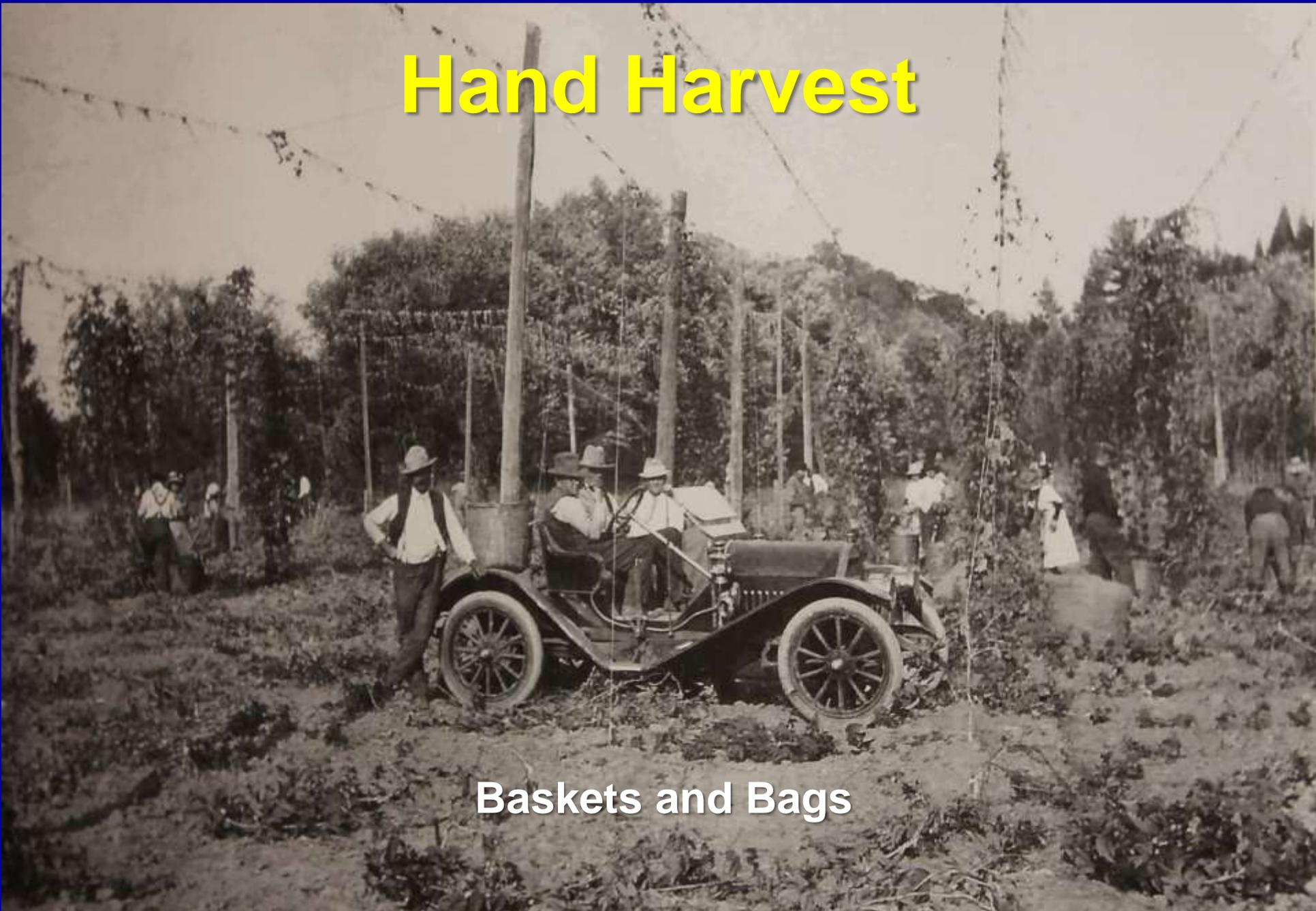
Lorraine Kimes mother, grandmother
and aunts – Wohler Ranch

Hand Harvest in Sonoma County



Pickers were also Pomo Native Americans, Chinese, and Japanese workers

Hand Harvest



Baskets and Bags

Traditional hop basket

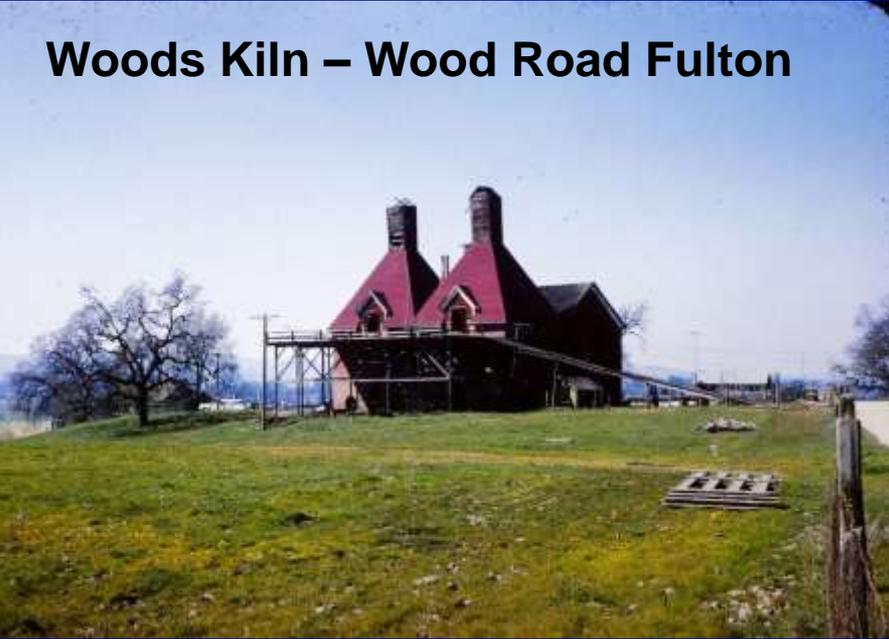


Bags weighed & transported to dryer



Old hop kilns (dryers)

Woods Kiln – Wood Road Fulton



Woods Kiln – River Road

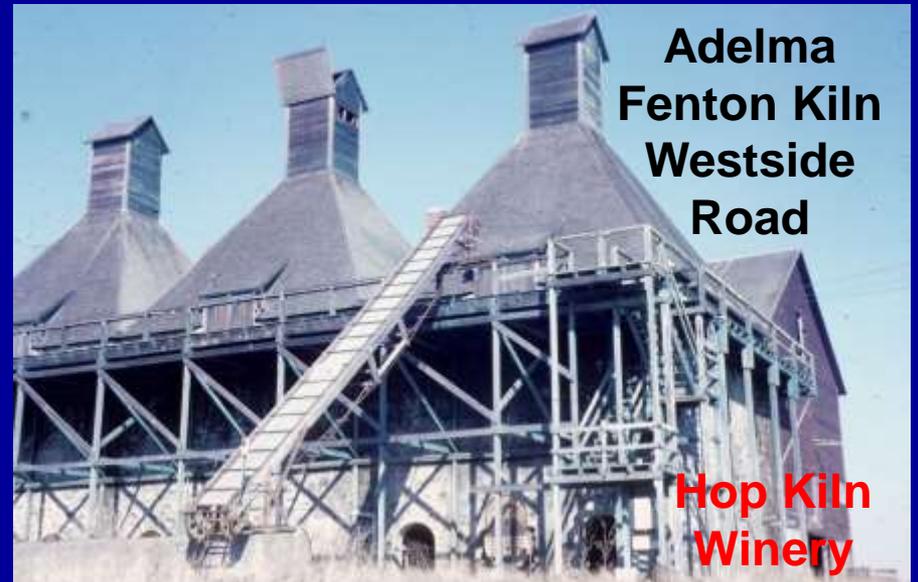


Martinelli Winery

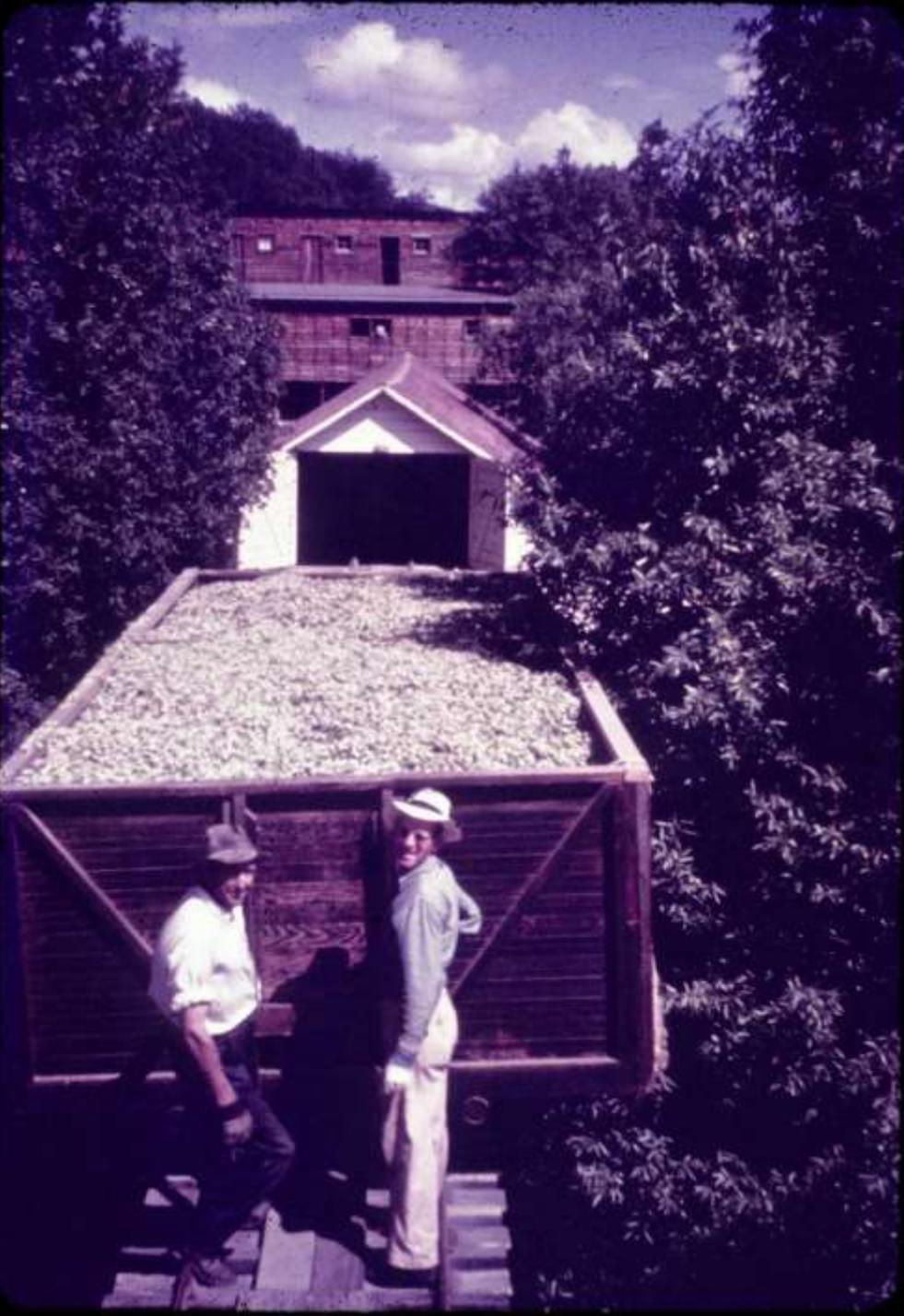
Frost Ranch – Old Story Ranch Kiln



Adelma
Fenton Kiln
Westside
Road

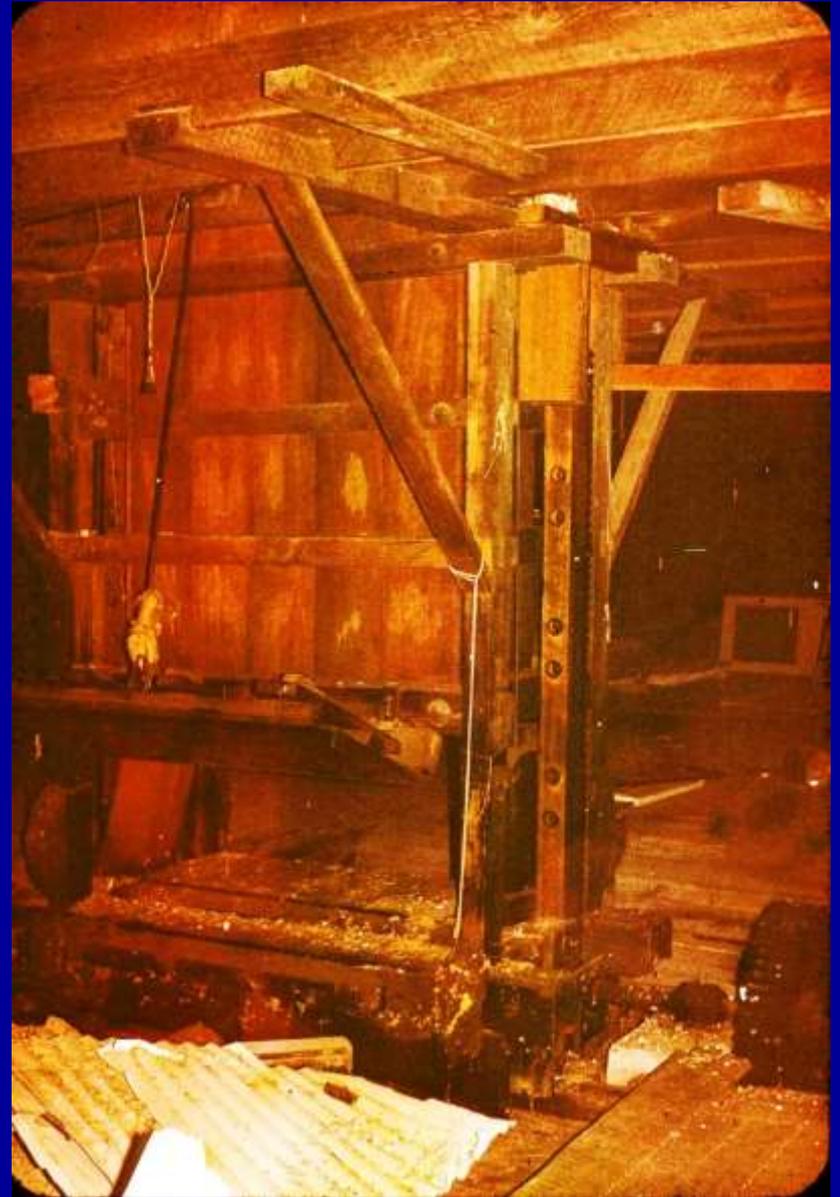


Hop Kiln
Winery



**Cooling
hops after
drying, prior
to bailing**

Old hop bailers



Old hop bailer



Bailed hops transported to RR



Good Market – Good Prices

33 CTS. OFFERED FOR HOPS NOW

Ukiah Reports a Number Sales Thursday at Thirty-two and a Half Cents Per Pound—Condition of the Market Here Thursday.

Friday

Aug 17/1917

Thirty-three cents per pound was offered for hops in this city on Thursday. This is the top notch price so far this season and in a little over two weeks the price has jumped from fourteen and a half cents to thirty-three. And the growers believe the price will advance still higher. "Watch 'er climb," said one grower on Thursday.

The following sales were made on Thursday at Ukiah:

E. L. Cunningham, 100 bales; Bert Johnson, 150 bales and Joe Cunningham and Charles Crawford, each 100 bales, at thirty-two and a half cents.

1917

Friday Morning.....July 18, 1919

40,000 POUNDS OF HOPS SOLD BY GRACE AT 52 1-2 CENTS LB.

Biggest Price Paid This Season for 1919's, and Indications Are That the Price Will Still Further Advance — Lucky Growers Who Still Have Hops to Sell.

Frank P. Grace on Thursday sold forty thousand pounds of his crop of hops of the present year. He sold at the highest price yet paid in Sonoma, fifty-two and a half cents. This little transaction foots up in the neighborhood of \$32,000. So it is quite a nice little day's business for Frank P. He has still a snug lot to sell at

1919

SUNDAY, DECEMBER 7, 1919

SIXTY CENTS OFFERED FOR 1920 CROP OF SONOMA HOPS

When 1919 hops passed 35 cents, and when contracts were made for 1920, 1921 and 1922 crops at 45, 75 and 25 cents per pound, there were many who shook their heads and declared it couldn't be true.

Just to show that it was not true, contracts began to be made for the next three years at 50, 40, 30 cents.

But today it became known that still another record had been broken, and that several contracts were being offered by buyers for 50, 60 and 60 cents for the next three years' production.

There are movements in the hop world that the general public is scarcely getting glimpses of, indications for the first time in the history of the industry, a real profit to the growers.

An example of these movements was the visit to Ukiah three last week of a man with \$200,000 to invest in a hop yard.

The action of Mendocino county growers, as announced yesterday, to refuse shipment of hop roots for further plantings which might break the price, is another indication of the trend of the times.

1920

Great Prices \$ \$

THE PRESS DEMOCRAT, SANTA ROSA, CALIF.

NOV 15 1919

HOPGROWERS ARE NOW AT PINNACLE OF PROSPERITY

Democrat

NOV 11 1919

Local Market Price for 1919 Crop Reaches 85½ Cents, and Contracts Are Being Made for 1920 Crop at 52½ Cents, With Contracts for Three Years, 1920-1921-1922, Being Signed for 45, 40 and 35 Cents Per Pound; Condition Is Unprecedented.

Hop growers a year ago were fearful that with the country going dry their business would be ruined and one of California's industries wiped out of existence. Today, with war time prohibition in force and with federal constitutional prohibition soon to become a reality, hop growers are being offered as high as 45 cents for next season's crop, 40 cents for 1921 and 35 cents for 1922.

Even at these prices the present

from the Wm. P. Slusser hop farm, to be grown by B. F. Steele, and 15,000 pounds to be grown by E. T. Ross. The purchases are to be made by Strauss & Company of London, England, and Steele is to receive 45 cents a pound and Ross, whose contract was drawn up a week later, is to get 45½ cents.

Owners of the old crops held on 1915, 1916, and 1917 have been sold at from 37 to 40 cents. Of the 1918 crop and crops of prior years there are not

G. A. PROGTOR BUYS MENDOCINO HOPS

Local Dealer Pays 50-45-40 Cents for 130,000 Pounds of Mendocinos for Next Three Years.

UKIAH, Nov. 14.—One of the largest hop contracts of the season, which seems to guarantee that the hop growers are going to receive good prices during the next three years, was signed this week by Warren L. Brown and George A. Sturtevant, and disposes of 130,000 pounds of hops for the years 1920, 1921 and 1922. G. A. Proctor of Santa Rosa purchased the hops through local agents.

The contract calls for 30,000 pounds per pound, 50,000 pounds in 1921 at 45 of hops of the 1920 crop at 50 cents, and 50,000 pounds in 1922 at 40 cents.

Higher price for Sonoma Hops

HOP PRICES STILL RISE; 31 1-2 CENT OFFER IS REPORTED

Quotations Advance From 28 to
30 Cents In Sacramento Dis-
trict; Higher in Sonoma
County

Hops are still hopping and since Monday the price has advanced from 28 to 30 cents in this section, according to F. V. Flint, one of the big hop dealers of this valley. Several hundred bales were sold this week at 30 cents. In Sonoma County 31½ cents has been offered this week.

Flint said that although high prices prevail it should not be taken for granted that all of the hop raisers are going to make a fortune. This good fortune comes to those who have held off and have not contracted their crops.

Most Of Crop Contracted.

Fully 85 per cent of this year's crop has been contracted for, the larger portion for 10 and 11 cents, which will barely pull the growers through, on account of the high prices for sulphur, twice as high

Gene
Slusser
trophy
“Best
Hops in
Western
USA”

*1904-1950
prices
ranged from
\$0.4 to
\$1.50 per
pound*



Why the hop industry failed

- **Mechanical harvest reduced labor needs**
 - Hops could be grown in more isolated areas
 - Managing 1000's of people
 - Hand labor related quality problems
- **WA and Oregon – lots of cheap land**
 - Big parcels with lots of cheap irrigation water
- **Better climate with lower humidity**
 - Less P. Mildew and Downy Mildew
- **Farther North Latitude = higher yields**
- **Quality was “relative” for big beer brands**

Florian Dauenhauer's Hop Picker



Old Mechanical Harvesters

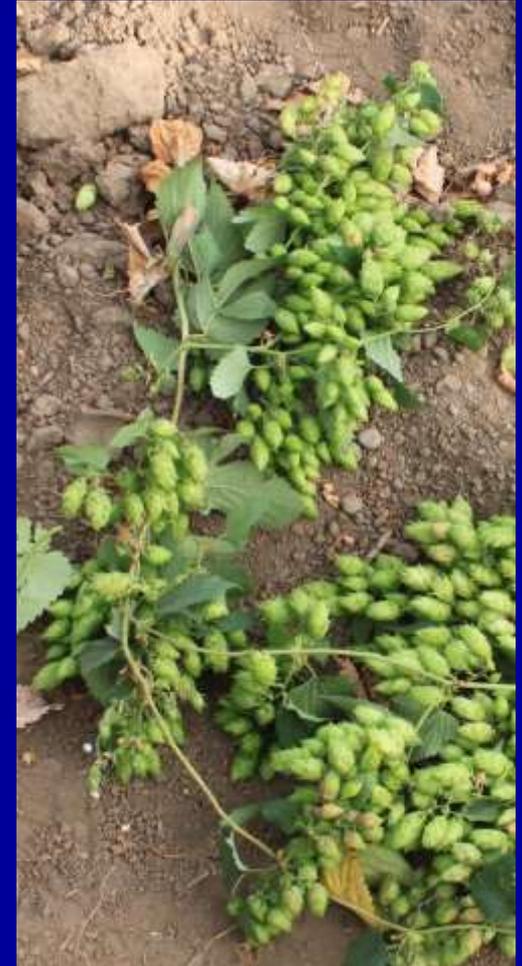


Old Mechanical Harvesters



Basic Mechanisms

Remove cones & separate leaves



Basic Mechanisms

Remove cones & separate leaves



WA-OR cheap, good land



And lots of water in WA-OR



Big Volume



Large scale - volume



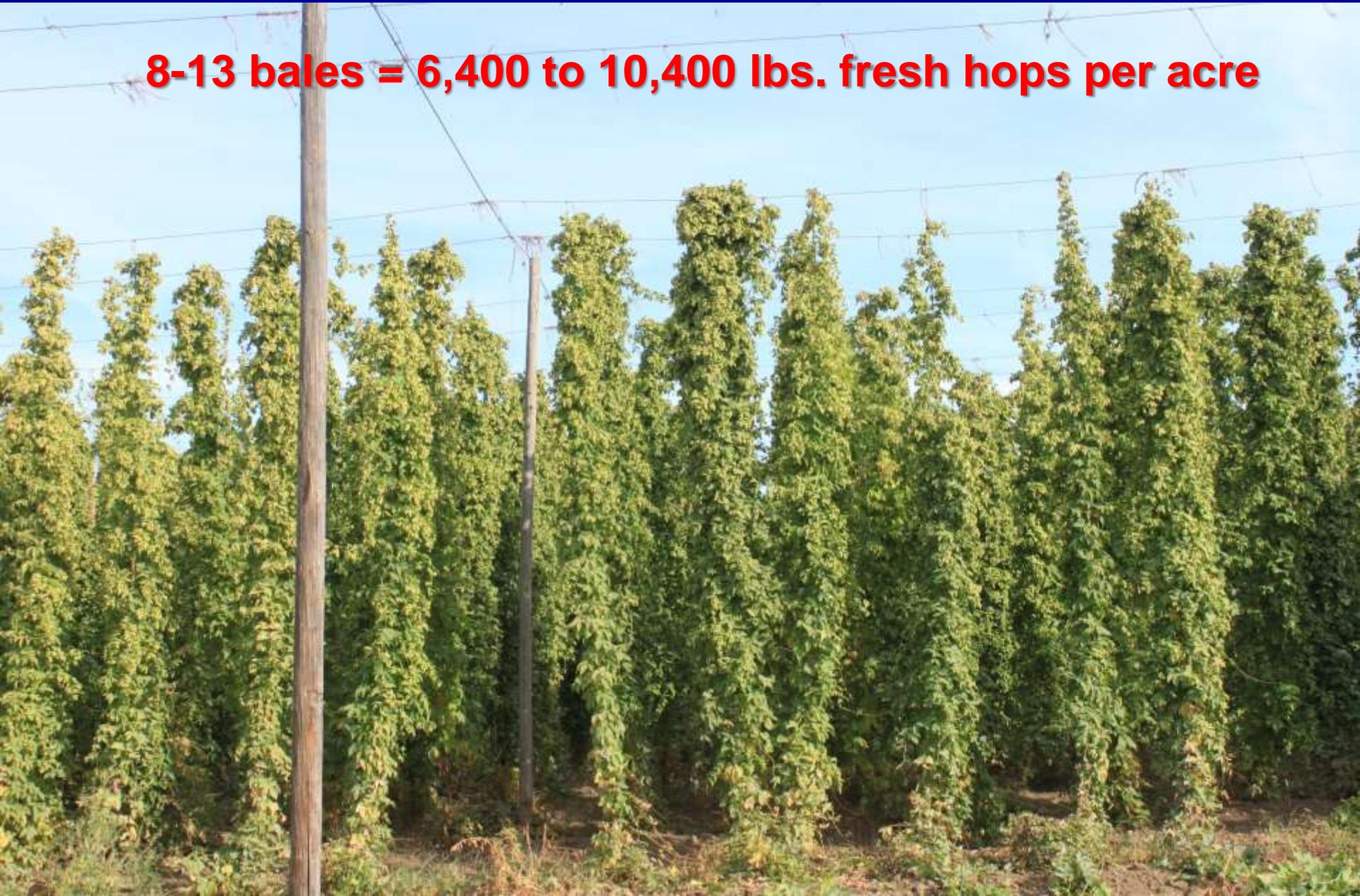
Low humidity – less disease



Mildews were especially bad in Sonoma County next to rivers and low lying, cool fields

High Yields – Far North Latitude

8-13 bales = 6,400 to 10,400 lbs. fresh hops per acre



Demand low & for BASIC hops



**Bobbysockers with the
palates of wimps.**



**“Rosie the Riveter”
considered a well-
hopped beer to be bitter,
heavy, fattening**

HOP PRICE UP TO 20 CENTS

Two Hundred Bales of 1921
Crop Contracted For; Proc-
tor Pays 13c for 1920's.

A contract for 200 bales of 1921 Sonoma county hops was made at 20 cents a pound Saturday, a jump of two cents over one contract made earlier in the week. For two days it had been rumored that 20 cents would be paid if a taker could be found and Saturday the transaction was closed.

George A. Proctor bought a car-load of spots, or 1920 hops, and paid 13 cents a pound for the same Saturday, an increase of half cent a pound advance on an purchase earlier in the week.

It is positively stated that in view of the dirty picking of hops last year that English buyers will make no offers on the coming crop until after it is picked and baled so that they may see just what they are buying. Growers might just as well understand now as any time, dealers state, that there will be no market this season for dirty hops and they must be picked clean.

**Fluctuating prices
Low prices**

**Poor quality
“dirty hops”**

**1921 - English
buyers: No market
for dirty hops**

Crops Lost since 1940-50

- Prunes: 20,000 acres worth \$6 million
- Apples: 14,000 acres worth \$1-2 million
- Hops: 2,800 acres worth \$2 million
- Walnuts: 1,100 acres worth \$800,000
- Pears: 3,000 acres worth \$630,000
- Cherries: 1,000 acres worth \$624,000
- Berries: 670 acres worth \$178,000
- Peaches: 200 acres
- Kiwi: 44 acres
- Figs: 13 acres



Production Statistics

- PNW: 98% of U.S. production
- 2014: 37,000 acres of hops
- WA: 30,000 acres - 74%
- OR: 5,500 acres - 14%
- ID: 3,800 acres – 10%
- 2013: 38% of the world hops from USA
Germany produced 33%



How its done in Yakima WA

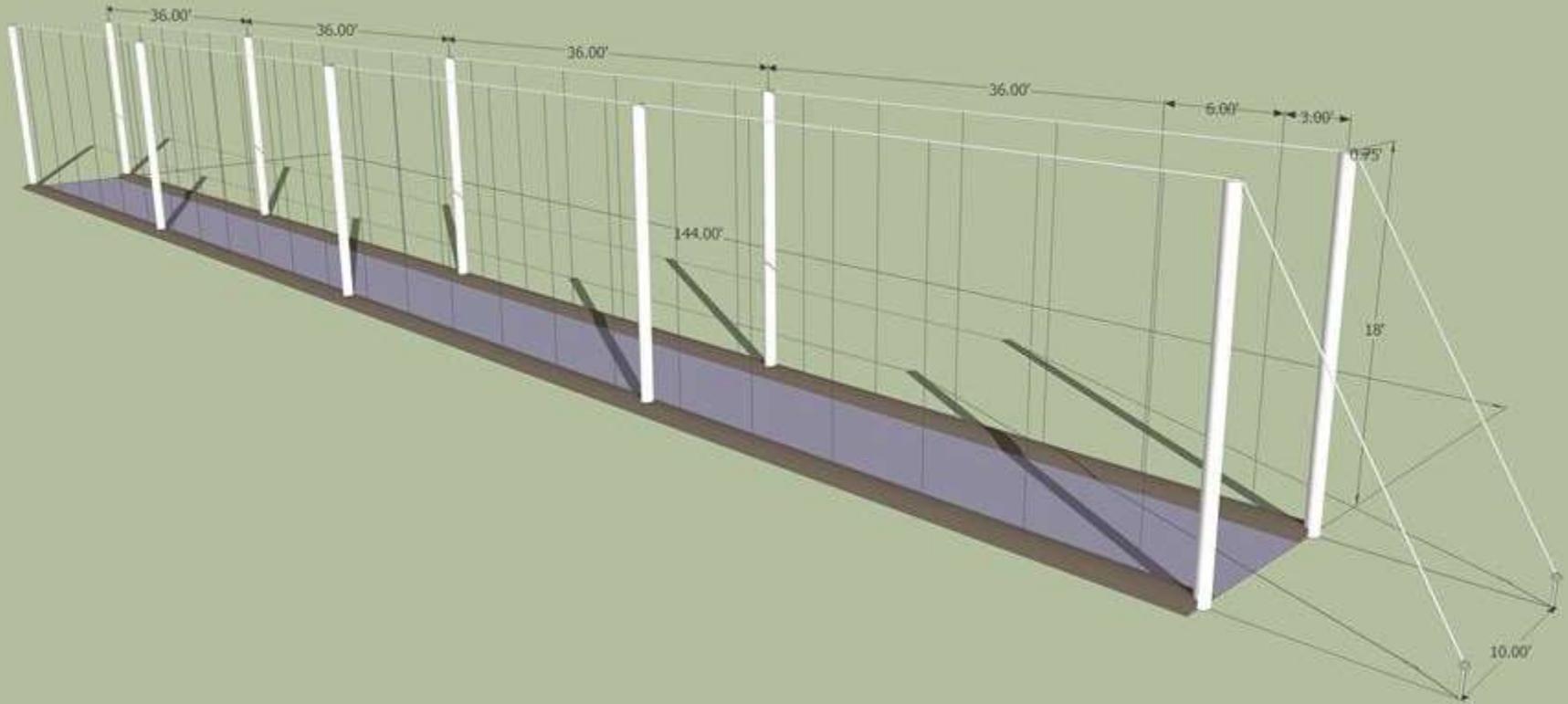


Land Preparation



WSU Cost Study 2010
Disc, subsoil, plow/rototill,
springtooth 2X = \$150/a

Hop Trellis ~ \$3,000



2010 Yakima WA Cost Study (per acre)

- 60 poles + 10 anchor poles (12' x 28')
- Holes, anchor material, cable, wire, staples

Poles, cables, wires, dead-men



Poles



Poles soaked in preservative



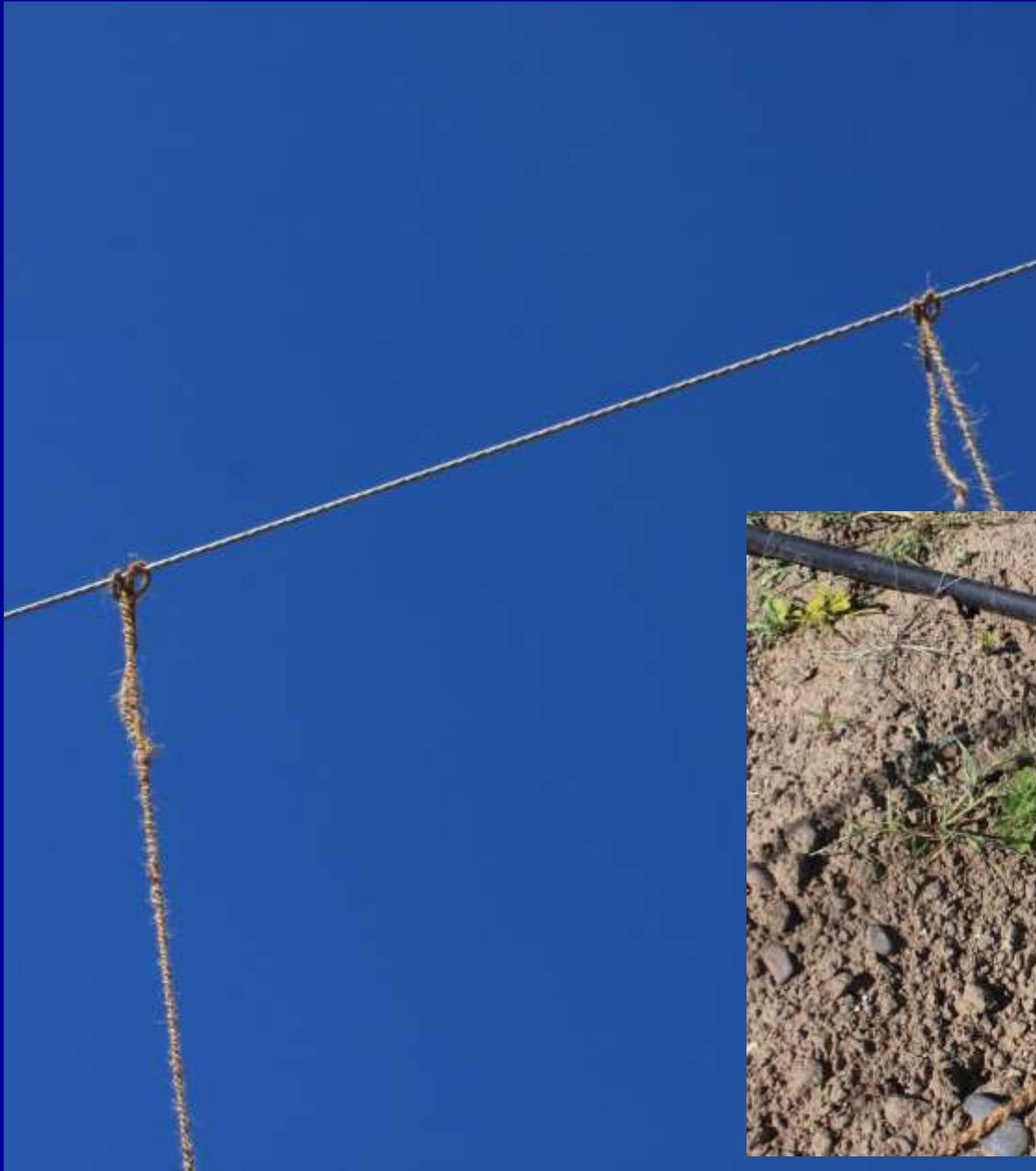
Poles, cables, wires, twine



Tall carts



Cables, twine, hopclip



Training vines onto twine



**WSU Cost Study 2010
4,000 roots @ \$0.20 each
\$800/acre**

Training vines onto twine



Training vines onto twine



Training vines onto twine



Minimal Weed Competition



**Reaches the top
laterals form
Flowering starts**



Primary Hop Pests

- Downy Mildew
 - Powdery Mildew
 - Virus-viroids
 - Spider Mites
 - Aphids
-
- Many miscellaneous
Secondary pests



Hop Diseases - PREVENTION

Sanitation:

- Remove or compost all overwintering plant material
- Trim up lower leaves and side shoots
- Reduce humidity



Hop Latent & Apple Mosaic Virus

Stunts growth and
dramatically reduces cone set

Control: plant certified
virus free plants



Hop Assn. Certification Program



Cleanup Program

For hops currently in the NCPN-Hop cleanup program, [click here](#). Please note: not all hops are available for distribution at this time. Those which have been verified as free of virus have been assigned "virus free numbers" (VF#) and are candidates for distribution; others may still be undergoing testing, therapy, or require formal treatment before they can be distributed.

Hop Sales

Material is offered for sale twice a year:

Limited quantities of potted plants are available starting in January
Sale: limited quantities of unrooted green node cuttings and potted plants starting in June

Information is posted on this site, and in the *USA Hop News* newsletter.

Supply is limited. When this happens, NCPN-Hops will prorate the available material to meet their requests by the established deadline.



Downy Mildew can ruin the crop



P. Mildew can ruin the crop



Healthy



Diseased

**Critical
Control
Period**

**3 weeks
during early
cone
development**

WA P. Mildew infection examples

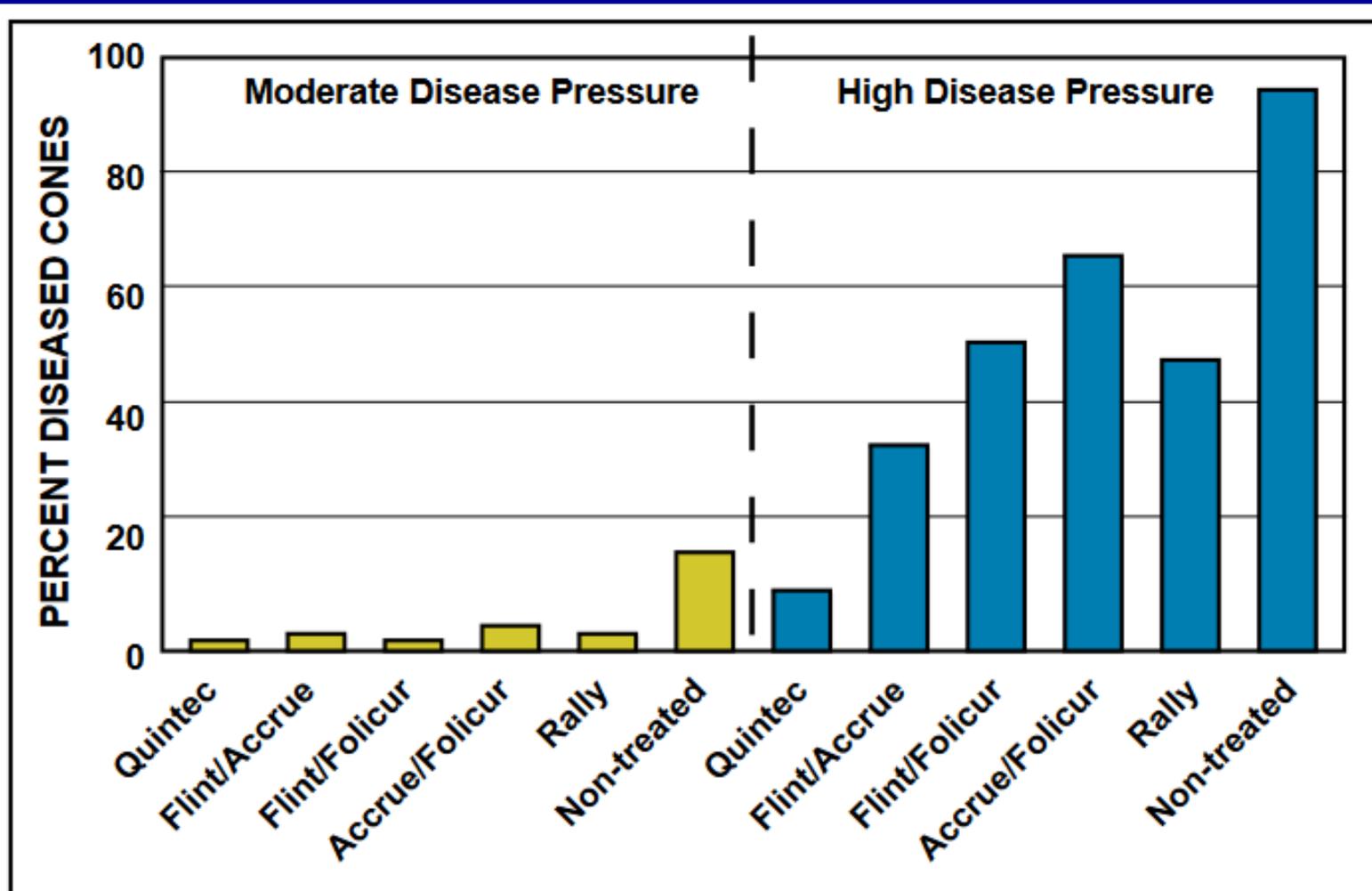


Figure 38. Efficacy of powdery mildew fungicides under moderate and high disease pressure in Washington. Notice that most fungicides provide acceptable control when disease pressure is moderate.

Powdery Mildew



Control:

- Sanitation
- Mod. fertilization
- Mod. irrigation
- Timely fungicide applications

Hop Diseases

(Resistant Varieties)

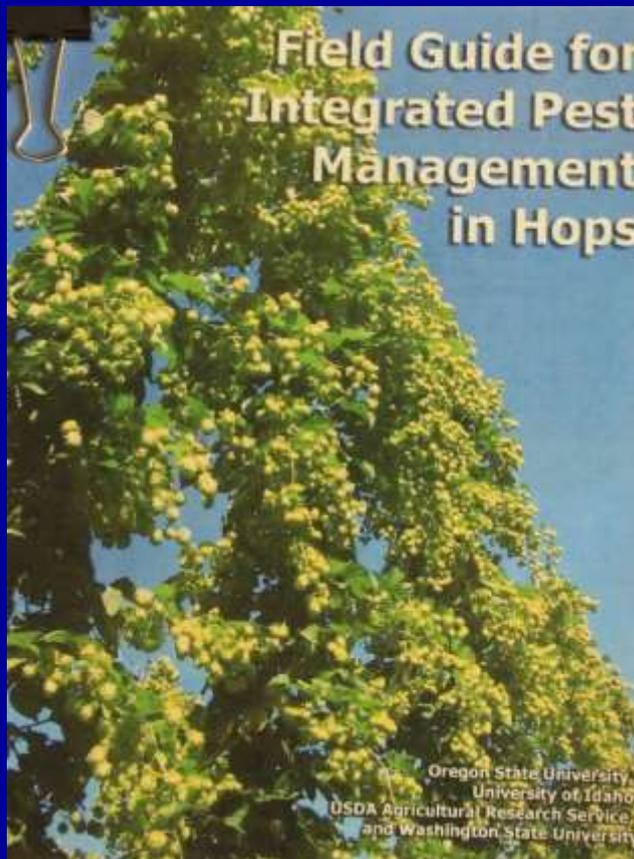


Table 2. Disease Susceptibility and Chemical Characteristics of the Primary Public Hop Varieties Grown in the U.S.

Variety	Usage	Disease Susceptibility*		
		Powdery Mildew	Downy Mildew	Verticillium Wilt
Brewers Gold	Bittering	S	MR	MR
Bullion	Bittering	S	MR	R
Cascade	Aroma	MR	MR	MR
Centennial	Bittering	MR	S	U
Chinook	Bittering	MS	MR	R
Columbia	Aroma	MS	MR	S
Comet	Bittering	R	S	R
Crystal	Aroma	R	S	R
East Kent Golding	Aroma	S	S	MR
First Gold	Bittering	R	S	MR
Fuggle	Aroma	MS	R	S
Galena	Bittering	S	S	R
Glacier	Aroma	S	S	U
Hall. Gold	Aroma	MS	R	S
Hall. Magnum	Bittering	S	R	MR
Hall. Mittelfrüh	Aroma	MS	S	S
Hall. Tradition	Aroma	MR	R	MR
Horizon	Bittering	MS	S	MR
Late Cluster	Aroma	S	S	R
Liberty	Aroma	MR	MR	U
Mt. Hood	Aroma	MS	S	S
Newport	Bittering	R	R	U
Northern Brewer	Bittering	S	S	R
Nugget	Bittering	R	S	S
Olympic	Bittering	S	MS	R
Perle	Aroma	S	R	MR
Pioneer	Bittering	MR	MR	U
Saazer	Aroma	S	MS	S
Saazer 36	Aroma	S	MS	S
Spalter	Aroma	S	R	MR
Sterling	Aroma	MS	MR	U
Teamaker	Aroma	MR	MR	S
Tettnanger	Aroma	MS	MS	S
Tolhurst	Aroma	S	S	U
U.S. Tettnanger	Aroma	MS	MS	S
Vanguard	Aroma	S	S	U
Willamette	Aroma	MS	MR	S

Hop Downy & Powdery Mildew

- PM favored by rapid plant growth
- Both like mild temperatures (47-82°F)
- Both like high humidity
- DM likes 24 hours of wetness
- Not the same as PM of grapes

Hop Insects

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Chart of Seasonal Development for Key Groups of

Predatory Arthropods 61

Aphids

- Reduce Nitrogen
 - Soaps
 - Oils
- Selective conventional pesticides



Spider mites

- Monitor weekly for economic threshold
- Reduce Nitrogen
 - Reduce Dust
- Selective miticides
 - Avoid using conventional insecticides that kill natural enemies



Yakima Hop Harvest

- Most common: Haul bines to processor
- Carpenter Ranch: Haul hops and leaves to processor without bines and twine
- Remove cones by raking whole long bine
- Remove cones by chopping & raking
- Clean cones from leaves with fans and slanted conveyor belts

Carpenter Harvest



Carpenter Harvester



Carpenter Harvester



Carpenter Harvest – hops & leaves



Carpenter Harvest Method



Carpenter Harvest – vine and twine



Harvest with the Vine



Bottom Cutter – 1st



Bottom Cutter – 1st



Top Cutter – 2nd



Top Cutter



Vine Transport



Hop yard after harvest



Hanging vines – cones scraped off



Cutting up bines



Rotating wire “rakes” knock off cones



Chopped up – raked vines

A large pile of chopped-up green vines and leaves is shown on a dark surface, likely a tarp or a large sheet. The material is densely packed and appears to be the result of a raking or chopping process. The leaves are mostly green with some yellowing, and the stems are thin and fibrous. The pile is situated on a dark, possibly black, surface. In the background, a concrete curb and a metal railing are visible, suggesting an outdoor or semi-outdoor setting. The overall scene is a close-up view of the waste material.

With lots of leaves
and debris



**Cones
separated on
multiple
slanted
conveyor
belts**

Slanted conveyor belts



Fans blow out leaves



Clean cones bound for dryer



Yakima Hop Processing

- Drying: 128-160°F for 6-8 hours < 10% H₂O
- Cooling: ~ 12-24 hours conditioning
- Bale dried hops: 200 lb. bales
- Storage: bales kept at 28°F
- Pelletize: crushed and pressed
- Extract: CO₂ Extraction Process
- Fresh hops: Transport: fresh hops in 1/2 size field bins in refrigerated trucks

Dryer beds – 3 ft. deep



Hops dried to 8% moisture



Dry hops cooled and bailed



Bailing



Bales stored (28°F)



Random samples
taken from bales

Why not hops again ?

- **They grow just fine here**
 - Yields may not be quite as good, but
 - Mechanical harvesters are available
- **Diseases & Insects are manageable**
- **Drip irrigation technology**
- **“Locally Grown” is a marketing bonus**
 - Lots of specialty microbreweries here
 - Strong interest in fresh hops
 - Fresh hops are expensive to ship
- **Quality of fresh hops is likely better**

Small-scale growing



Mike Stevenson
Sebastopol

Small-scale hop growing

Posts, cable,
turnbuckles,
anchors, drip
tubing, cement,
twine for 105 x 40 ft
(0.10 acre)
175 hop plants



Hop Basics (*Humulus lupulus*)

- Climbing perennial (bine) with storage roots
- Dies back winter – regrows from crown in spring
- Growth and flowering influenced by daylength
- Male & female flowers on separate plants
- Only female plants grown (males rogued out)
- Seeds are “undesirable” – add weight
- Plant flourishes with good nutrition & water
- Susceptible to many diseases and insects
- Flowers – “cones” with many scales in clusters
- Lupulin: yellow granular oily resin = flavor
- Resin acids: Alpha & Beta = bitterness
- Oils: volatile aromatics

Growing hops

- **Site: full sun & well drained soil**
- **Spacing 2-5' in row – 7-14' between rows**
- **Yakima: 3.5' x 12' = 1,037 crowns/acre**
- **Plant ~ 4,000 roots/acre (3-4 per hill)**
- **22' Poles: 60-130/acre + 10 anchor poles (12'x28')**
- **Buried 3-4 ft. with DM anchors (+ - cement)**
- **Drip irrigation system (~ \$1,500/acre)**
- **Prune crown in late winter/early spring**
- **Train 2 vines/string – 4-6 per crown**
- **50% yield year 1 – 80% year 2 – 100% year 3**
- **Fresh yield: 65-80% H₂O ~ 4-6,000 lbs/acre**

Fresh Hops

- Very perishable (quickly compost & mold)
- Remove field heat ASAP (forced air cooler)
- Cold storage at 33-34°F – shallow crates
- Keep 48-72 hours



Used Wolf Harvester \$25,000



Used Wolf Harvesters 2015

140/170 7 drum upgrade	\$25,500.00
220	\$40,000.00
280	\$45,000.00
400	\$125,000.00
Pellet mill w vac bagger	\$85,000.00
Drying floor w heater	\$7,500.00
Baler	\$6,500.00

Glen Fuller

Rising Sun Farms

North American Hop Equipment LLC

16540 Grange Road

Paonia Co 81428

970-209-8684

organichops@rof.net

<http://www.coloradoorganichops.com/>

<http://www.wolfharvester.com/>

Wolf Hop Harvesters and other Hop Farming Equipment

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Home

Offer

Hop Pickers Export

Wolf Hop Harvesters

Hop drying floors

Carp cleaners and carp cutters

Other equipment



SC Economic Dev. Board Report

- Sonoma County 2014: 23 craft breweries, 11 craft distilleries, and 7 craft cideries
- Craft brewing industry's economic impact \$169,000,000 in 2013 (*most current data available*)
- 37.4% increase from 2012.
- Raw materials represents the largest overall supply cost
- Interest is high for locally sourced products

Beer Goes Trendy

Up to Sonoma Where Something New Is Brewed

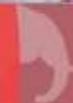
Still best known for its wines, northern California's Sonoma County has a burgeoning beer scene that is drawing a growing crowd



BEST INSIGHT YOU NEED



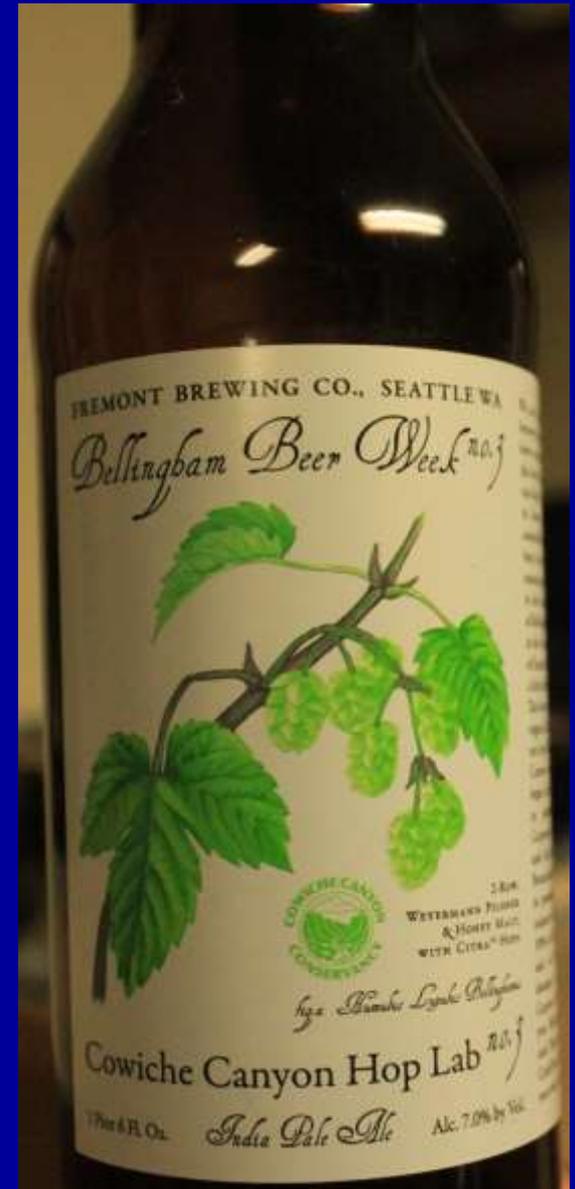
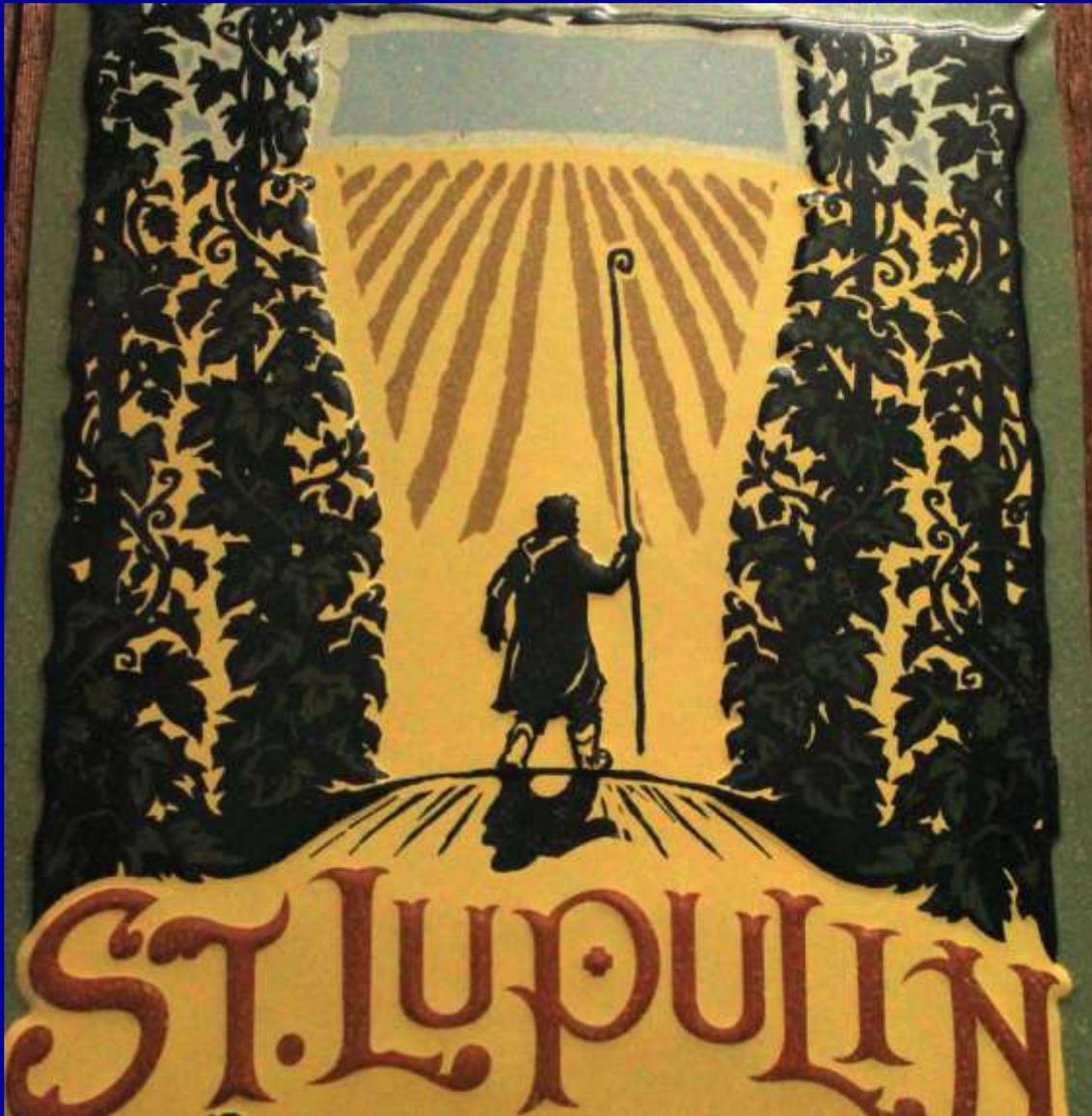
SPECIAL ELECTION PACKAGE \$1 PER WEEK



THE WALL



“Sophisticated/Differentiated” Beer



Labeling Beer with the Hop Varieties



BALE BREAKER BREWING COMPANY



FIELD 41 PALE ALE

4.5% ABV 38 IBU

Don't be fooled by the powerful hop aroma of Field 41 Pale Ale. Heavily dry-hopped with Simcoe® and Ahtanum™, this perfectly sessionable Pale Ale drinks easy with a smooth bitterness and is named for the hop field that is home to Bale Breaker Brewing Company. Light and refreshing, it's the perfect beer for a day on the river or afternoon on the slopes.



TOPCUTTER IPA

6.8% ABV 70 IBU

Our flagship IPA is a well-balanced yet aggressive West Coast IPA that showcases Yakima Valley hops at their finest. Late additions of Simcoe®, Citra®, Ahtanum™, and Mosaic™ give this beer its complex citrus, fruity, and floral aroma and flavor. Named for a unique piece of farm equipment that removes hop vines from the trellis during the annual hop harvest, Topcutter IPA delivers loads of hoppiness all year long.



BOTTOMCUTTER IMPERIAL IPA

8.2% ABV 100 IBU

Double dry-hopped with homegrown Yakima hops, Bottomcutter IPA may be light in color but is packed with citrus and pine hop character. This Imperial IPA is brewed to finish dry, perfect for the combination of Citra®, Simcoe®, and Equinox hops. As the bottomcutter is a tractor that leads the topcutter through the fields during harvest, this beer will lead to a new appreciation for our valley's hops.



RAGING DITCH DRY-HOPPED BLONDE

5.3% ABV 20 IBU

Named for the maze of irrigation ditches that flow throughout the Yakima Valley's rich farmland, Raging Ditch Dry-Hopped Blonde will quench a drinker's thirst on a hot summer afternoon. While on the lighter side, this summer seasonal is dry-hopped with two exciting new hop varieties. Equinox™ imparts the bright citrus hop notes, while the still-experimental hop variety, HBC344, provides a touch of tropical fruit character.

Going Big Time



Vinnie Cilurzo



A photograph of a hop field. In the foreground, a blue irrigation pipe runs along a dirt path. The field is filled with green hop plants. In the background, there is a wooden structure, possibly a greenhouse or a shed, and some trees.

Our mission is to provide a structured organization for the promotion of local hop growing by sharing research, knowledge, resources, marketing, and a common set of farming principles - recognizing our role as responsible stewards of the land.

NORCAL HOP GROWERS ALLIANCE

NorCal Hop Growers Alliance Members
Sonoma County, California

Fogbelt Brewing Co.



Warm Spring Wind
Hop Farm



Three Disciples
Brewing Co.



Carneros Brewing Co.



Eric Johnson Hops



Hop Growers Alliance Map of Hop Growers



NorCal Hop Growers Alliance Newsletter, December 2015

It's been a big year for the resurgence of hop growing in Sonoma County. The once booming hop growing region is now buzzing with the potential for high-quality craft hops. Warm Spring Wind Hop Farm founder Mike Stevenson planted his first 125 plants after being inspired by local hop farmer and craft brewer Paul Hawley of Fogbelt Brewing Company. It was an awesome learning experience and Warm Spring Wind's first hop harvest yielded some high quality hops.

Mike believed that with so many new craft breweries opening the timing was right to bring hop growing back to Sonoma County. Mike formed the NorCal Hop Growers Alliance to promote and provide mutual support for local hop farmers. Mike and Paul reached out to other potential hop farmers and UC Cooperative Agriculture Adviser Paul Vossen. Mike got in touch with childhood friend Matt Penpraze of recently founded 3 Disciples Brewing out of Sebastopol. 3 Disciples recently earned a hard-won battle to brew on land zoned for agriculture. They are growing their own hops and barley onsite and are an important example of concept that "beer is agriculture."

The first Alliance meeting took place in September, right after harvest. Matt and Mike spent several hours talking with Paul Vossen about history, laws, networking and current market trends. Paul had recently taking a trip to Yakima Valley to research hop growing at the professional level. He had already scheduled a return trip to Washington to learn more about harvest. We left the first meeting feeling inspired and worked to reach out to more potential growers.

Useful Links for hop growers

- Farming and research

- http://msue.anr.msu.edu/news/training_hops

- http://thehopyard.com/wp-content/uploads/2012/06/COState_Soil.pdf
- <http://www.uvm.edu/extension/cropsoil/hops>

- Small scale equipment

- <http://steenlandmanufacturing.com/steenland-hh1000.pdf>
- <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/Hops-Harvester-Factsheet.pdf>
- <http://steenlandmanufacturing.com/steenland-hh1000.pdf>

- Interesting hop growing business model

- <http://gorstvalleyhops.com/>

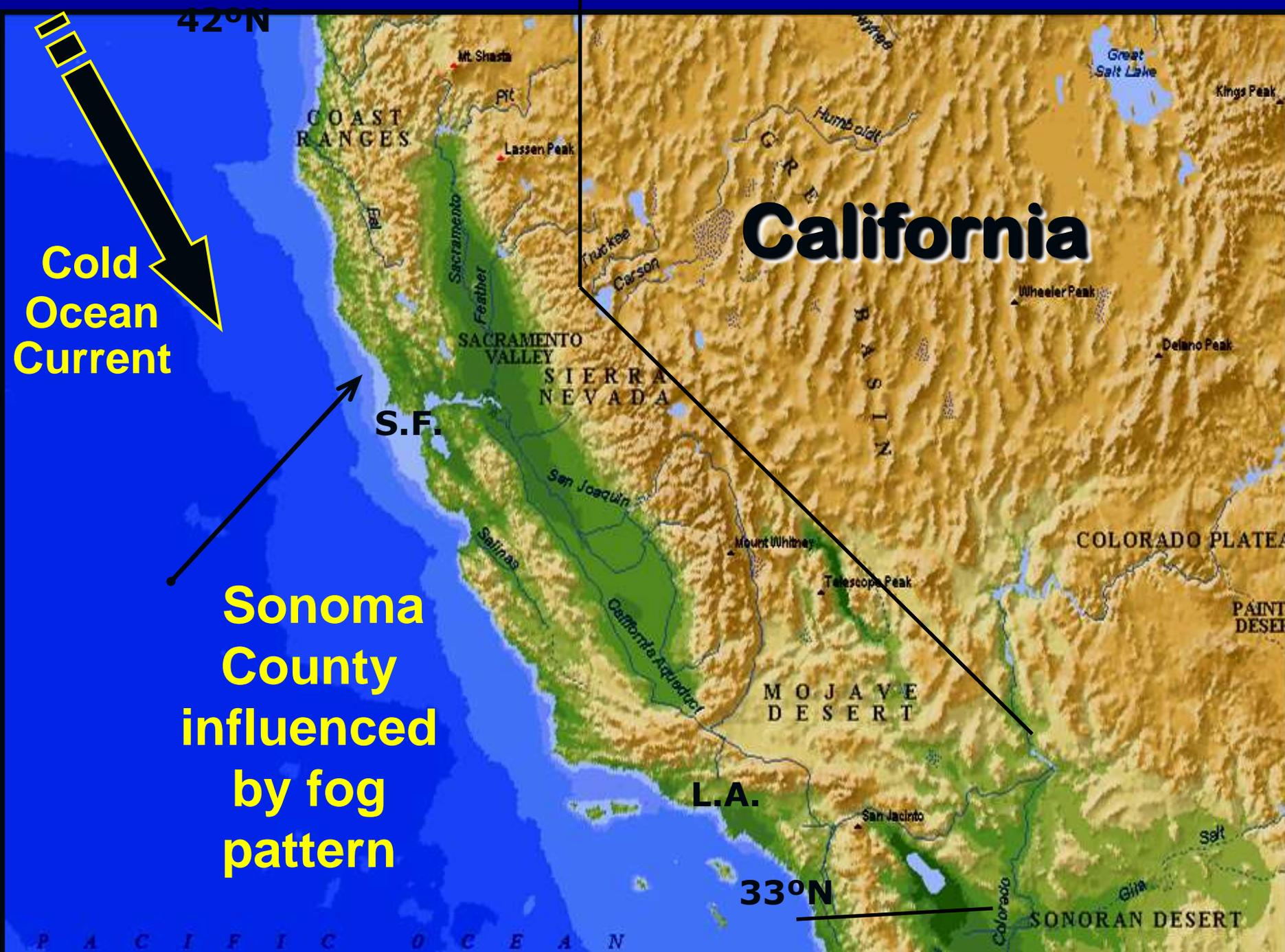
- A growers collective model

- <http://www.northeasthopalliance.org/>

The Specialness of Sonoma

- Natural beauty - diversity
- Climate
- Good soils
- Water
- Clean air
- High quality wine
- Diversity of products





42°N

**Cold
Ocean
Current**

**Sonoma
County
influenced
by fog
pattern**

California

S.F.

L.A.

33°N

P A C I F I C O C E A N

Can beer labeled with “**Locally Grown Hops**” sell at a high enough price to make a profit?



OR
If beer tastes better made from Sonoma County hops



Small Grains *(locally grown)*



Deborah Walton – Canvas Ranch



Deborah Walton – Canvas Ranch North Coast Heritage Grain Alliance



NORTH COAST
**HERITAGE
GRAIN**
ALLIANCE

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WE ARE A COMMUNITY OF GROWERS & ARTISANS

committed to providing California's North Coast region with education and support to build a sustainable local grain economy.

Become a member!



Hop Irrigation

- **Ideal**: base on Evapotranspiration (ET)
 - Drip irrigate every day from May to harvest
 - Increase or decrease hours/day based on temp.
- **General**: 20-30"/season (minus soil H₂O)
 - Loam holds 2"/ft. rooting depth
 - 20-30" = 543,000 to 814,000 gallons/season
 - Hops tolerate drought, but stress ↓ production
- **Critical Times**: spring growth & flowering

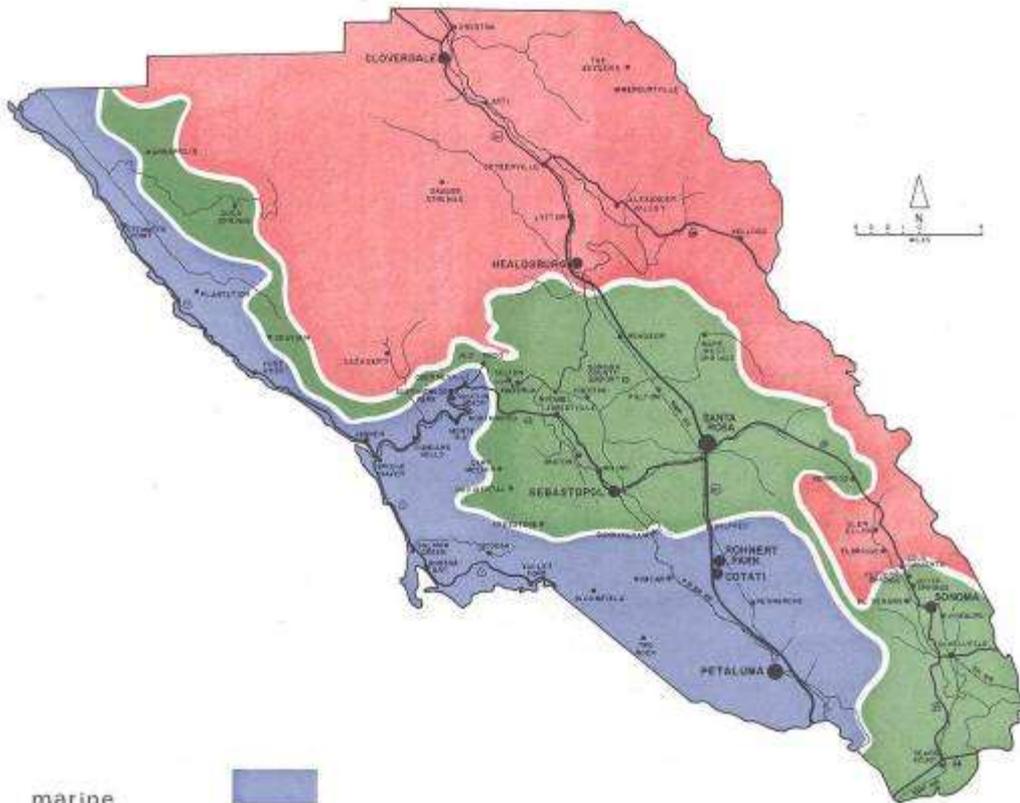




**Sebastopol soil ~ 2 ft. deep underlain
by impervious clay**

Soil holds ~ 2"/ft. = 4 inches of water

SONOMA COUNTY climatic zones



marine



coastal cool



coastal warm



Marine

Coastal Cool

Coastal Warm

Seasonal Water Requirement

April - October (30 yr. average in inches) (Sonoma County)

	<u>Marine</u>	<u>Coastal Cool</u>	<u>Coastal Warm</u>
April	2.8	4.0	4.5
May	2.9	5.8	6.9
June	2.8	5.6	7.0
July	3.4	6.1	7.9
August	3.1	5.2	6.8
Sept.	3.1	4.4	5.7
Oct.	<u>3.1</u>	<u>3.3</u>	<u>3.7</u>
TOTAL	21.2	34.4	42.5

Plant - USE RATE

How Much Water Plants Use

Evapo - Transpiration (ET)

- Evaporation from soil surface = 10%
- Transpiration = 90% cooling of the leaves



Hop Irrigation *(Santa Rosa ET)*

			May	June	July	August	Sept.	Oct.
		ET_o inches/day	0.17	0.20	0.20	0.19	0.14	0.10
		ET_c inches/day	0.13	0.15	0.15	0.14	0.11	0.08
Size	ft²	Plant age	gallons per plant/day					
4	ft²	new	0.6	0.8	0.8	0.7	0.5	0.4
9	ft²	young	0.7	0.9	0.9	0.8	0.6	0.4
25	ft²	mature	2.0	2.4	2.4	2.2	1.7	1.2
40	ft²	mature	3.2	3.8	3.8	3.5	2.7	2.0
43,560	ft²	1 acre solid cover	3,456	4,168	4,139	3,784	2,885	2,037

Hop Irrigation

- Spaced 3x14 ft. (40 ft²)
- Cool spring = 3 gal/plant/day
- Warm summer = 4 gal/plant/day

- Spaced 2x12 ft. (24 ft²)
- Cool spring = 2 gal/plant/day
- Warm summer = 2.5 gal/plant/day

**Hop roots will grow in the entire rooting zone
Most roots are in the top 2-3 feet**

Hop Nutrition Requirements

- Nitrogen: ~ 100-150 lbs. per acre (needs to be in the soil available by end of May)
- Phosphorous: ~ 0-60 lbs. per acre (if soil analysis is >60 ppm = not needed)
- Potassium: ~ 80-160 lbs. (K_2O) (if soil analysis is >200 ppm = not needed)
- pH: 5.0 to 7.0 = no problems (6.0 is perfect)
- Ca, Mg, Mn, Lime: soils above 5.7pH = nothing needed (ratio of 3Ca:1Mg = good)

Hop Organic Nutrition

cover crops, compost, concentrates



Tilled in large biomass of legumes



Till in 3-5 tons/acre in the fall

*CalPhos
or similar
product*



*Feather or
fish meal*



Hop Varieties



Jason Perrault

Select
Botanicals

Brewers

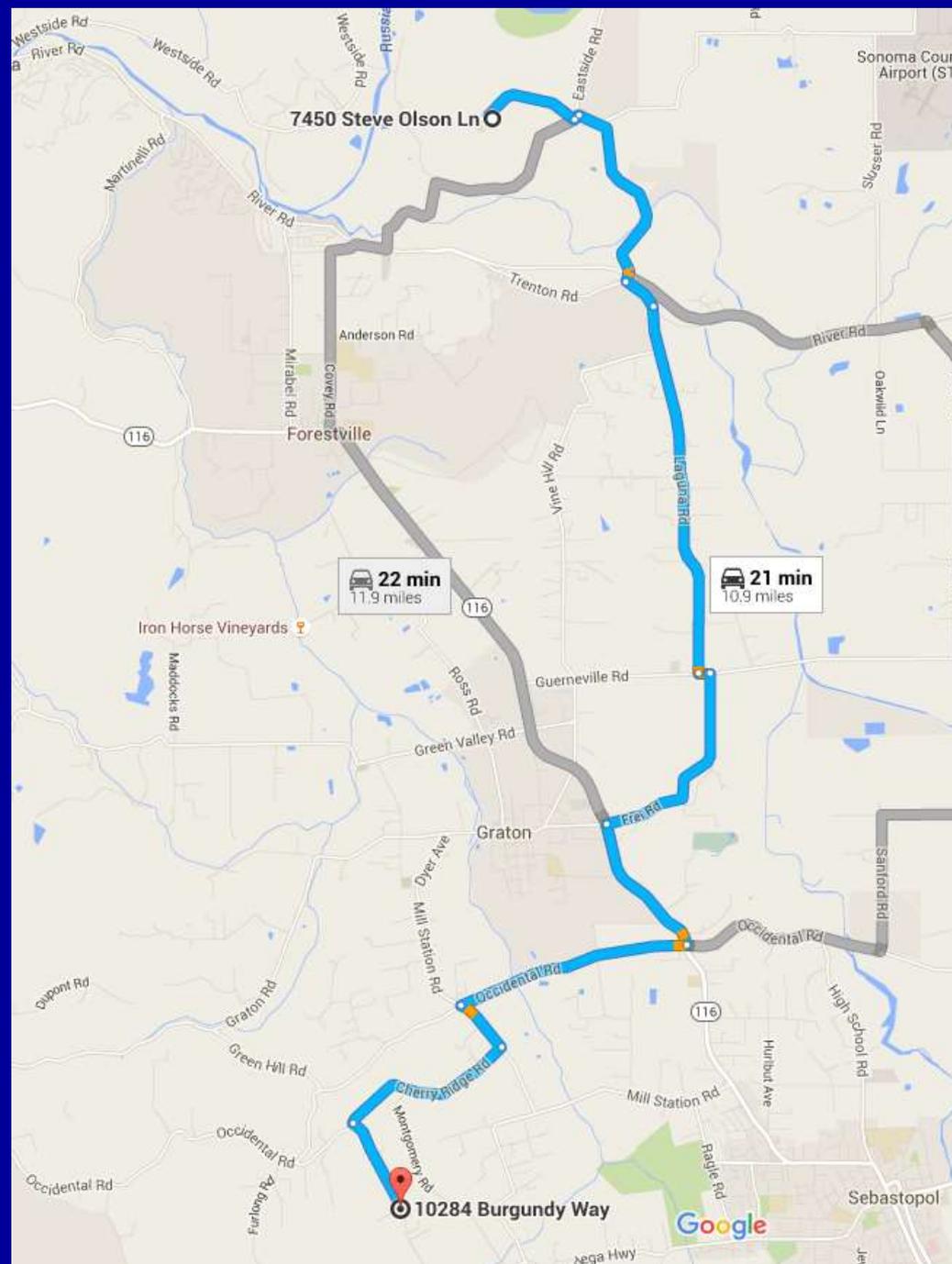
Paul Vossen Specialty Crops Advisor – UCCE (Sonoma-Marin)

<http://cesonoma.ucanr.edu>

pmvossen@ucanr.edu



- SRJC Farm Steve Olson Lane
- Turn left onto Eastside road
- Immediately Turn Right onto Healdsburg Trenton
- Cross River Road – Turns into Laguna Rd
- Dead ends on Guerneville Rd. Turn left
- Immediately Turn Right onto Frei Rd
- Dead ends on 116 (Gravenstein Hwy) Turn Left
- Turn Right onto Occidental Road
- Turn Left onto Mill Station Rd
- Turn Right onto Cherry Ridge Rd.
- Turn Left onto Grandview Road
- Turn Right onto Burgundy Way
- Park only on the left side.



SUNDAY, DECEMBER 7, 1919

SIXTY CENTS OFFERED FOR 1920 CROP OF SONOMA HOPS

When 1919 hops passed 85 cents, and when contracts were made for 1920-1921 and 1922 crops at 45, 35 and 25 cents per pound, there were many who shook their heads and declared it couldn't be true.

Just to show that it was very true, contracts began to be made for the next three years at 50, 40, 30 cents.

Saturday it became known that still another record had been broken, and that several contracts were being offered by buyers for 60, 50 and 40 cents for the next three years' production.

There are movements in the hop world that the general public is merely getting glimpses of, indicating for the first time in the history of the industry, a real profit to the grower.

An example of these movements was the visit to Santa Rosa last week of a man with \$200,000 to invest in a hop yard.

The action of Mendocino county growers, as announced yesterday, to refuse shipment of hop roots for further plantings which might break the price, is another indication of the trend of the times.