Growing Hops on the North Coast of California

Overview - History – Economics - Feasibility

March 26, 2016
Shone Farm

Paul Vossen
UC Cooperative Extension

http://cesonoma.ucanr.edu

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Sonoma County

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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)

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NATURAL RESERVE SYSTEM

CALIFORNIA 4-H YOUTH DEVELOPMENT PROGRAM

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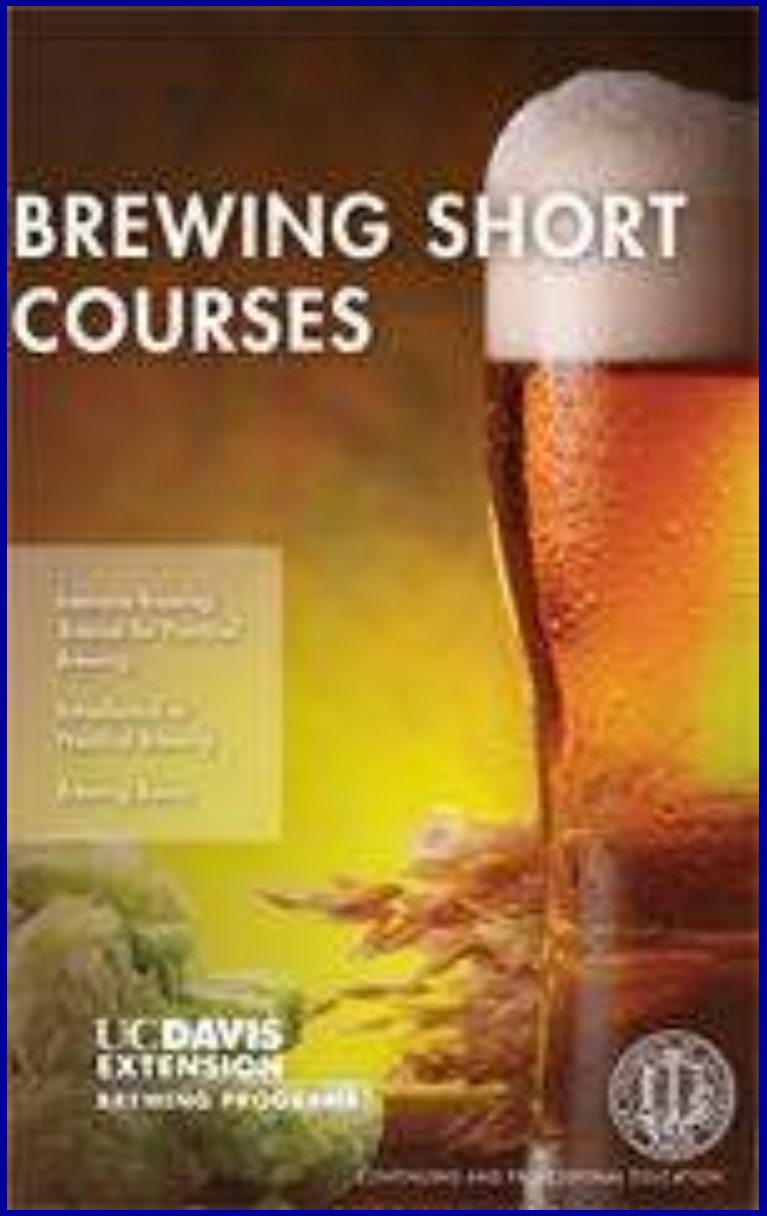
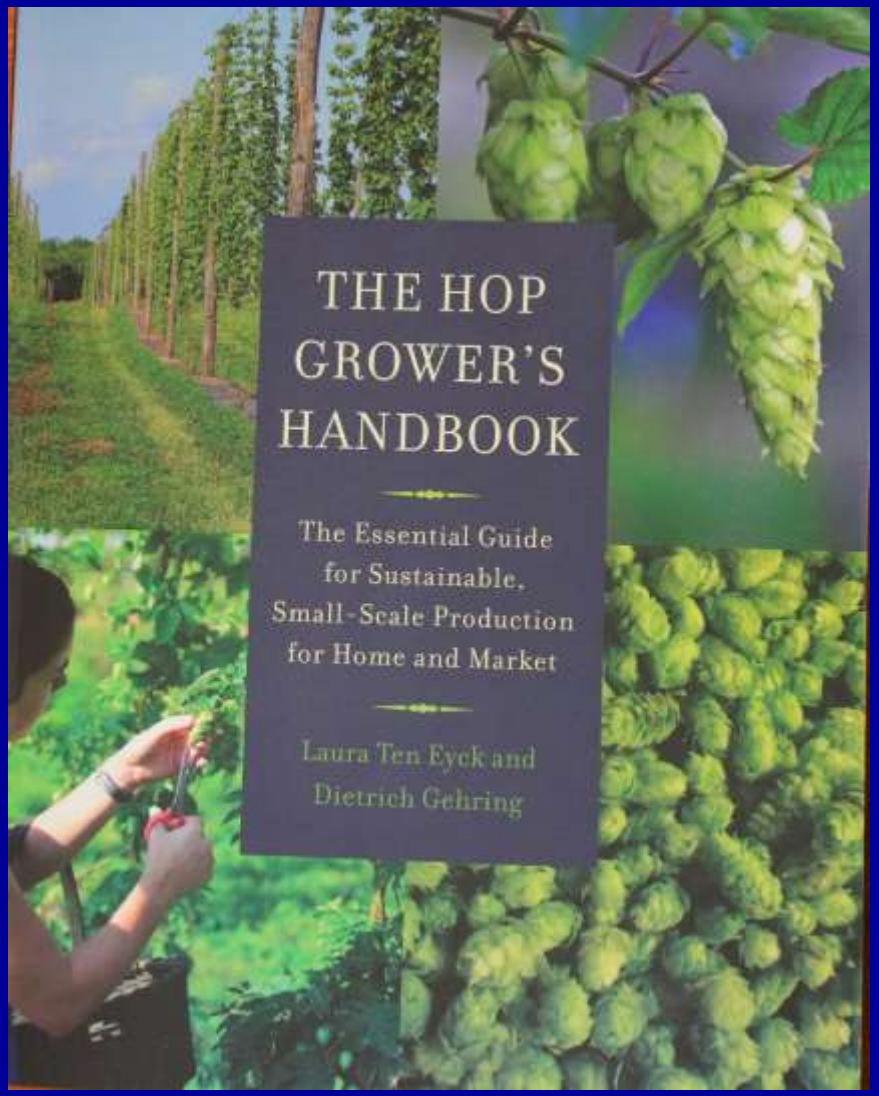
TRY OUR WINEMAKING CERTIFICATE PROGRAM FOR FREE!

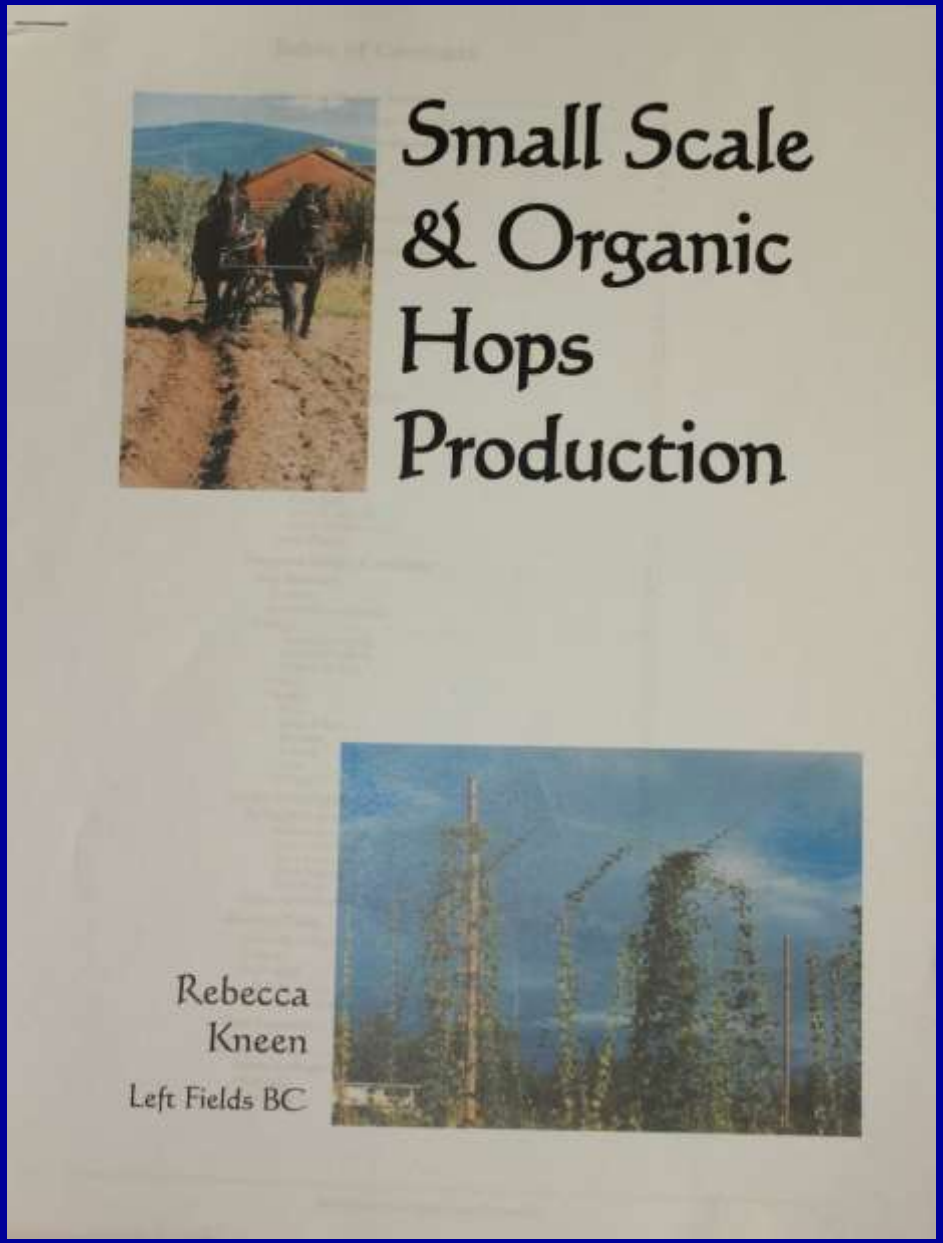
Learn the Science Behind the Art of Winemaking

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

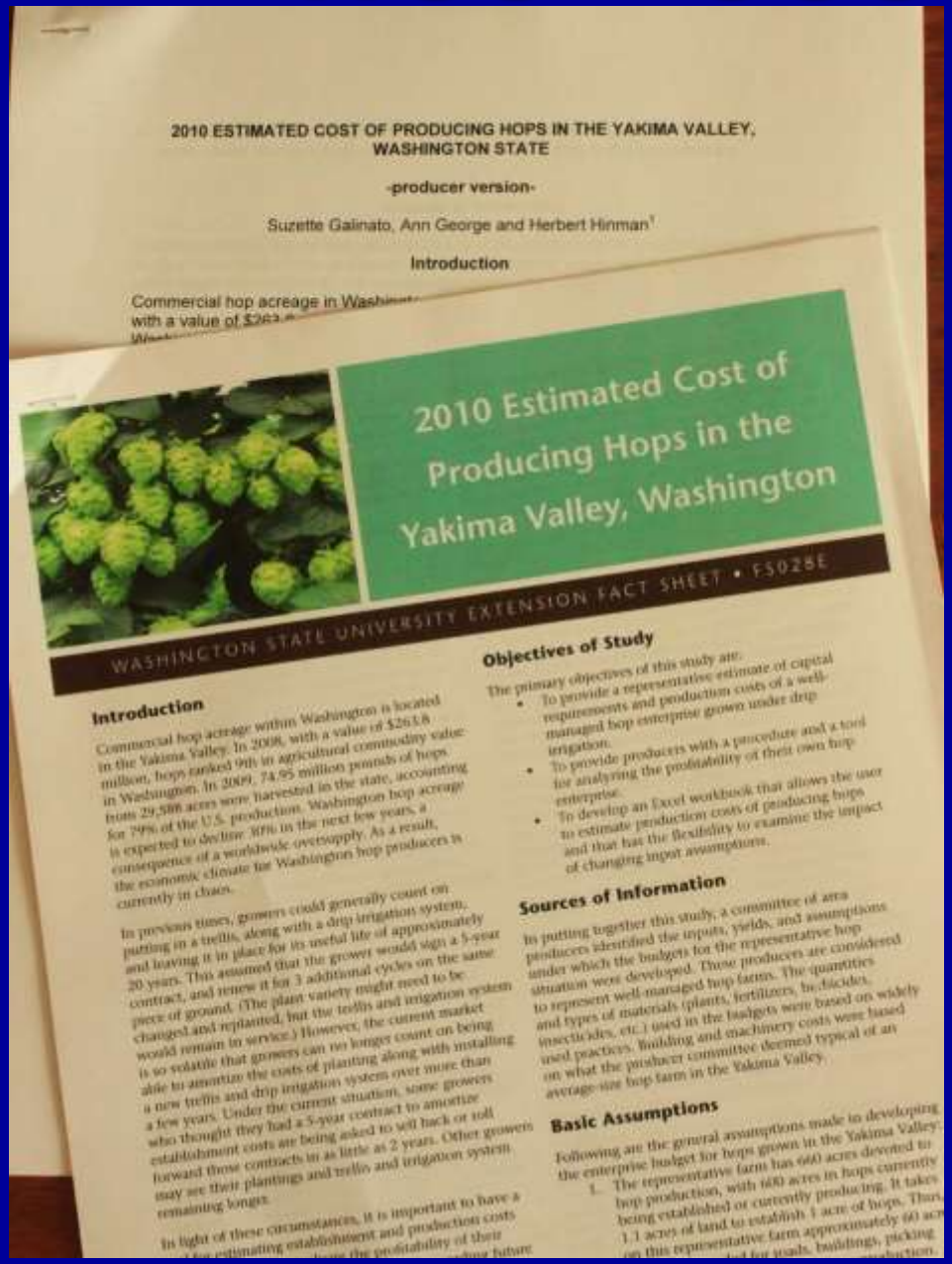


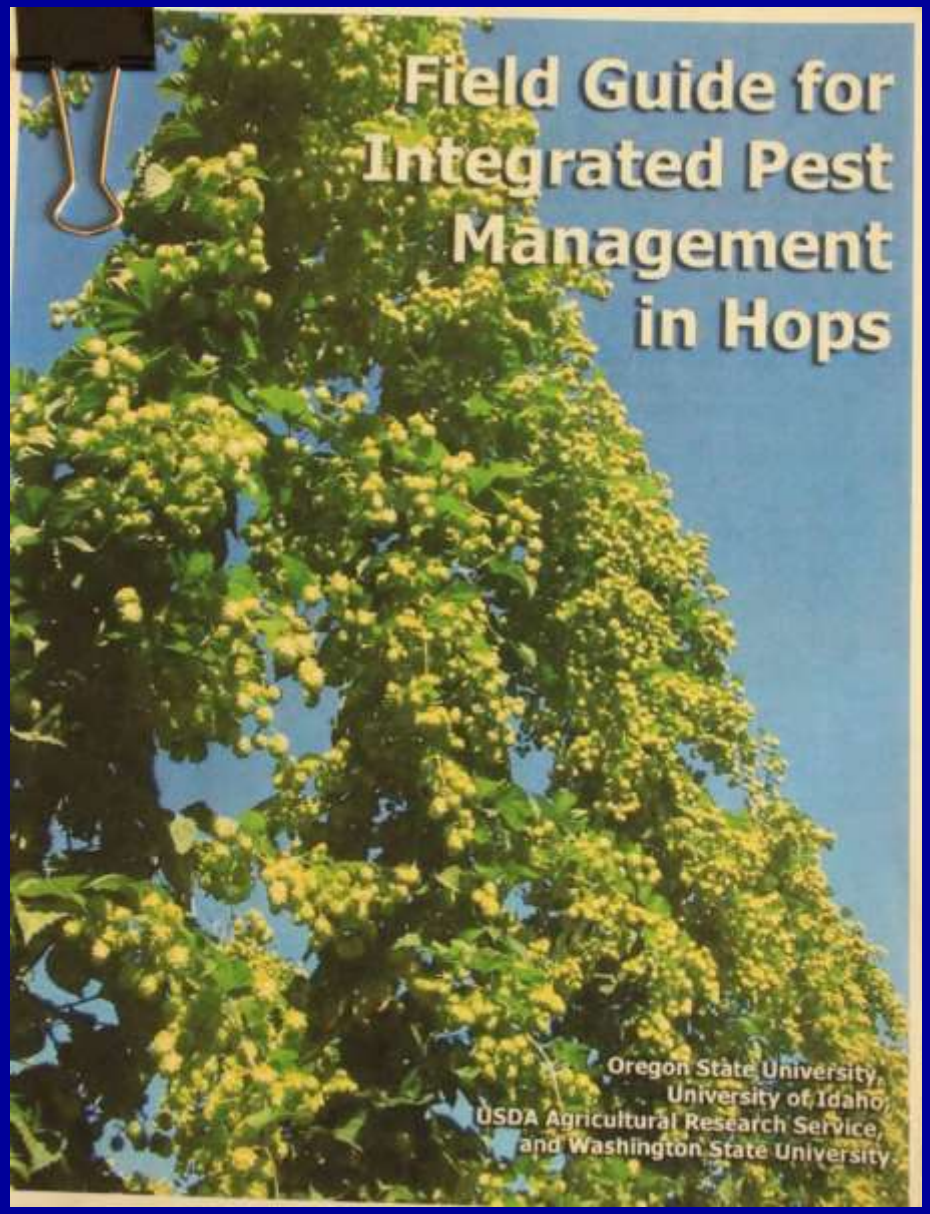
More Information





WSU – OSU Information





North-East Information

Northeast Hops News

2015 Cornell Integrated Hops Production Guide Now Available

The Pesticide Management Education Program (PMEP) at Cornell University is pleased to

May 2015

Northeast Hops News

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

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:

Photo 1

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.

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Email: nancy@oregonhops.org

USA Hops Assn. Varieties

USAHOPS.ORG

Home

HOP INFO | HOP FARMING | STATISTICS | NCPN HOPS | RESEARC

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

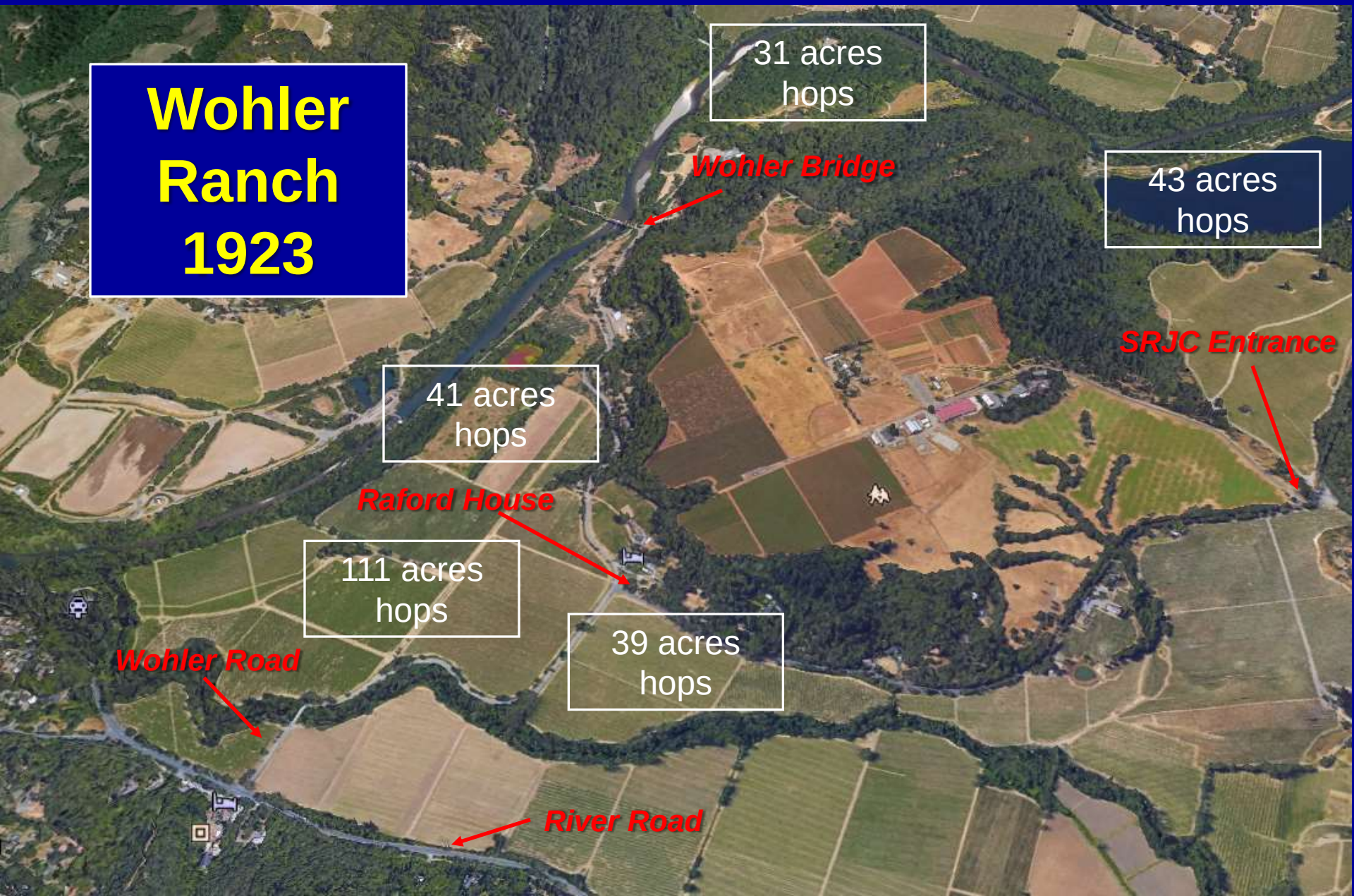
Windsor Museum
Sonoma State Library

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

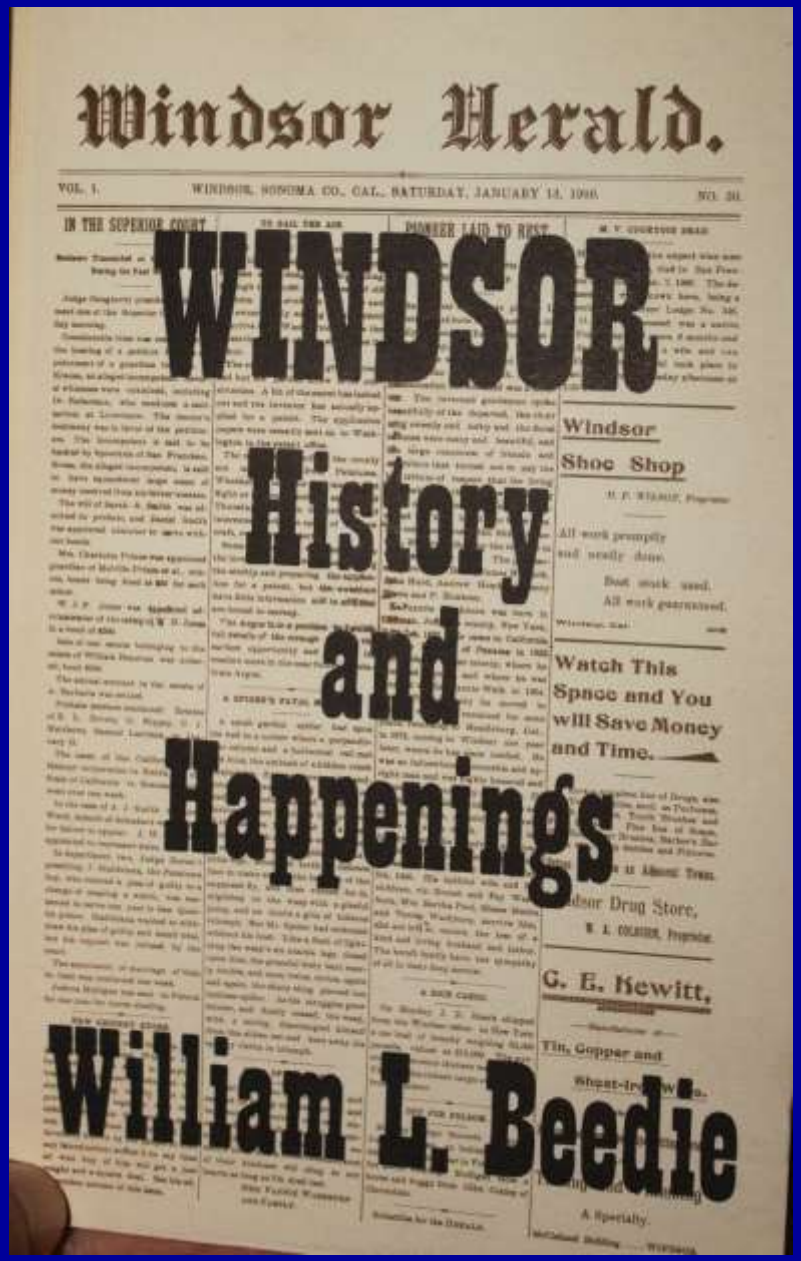
SRJC Shone Farm

SRJC Farm surrounded by hops



Wohler 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

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

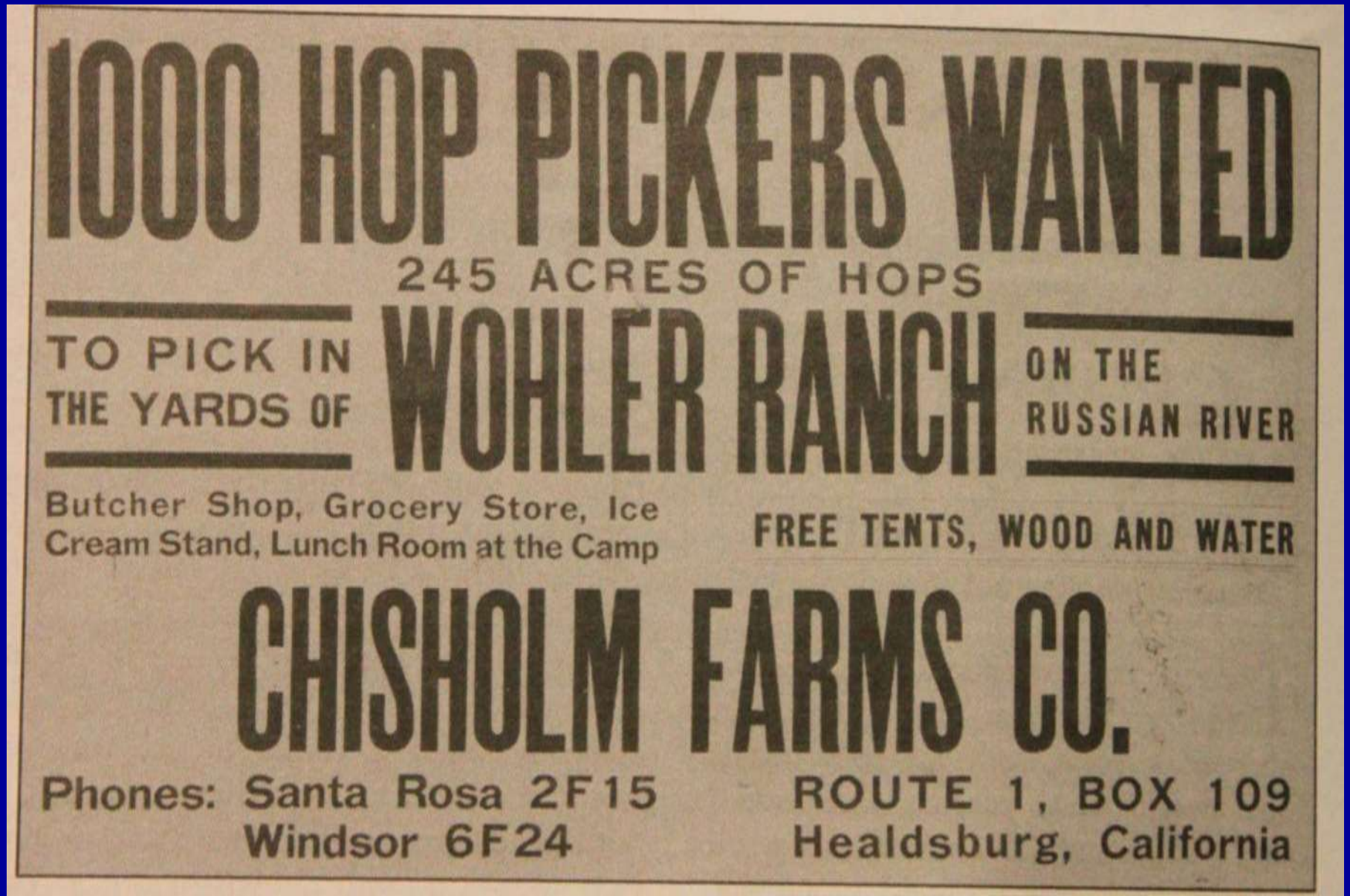
For control of:

- 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 2F15
Windsor 6F24

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.

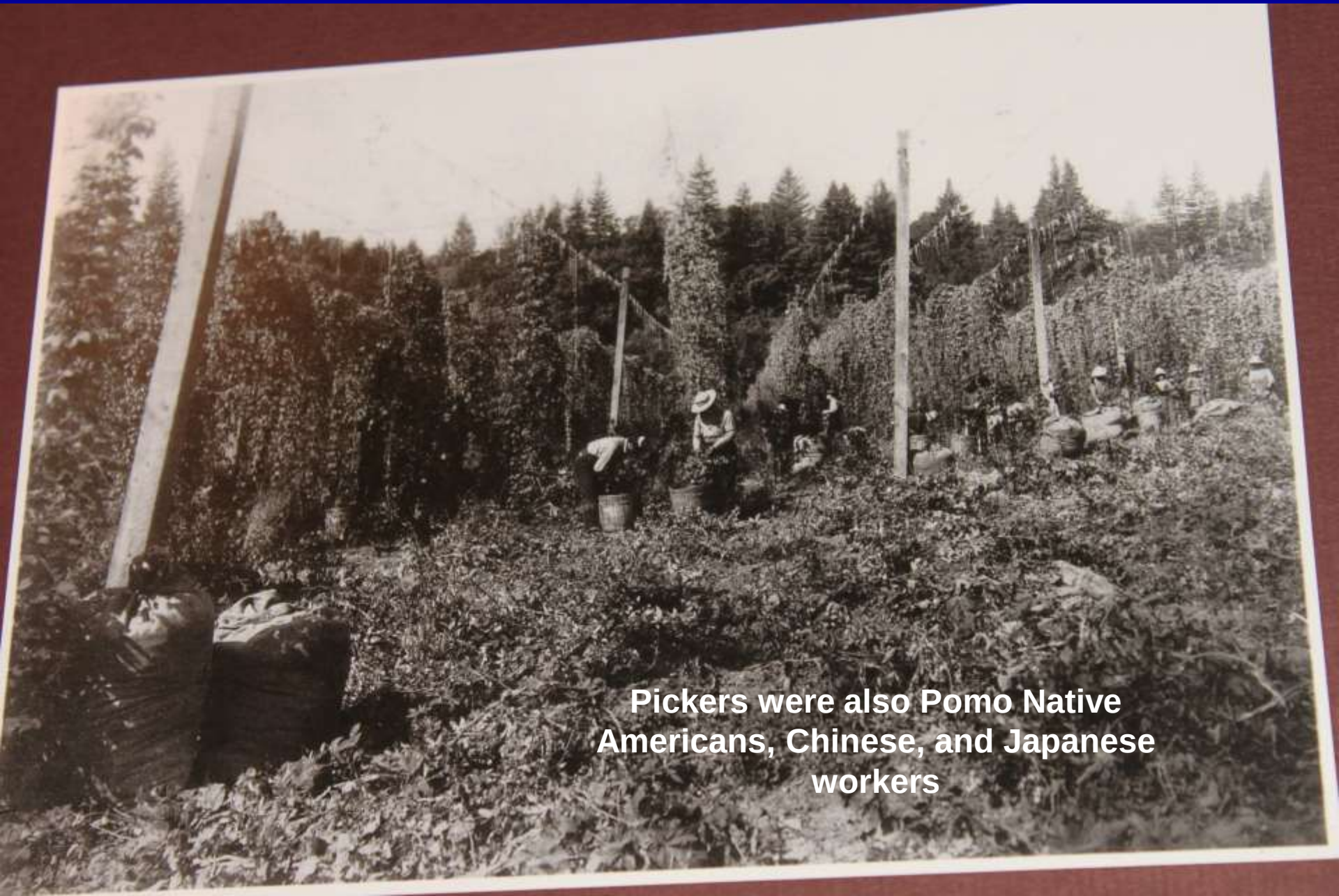
This colony of pickers will be as-

Sonoma County Hand Harvest

Windsor Museum – *Steve Lehmann*

Lorraine Kimes mother, grandmother and aunts – Wohler Ranch

Hand Harvest in Sonoma County

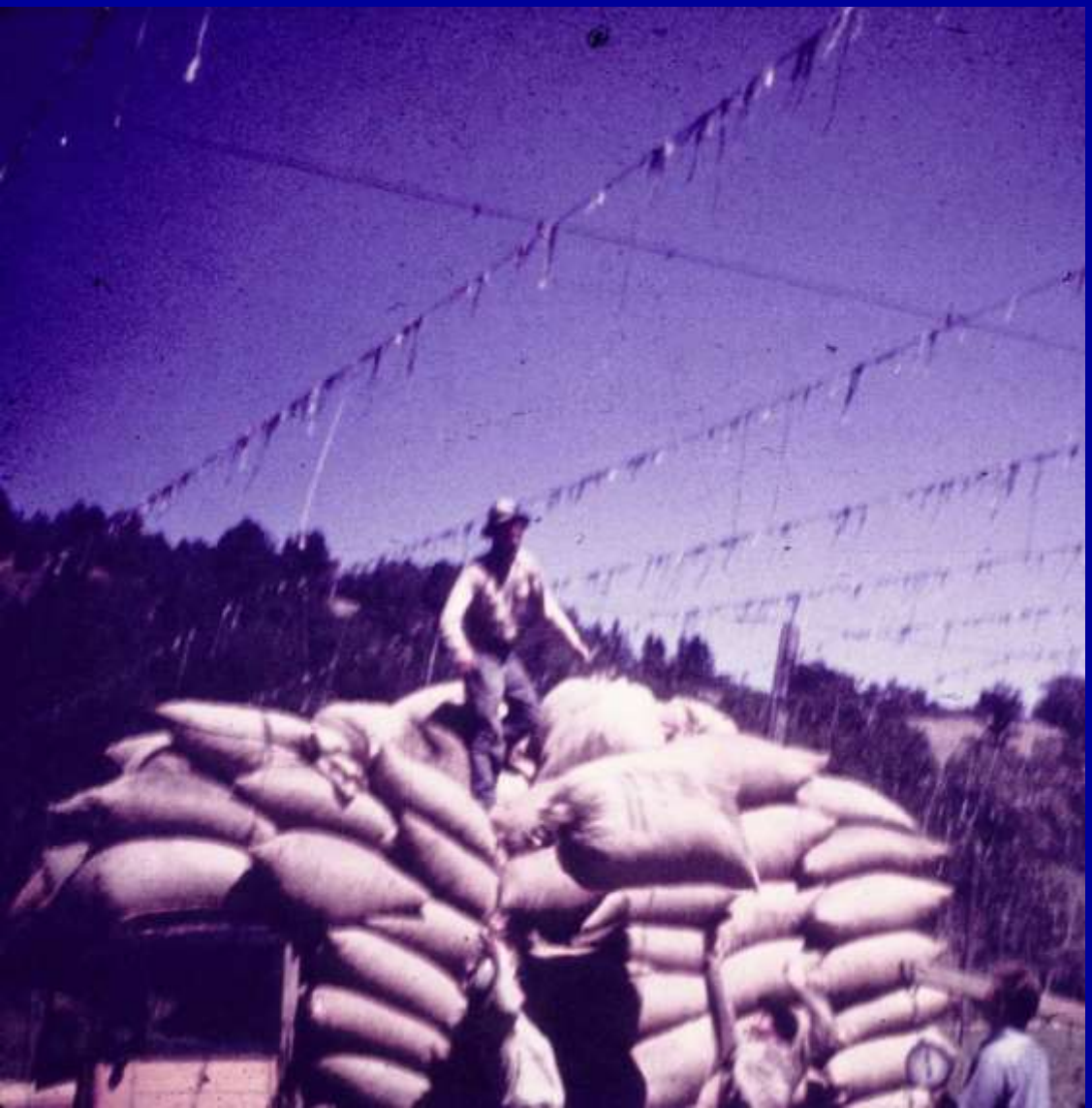


Hand Harvest

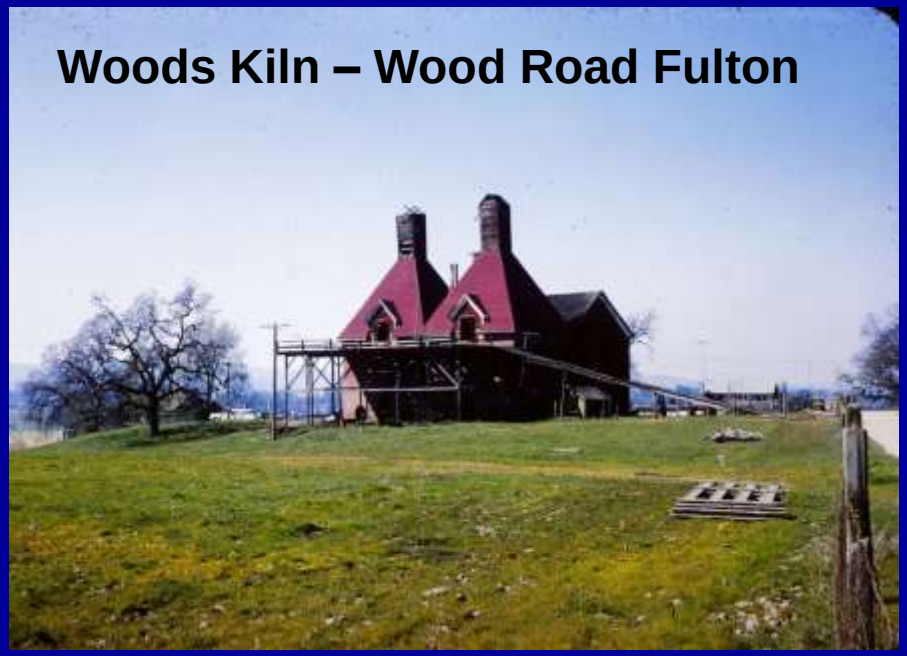
Baskets and Bags

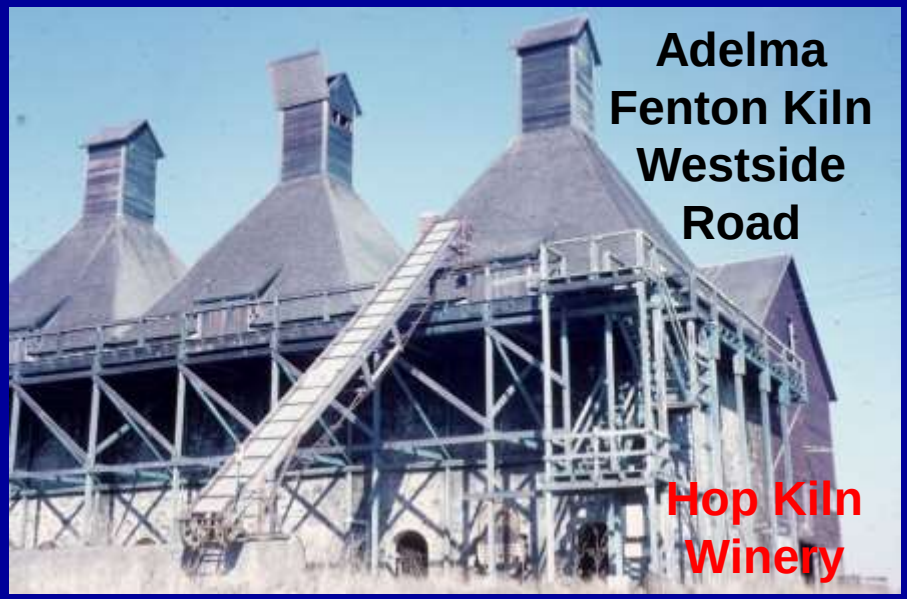
Traditional hop basket

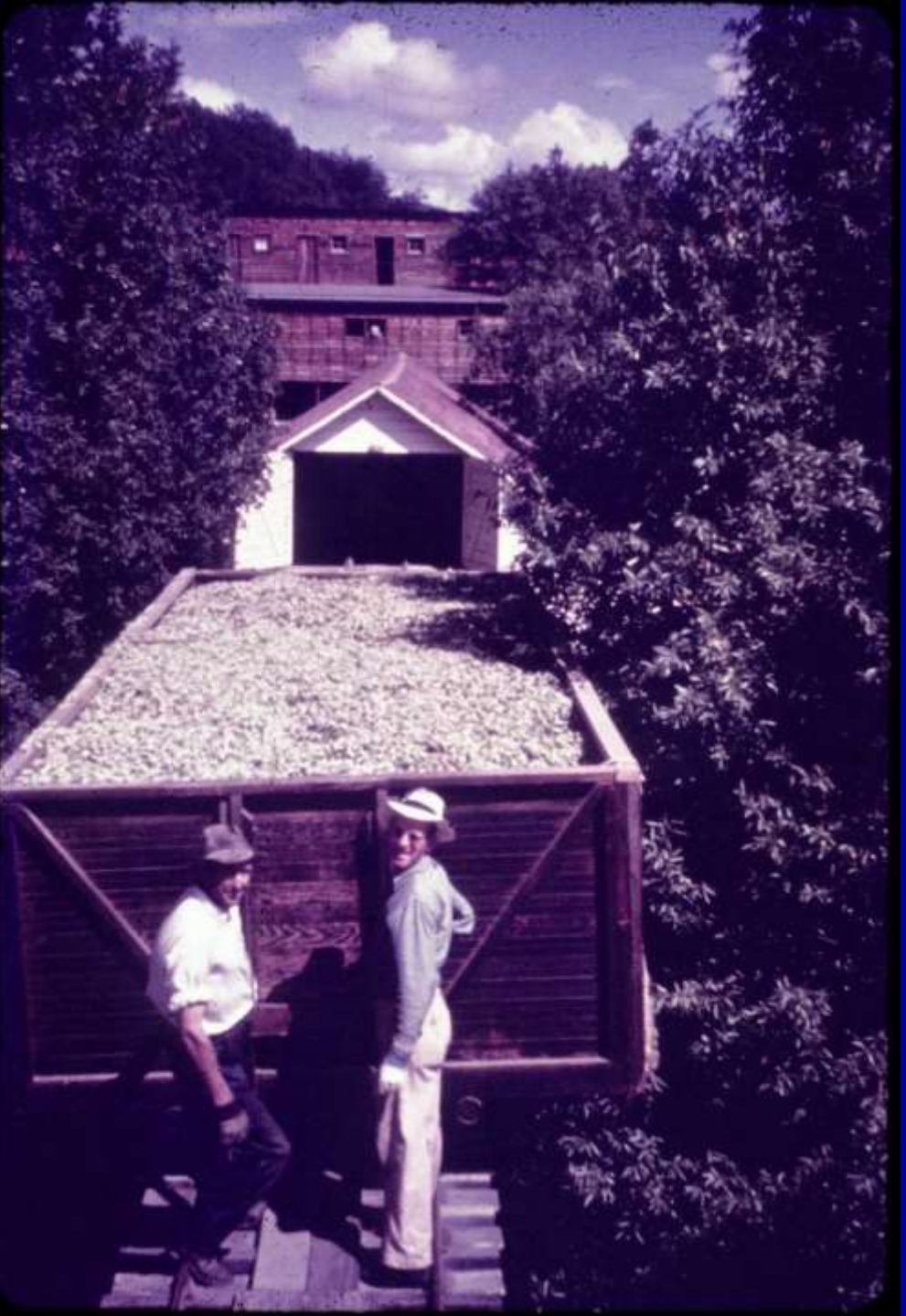
Bags weighed & transported to dryer



Old hop kilns (dryers)







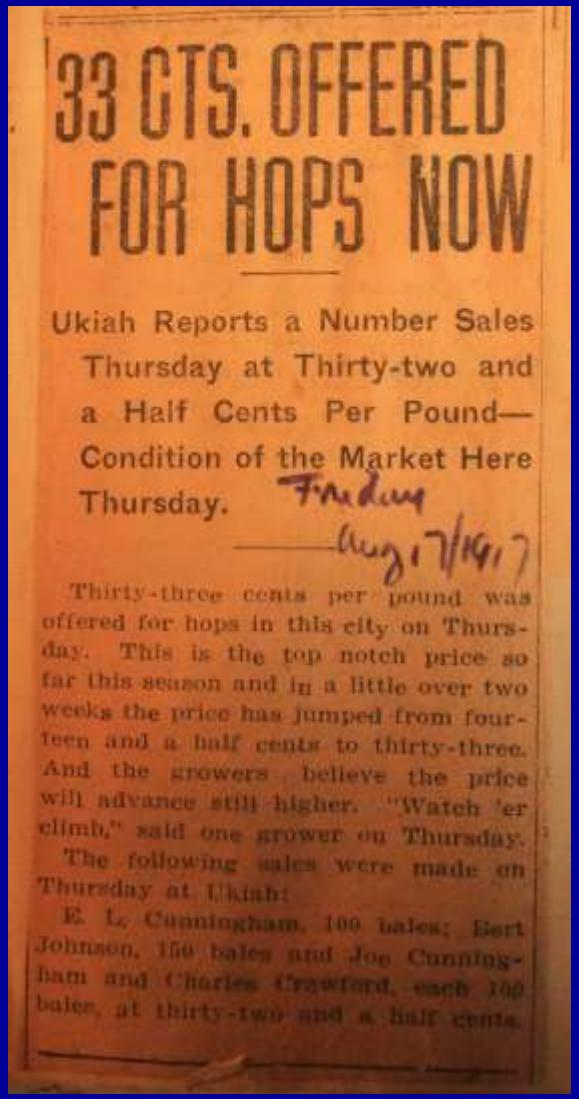
Cooling hops after drying, prior to bailing

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.

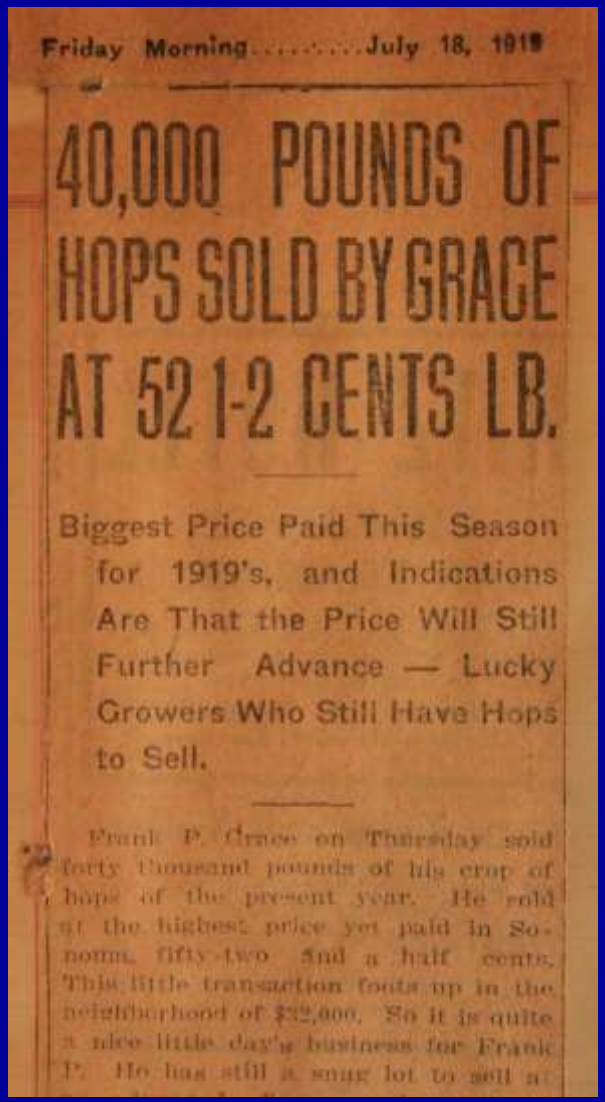
Friday
Aug 17/1917

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



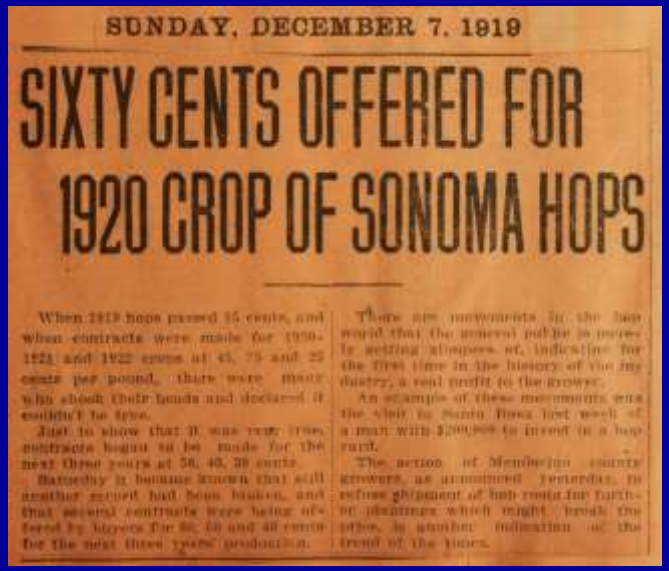
Friday Morning.....July 18, 1919

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 $22,000. 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 15 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 very true, contracts began to be made for the next three years at 58, 40, 30 cents.

Recently 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 prone to settle slowness of, indicative 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 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.

1920

Great Prices $ $

THE PRESS DEMOCRAT, SANTA ROSA, CAL

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

NOV 15 1919

G. A. PROCTOR 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 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 District; 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

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

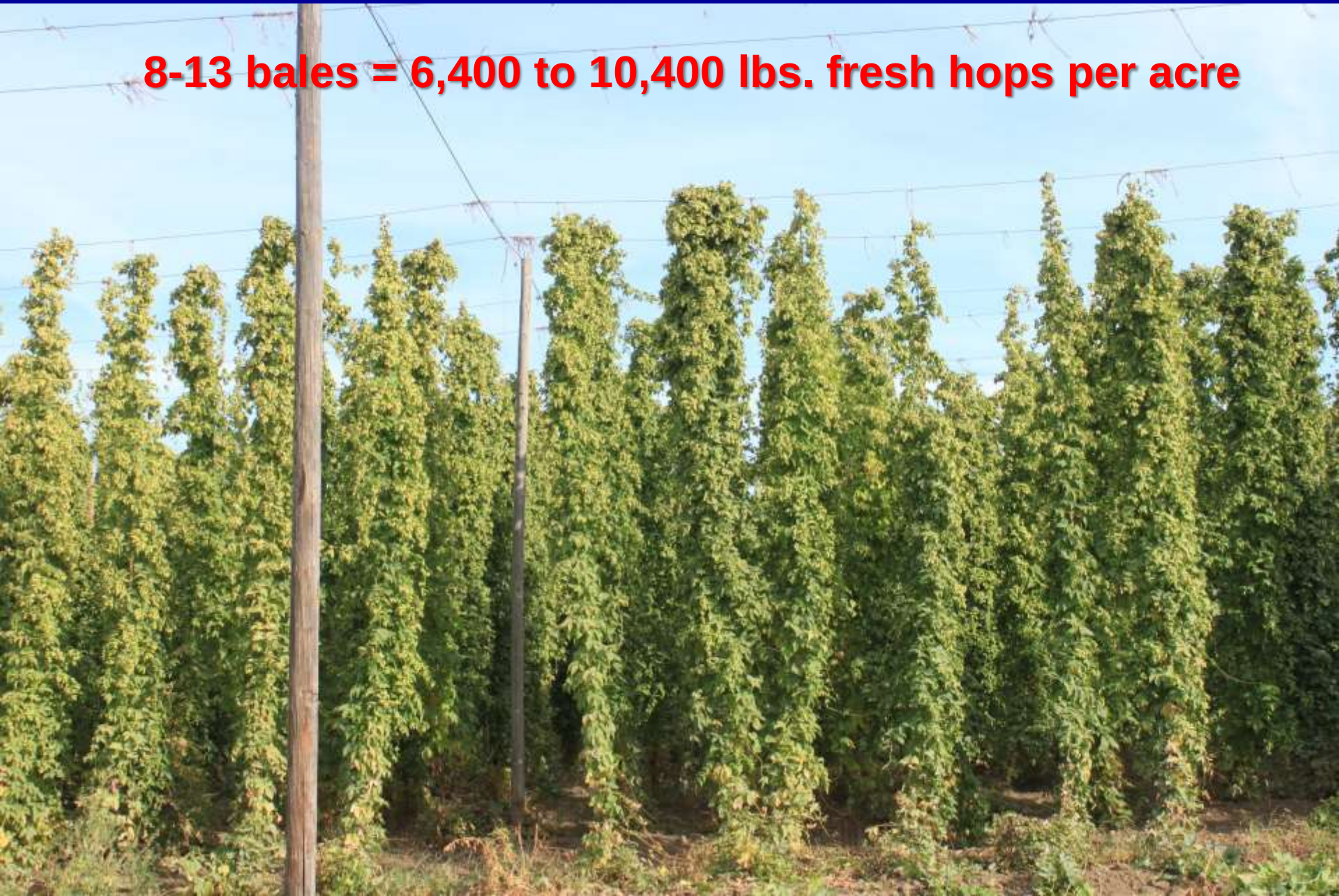
Big Volume

Large scale - volume

Low humidity – less disease

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

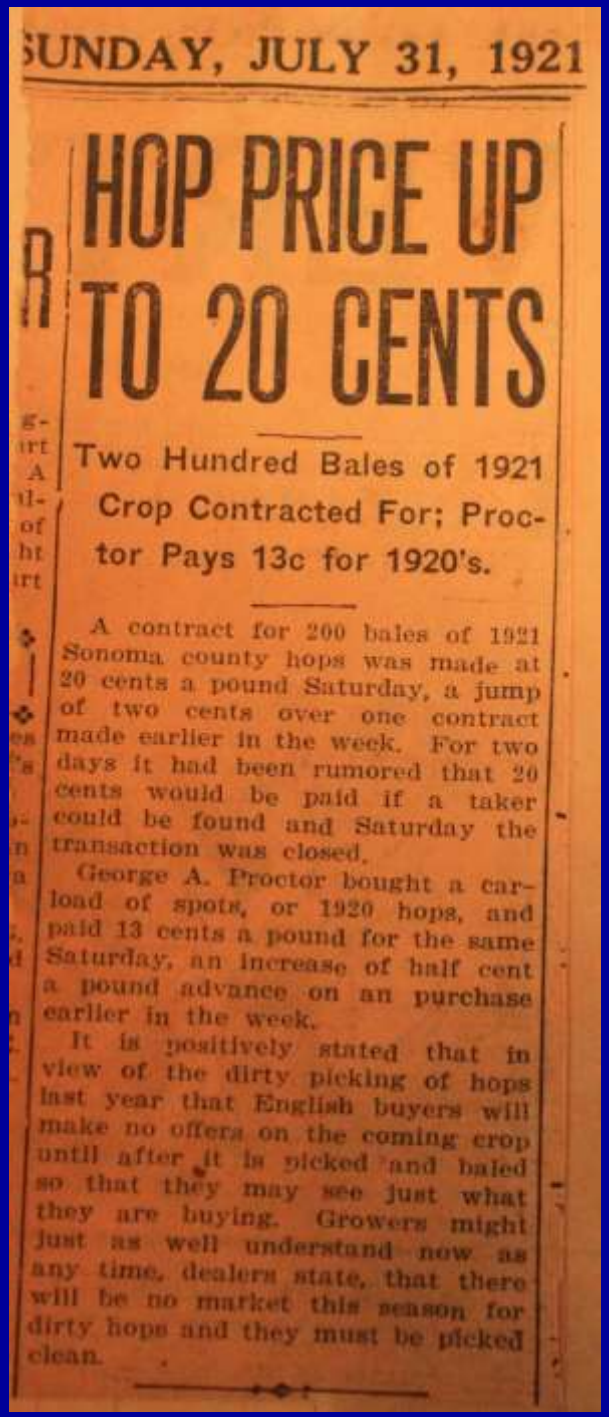
High Yields – Far North Latitude



Demand low & for BASIC hops

Bobbysockers with the palates of wimps.

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



SUNDAY, JULY 31, 1921

HOP PRICE UP TO 20 CENTS

Two Hundred Bales of 1921 Crop Contracted For; Proctor 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 carload 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%

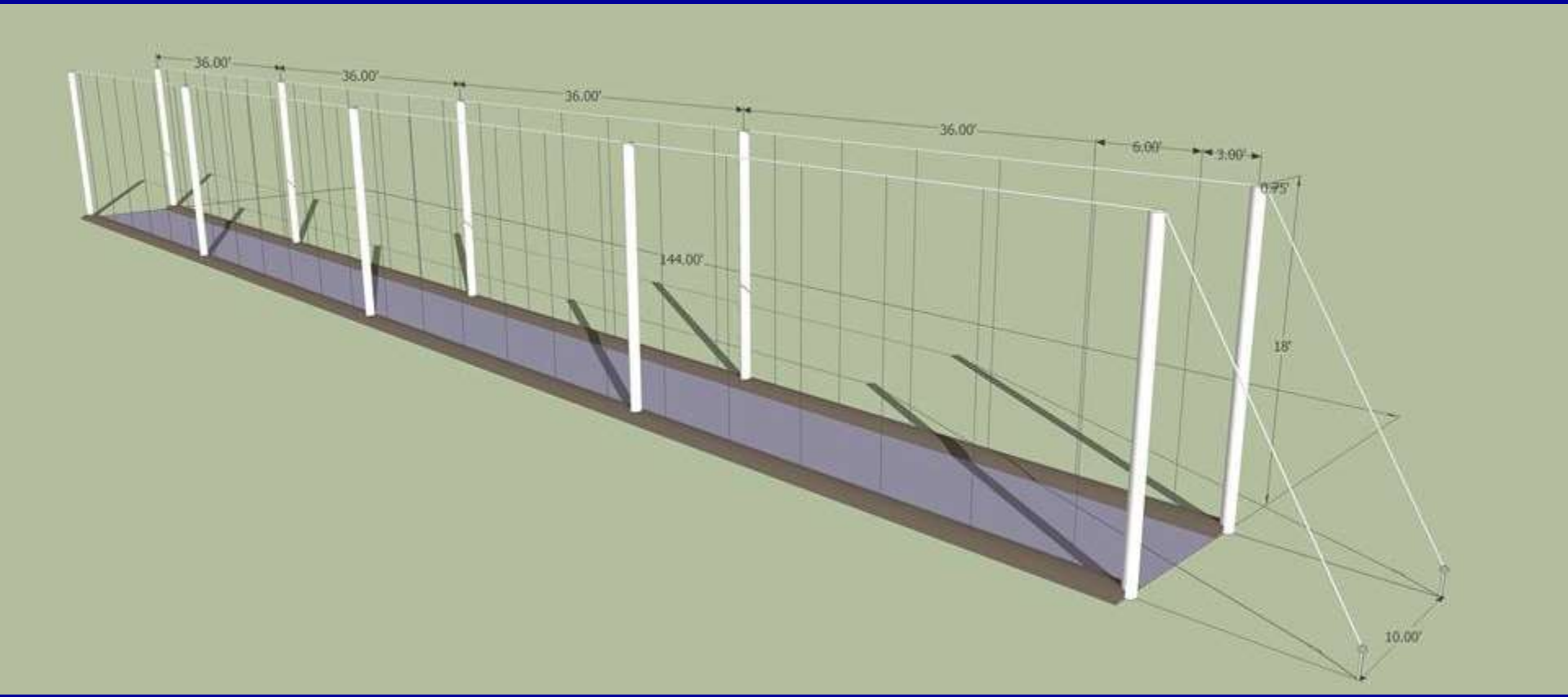
How its done in Yakima WA

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

HOP INFO | HOP FARMING | STATISTICS | NCPN HOPS | RESEARCH | N

eanup Program

rs currently in the NCPN-Hop cleanup program, click here. Please note: not vailable for distribution at this time. Those which have been verified as free have been assigned "virus free numbers" (VF#) and are candidates for able; others may still be undergoing testing, therapy, or require formal hey can be distributed.

lop Sales

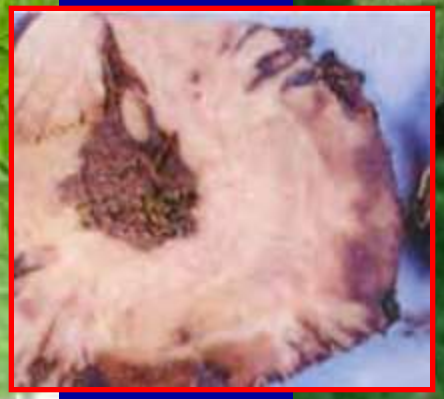
material is offered for sale twice a year:

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

d on this site, and in the *USA Hop News* newsletter.

s supply. When this happens, NCPN-Hops will prorate the available material mit 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

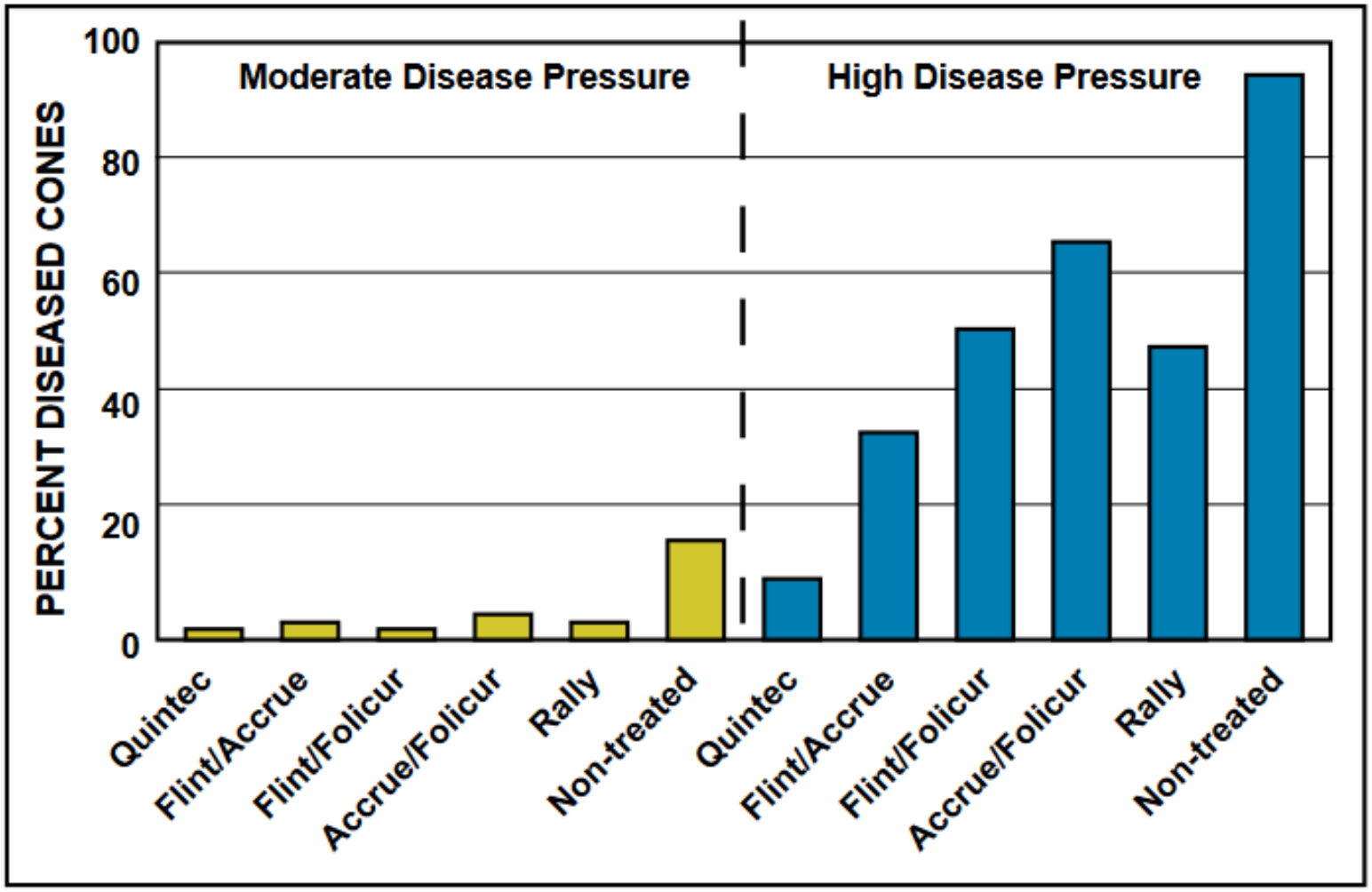


Figure 38. Efficacy of powdery mildew fungicides under moderate and high disease pressure in Washington. Notice that most fungicides provide acceptable control when disease pressure is moderate.

Powdery Mildew

Control:

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

Hop Diseases
(Resistant Varieties)

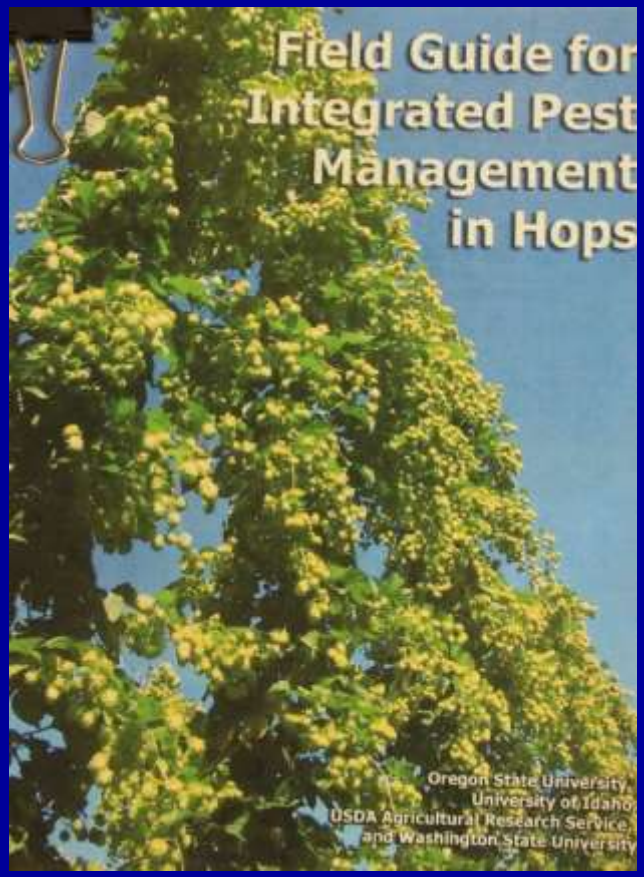


Table 2. Disease Susceptibility and Chemical Characteristics of the Primary Public Hop Varieties Grown in the U.S.

Variety	Usage	Disease Susceptibility[a]		
		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 (47-82ºF)
- Both like high humidity
- DM likes 24 hours of wetness
- Not the same as PM of grapes

Hop Insects

Table of Contents

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

Cones separated on multiple slanted conveyor belts

Slanted conveyor belts

Fans blow out leaves

Clean cones bound for dryer

Yakima Hop Processing

- Drying: 128-160ºF for 6-8 hours < 10% H_2O
- Cooling: ~ 12-24 hours conditioning
- Bale dried hops: 200 lb. bales
- Storage: bales kept at 28ºF
- Pelletize: crushed and pressed
- Extract: CO_2 Extraction Process
- Fresh hops: Transport: fresh hops in ½ size field bins in refrigerated trucks

Dryer beds – 3 ft. deep

Hops dried to 8% moisture

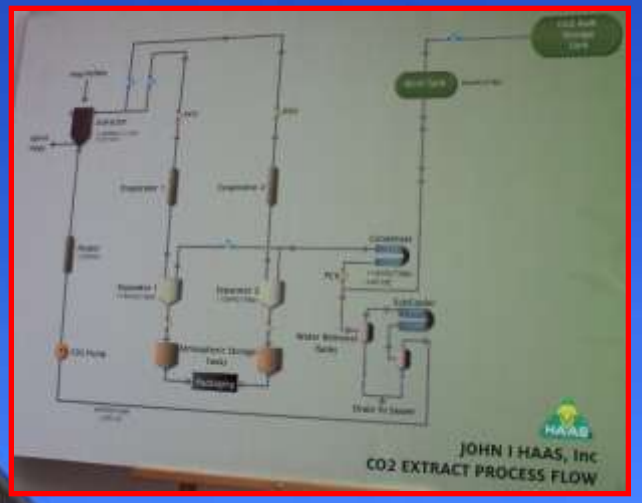
Dry hops cooled and bailed

Bailing

Bales stored (28ºF)

Random samples taken from bales

Pellets and Extract



HAAS

PELLET & WAREHOUSE COMPLEX

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

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% H_20 ~ 4-6,000 lbs/acre

Fresh Hops

- Very perishable (quickly compost & mold)
- Remove field heat ASAP (forced air cooler)
- Cold storage at 33-34ºF – 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/

SC Economic Dev. Board Report

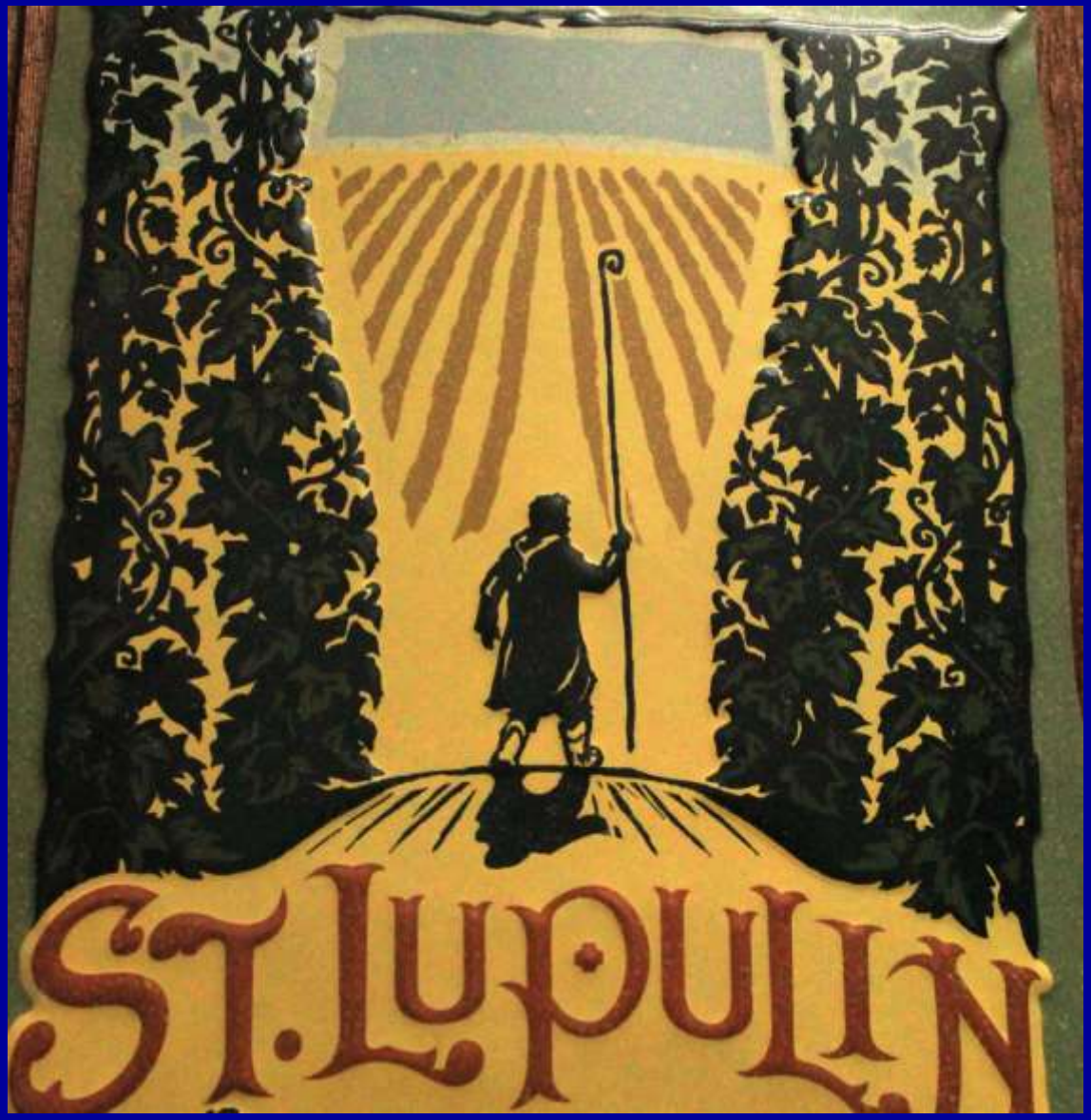
- Sonoma County 2014: 23 craft breweries, 11 craft distilleries, and 7 craft cideries
- Craft brewing industry's economic impact $169,000,000 in 2013 *(most current data available)*
- 37.4% increase from 2012.
- Raw materials represents the largest overall supply cost
- Interest is high for locally sourced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

Beer Goes Trendy

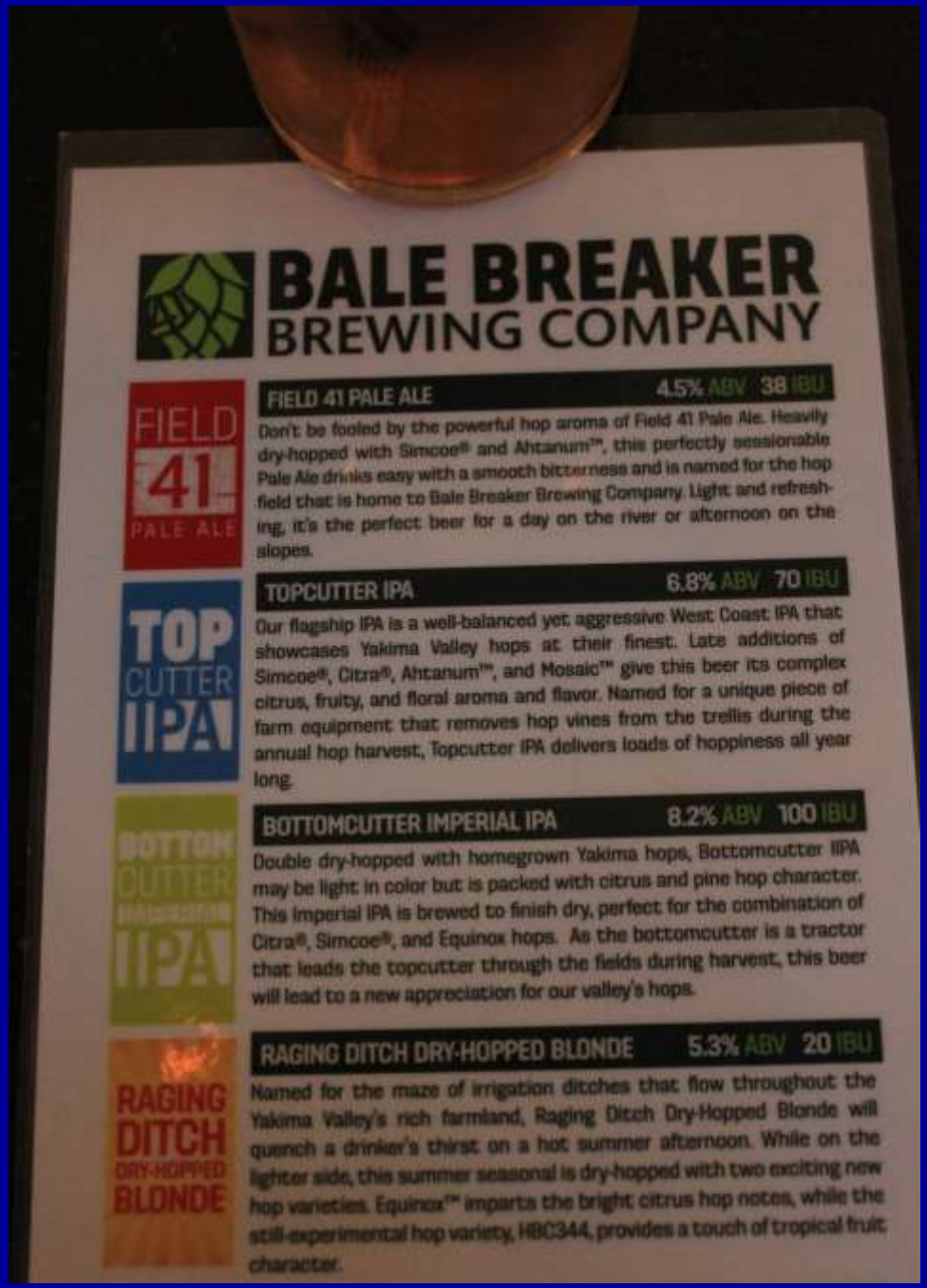
p to Sonoma Where Something New Is Brewi

s still best known for its wines, northern California's Sonoma County has a burgeoni
crowd

“Sophisticated/Differentiated” Beer



Labeling Beer with the Hop Varieties



Going Big Time

Vinnie Cilurzo


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

Date: 2/3/2016

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."

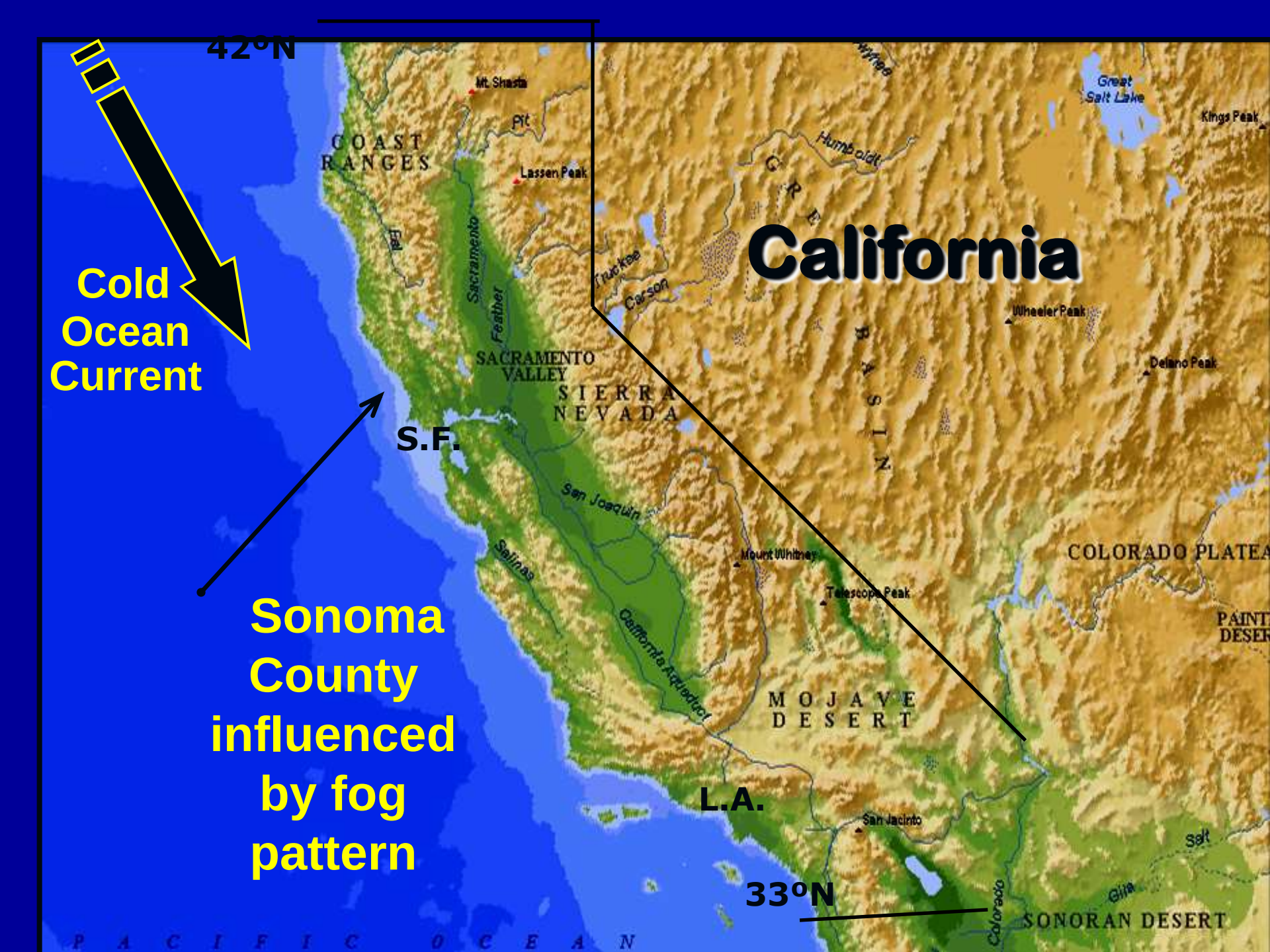
The first Alliance meeting took place in September, right after harvest. Matt and Mike spent several hours talking with Paul Vossen about history, laws, networking and current market trends. Paul had recently taking a trip to Yakima Valley to research hop growing at the professional level. He had already 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
S.F.
L.A.
33°N
California
COAST RANGES
SACRAMENTO VALLEY
SIERRA NEVADA
MOJAVE DESERT
COLORADO PLATEA
SONORAN DESERT
PACIFIC OCEAN
Mt. Shasta
Lassen Peak
Great Salt Lake
Kings Peak
Wheeler Peak
Delano Peak
Mount Whitney
Telescope Peak
San Jacinto
Sacramento
Feather
San Joaquin
Salinas
California Aqueduct
Humboldt
Truckee
Carson
Colorado
Salt
Gila

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)*

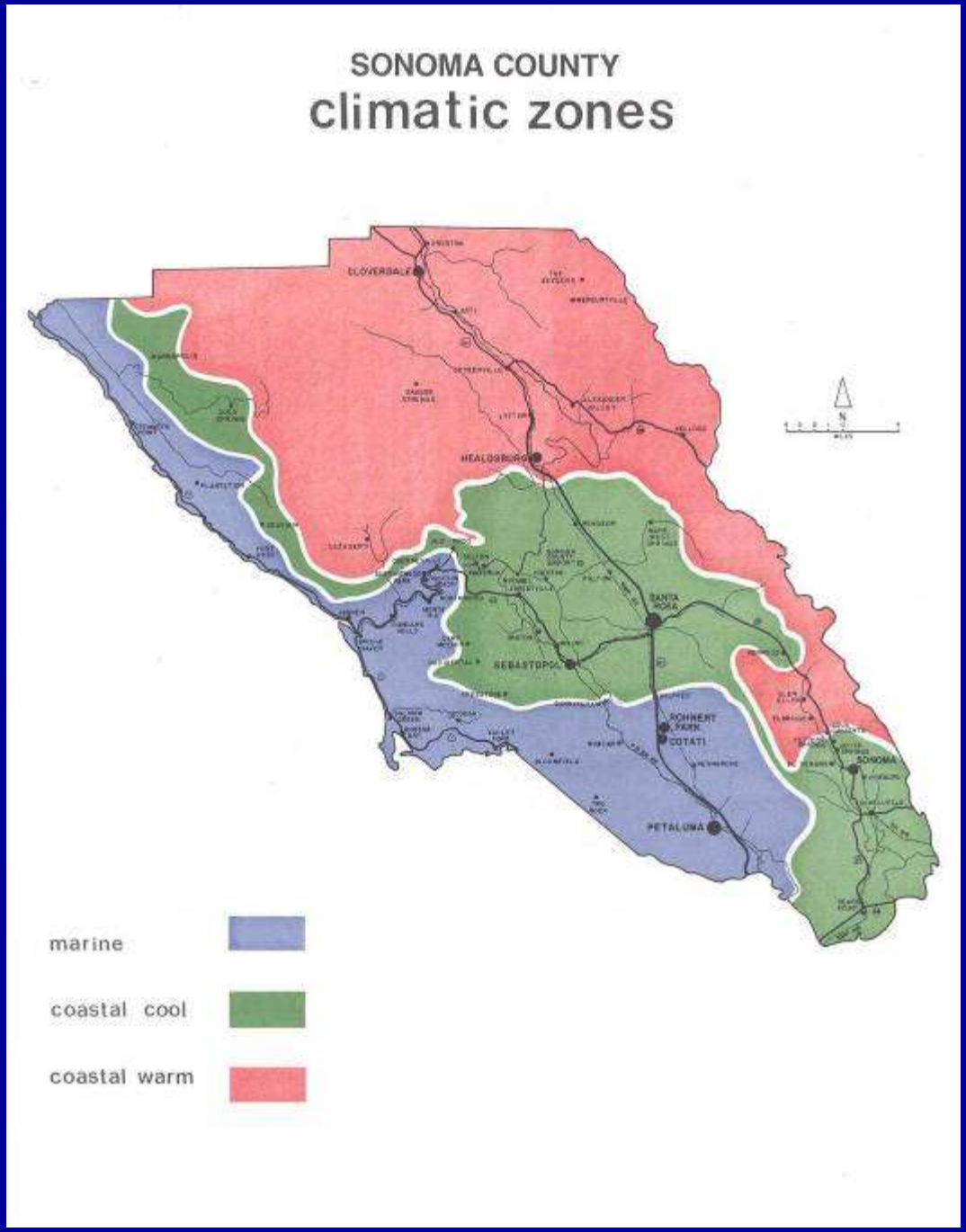
Deborah Walton – Canvas Ranch

Deborah Walton – Canvas Ranch
North Coast Heritage Grain Alliance

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 H_2O)
  - 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



Marine

Coastal Cool

Coastal Warm

Seasonal Water Requirement

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

	Marine	Coastal Cool	Coastal Warm
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.	3.1	3.3	3.7
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.
		ETo inches/day	0.17	0.20	0.20	0.19	0.14	0.10
		ETc inches/day	0.13	0.15	0.15	0.14	0.11	0.08
Size	ft²	Plant age	gallons per plant/day	gallons per plant/day	gallons per plant/day	gallons per plant/day	gallons per plant/day	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 ft^2)
- Cool spring = 3 gal/plant/day
- Warm summer = 4 gal/plant/day

- Spaced 2x12 ft. (24 ft^2)
- 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

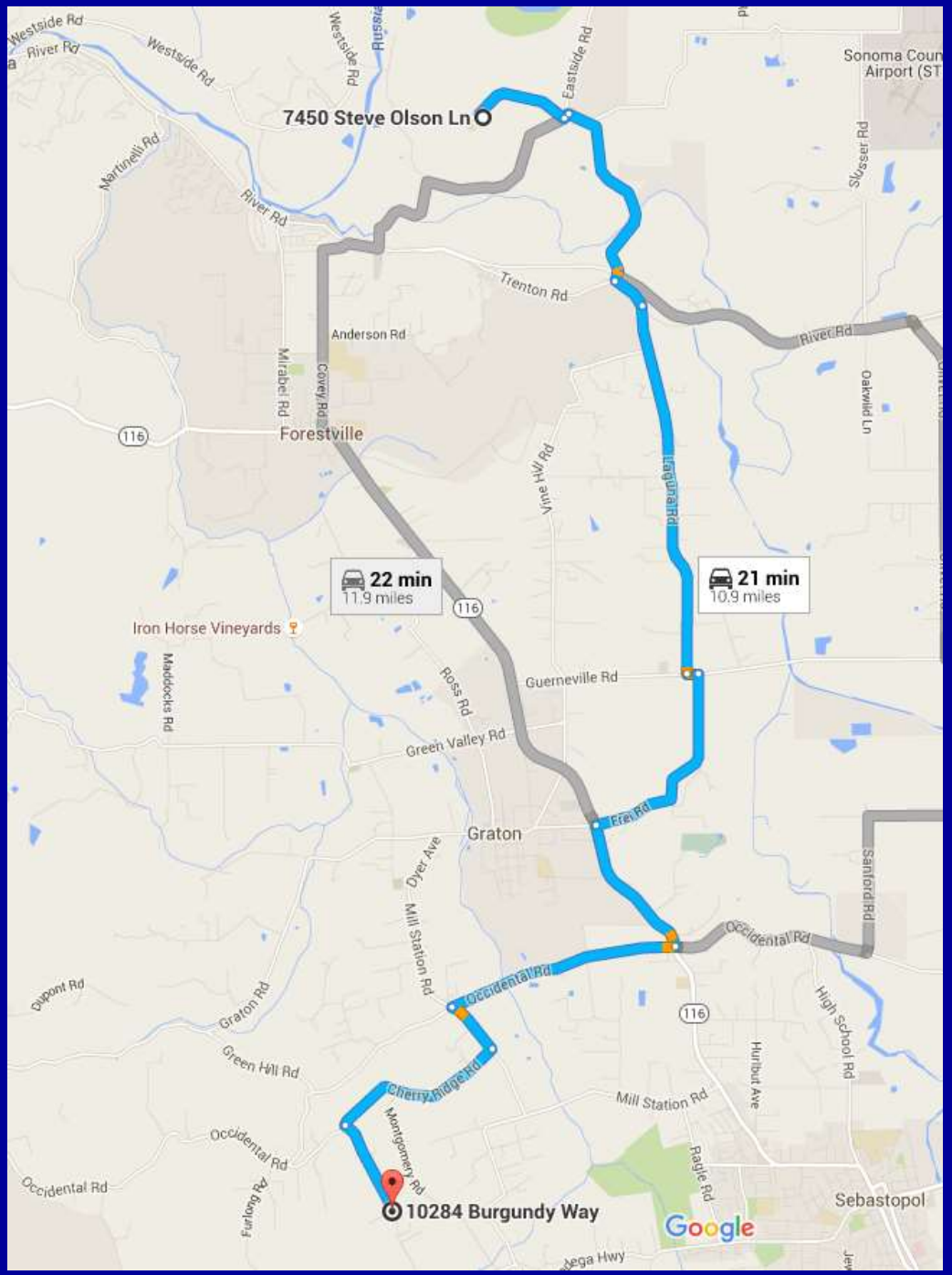
Brewers

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.