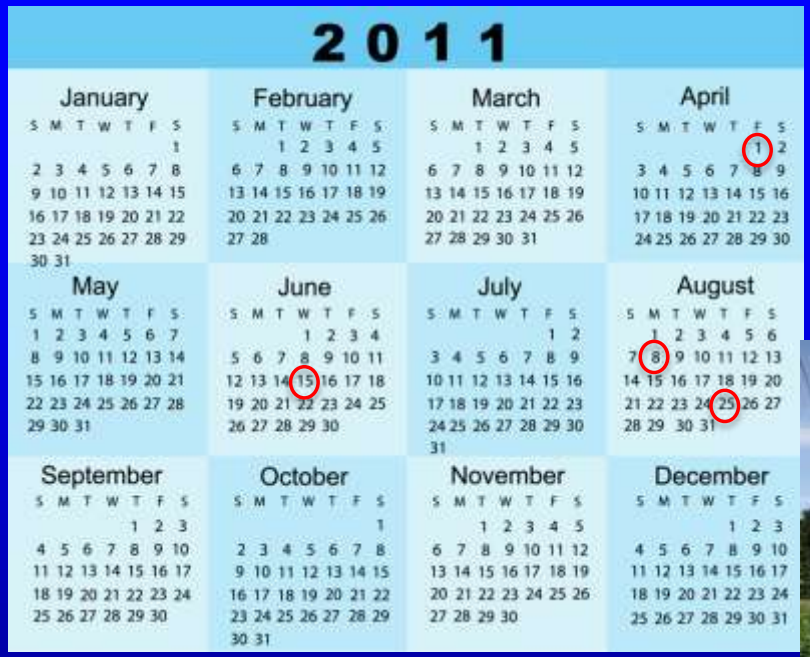
Calendar of Hops Field Work



Ron Godin, Ph.D.
Area Agronomist
Colorado State Univ. Extension
Delta, CO (970) 874-2197
ron.godin@colostate.edu

Calendar of Hops Field Work

Digging rhizomes for sale
Soil testing and fertilization
Bine pruning 1st and maybe 2nd growth
Training and trimming
Weed control
Pest Scouting
Petiole testing and foliar fertilizing
Cone ripeness evaluations
Harvesting
Fall compost application
Putting hop yard to bed for winter

Early Spring – once the ground thaws Digging Rhizomes and cut for sale

From Neve, Hops. (1991)

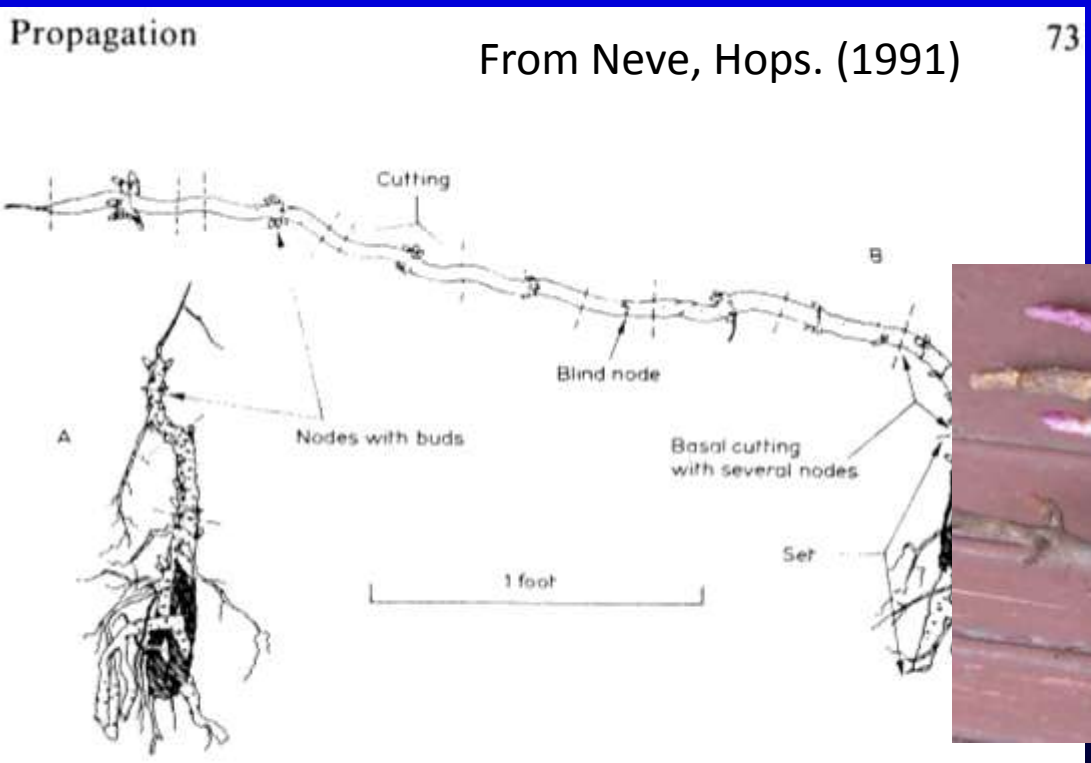


Figure 3.10 a) Bedded sett; b) layered bine. Dashed lines indicate suitable positions for dividing into cuttings (drawn by R. F. Farrar).

1 year old roots from rhizomes

Mychorhizal fungi
Promotes rooting

Hops rooting system

- can root to 8 ft deep
- Most roots in top 1 – 2 ft depending on top soil depth

-Rule of thumb

- 40, 30, 20, 10
- 40% of roots in top 10% of top soil
- 30% of roots in 2nd 10% or top soil

Takes approx. 3 years to fully develop

Collecting Rhizomes – leave crown intact

Soil Testing and Fertilization

Take a representative soil sample

Soil test

- Complete Analysis (Macro + Micro nutrients & B)
  - Must include
    - Nitrogen (150-200 lbs N/ac (dep. var.))
    - % Organic Matter
      - Contributes N
    - Zinc & Boron

Hops are sensitive to Zn & B deficiencies

What do all these numbers mean?

Rapport d'analyse

La Coop fédérée, 604, Place Trans-Canada, Longueuil (Québec) J4G 1P1
450 674-5271

Entreprise	296202	**Client**	100000

Crédétao (OSBL)	Credetao
188, Jeanne DArc bureau 200	
Papineauville (Québec)	(Québec)
J0V 1R0	
	Fax
	Courriel al.credetao@videotron.ca

No Rapport	COA-8260
Émission originale	03-06-2011
Émis le	03-06-2011

Rapport Final

No Échantillon	**Planté le**	**Reçu le**	**Bon de commande**
113395		17-05-2011	DS=24762
Description	Sol argile Jacques Lance houblon		

Paramètre(méthode)	**Résultats et unité**	Très Pauvre	Pauvre	Bon	Très Bon	Riche	Très Riche
CEC estimée	27.3 meq/100g						
pH eau (1:1)*	5.9						
pH tampon*	6.6						
Indice en chaux	66						
Ca (Mehlich III)*	7098 Kg/ha						
Saturation Ca	58.0 %						
P (Mehlich III)*	144 Kg/ha						
ISP1 (P/Al)	6.2 %						
Al (Mehlich III)*	1036 ppm						
K (Mehlich III)*	587 Kg/ha						
Saturation K	2.5 %						
Mg (Mehlich III)*	777 Kg/ha						
Saturation Mg	10.6 %						
Zn (Mehlich III)*	8.74 ppm						
Cu (Mehlich III)*	5.00 ppm						
Mn (Mehlich III)*	34.7 ppm						
B (Mehlich III)*	1.57 ppm						
Fe (Mehlich III)	268 ppm						
Matière organique (comb.)*	5.2 %						
Saturation -K+Mg+Ca	71.0 %						
Nitrate en N	25.40 ppm N						
S (Mehlich III)	9.61 ppm						

Hop Soil Nutrient Levels

Hop Soil Test Levels

Adequate Levels for Spring for 2+ year old bines

Soil samples taken from top foot of soil in and near the bine row

pH 5.5 – 8.0 Best 6.5 -7.5

Nutrient	Adequate Levels	Nutrients Needed
NO_3-N	40 - 50 ppm*†	160 – 200 lbs/ac
P	> 25 ppm	> 100 lbs/ac
K	> 120 ppm	> 480 lbs/ac
Ca	> 1800 ppm	> 7000 lbs/ac
Mg	> 125 ppm	> 500 lbs/ac
SO_4-S	> 25 ppm	> 100 lbs/ac
Zn	> 6 ppm	> 25 lbs/ac
Fe	> 12 ppm	> 50 lbs/ac
Mn	> 5 ppm	> 20 lbs/ac
Cu	> 1.5 ppm	> 6 lbs/ac
B	> 1.5 ppm	> 6 lbs/ac

* Nitrogen can be applied in split applications through early-mid June.
Each 1% OM = 25 lbs N/ac

† ppm x 4 = lbs/ac

Calculating hop nutrient needs from soil test results

N needed = 175 lbs/ac

Soil nitrogen (NO_3-N) = 20 ppm (ppm x 4 = lbs/ac (80 lb/ac)
Soil organic matter N = 2.5% (2.5 x 25) = 62.5 lbs/ac

Total soil N = 80 + 62.5 = 142 lbs N/ac
175 lbs/ac – 142 = 33 lbs N/ac needed
Compost 2 tons/ac = 30 lbs N/ac (≈4 lbs/plant)

Foliar nutrient applications covered later

Shoot Pruning

1st Shoot Emergence

Cut shoot at or below ground level

Stringing, Training & Pruning

<u>Stringing</u>

-2 strings/plant

<u>Train</u>

-2 – 3 bines/string

Prune excess shoots at ground level

Train before pruning!

Winter cold tolerance -30°F

- leave ground shoots on at harvest
- put plants to bed wet

Shoot frost tolerance ≈ 23°F

A few words about weeds

DON’T let them establish or take over!

Weeds compete strongly with hops for:

- Water
- Nutrients

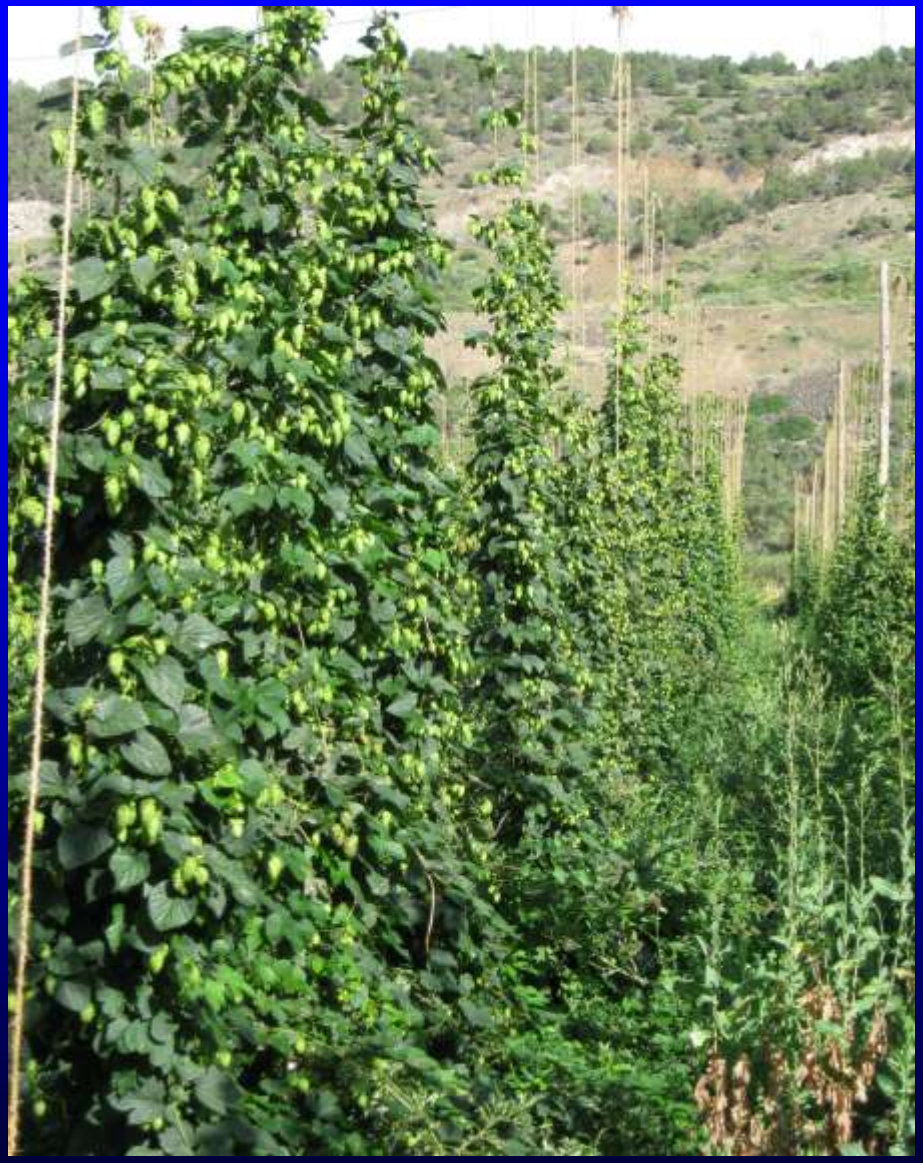
Reduce plant growth

Can reduce yields by 25% if left to grow

Root system of Canada Thistle

Weed Control

3rd year hops w/weeds



1st year hops no weeds

≈ 20 - 25% yield loss

July 15th

August 15th

Three year old plants

Weed Burner
400,000 BTU burner
3.5 – 10 lb tanks/ac
8 hours labor/ac

Favorite weed control method

Pest and Disease Scouting

- Should be done weekly through the season
  - know what pests and diseases to look for and where to look and scout accordingly.
    - aphids
    - hop loopers, borers, spider mites

  Walk your whole hop yard

  Spider mites love dusty areas!

Two spot spider mite

Catch them early with weekly scouting!
More later from Dr. Frank!

Hop Aphid

Hop Looper

Stripping lower leaves only if necessary!

IF spider mites reach 10 – 20 per leaf on lower leaves

- By hand
- Animals
- Concentrated acetic acid spray

Irrigation

Water Needs of Hops

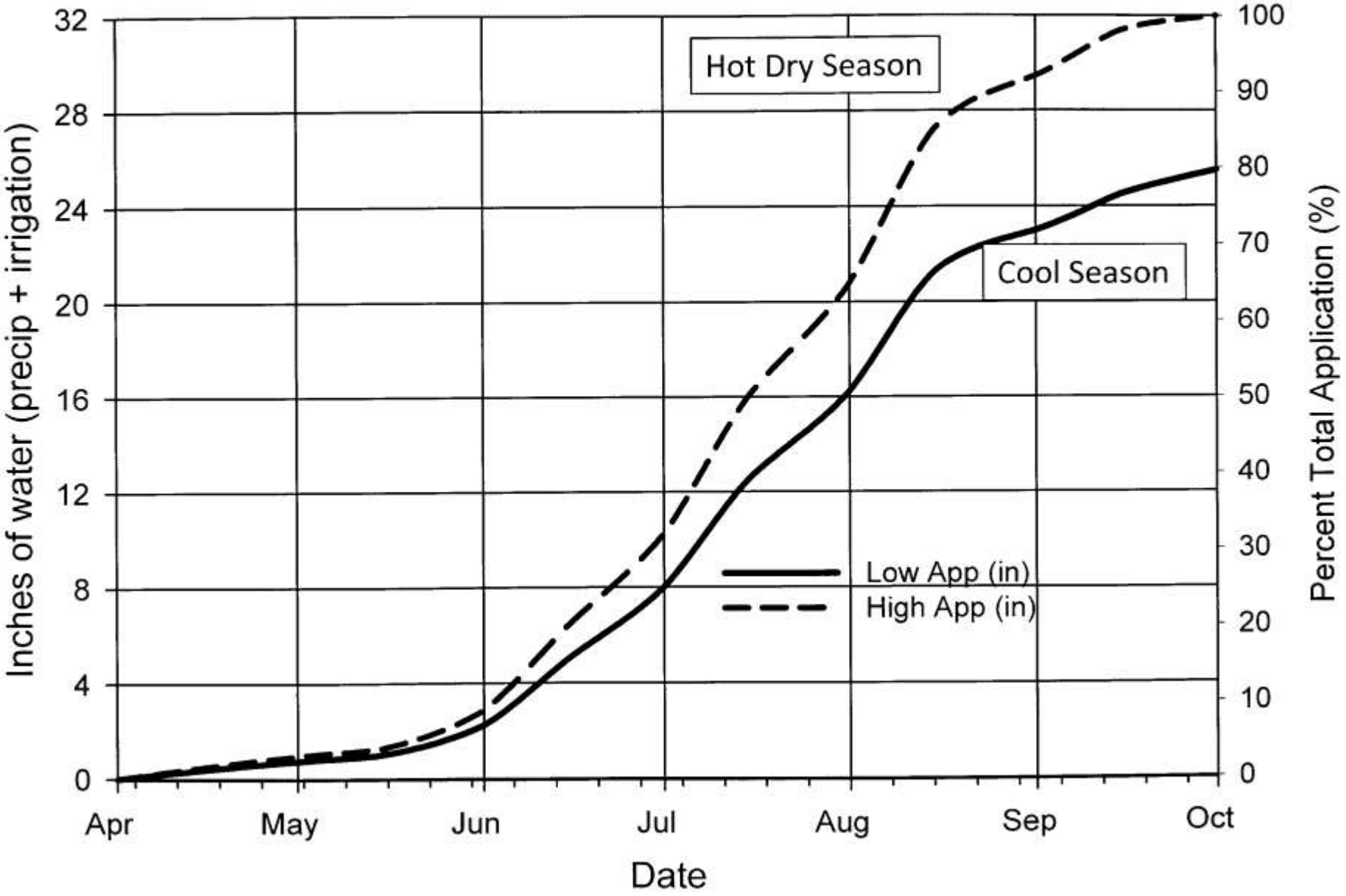
- Hops like to have moist soil but not wet
- Need little water early in the season if winter moisture has been good.
-Rule of thumb with irrigation:
  Start the season with your top soil full of water and irrigate to keep it full.
-Irrigate hops every 7 – 14 days depending on temps & sun
- Irrigation cycle shortens as season progresses

Table 2.2. Typical water holding capacity for Colorado soils (FC -- field capacity, WP -- wilting point, AC -- available water holding capacity, %WP -- percent of total water at wilting point; percentages on dry weight basis).

Upper 12 Inch Soil Layer

Soil Texture	Avg Bulk Density	Percent Water				Inches per Foot		
		FC	WP	AC	%WP	FC	WP	AC
Sand	1.60	8.7	3.5	5.2	40	1.67	0.67	1.00
Loamy sand	1.60	11.9	4.5	7.4	38	2.28	0.86	1.42
Sandy loam	1.55	15.4	5.8	9.6	38	2.86	1.08	1.78
Fine sandy loam	1.50	19.5	7.5	12.0	38	3.51	1.35	2.16
Loam	1.45	23.6	9.2	14.4	39	4.11	1.60	2.51
Sandy clay loam	1.40	27.0	13.5	13.5	50	4.54	2.27	2.27
Silt loam	1.40	27.2	10.9	16.3	40	4.57	1.83	2.74
Clay loam	1.40	27.3	15.1	12.2	55	4.59	2.54	2.05
Silty clay loam	1.35	28.8	13.0	15.8	45	4.84	2.18	2.65
Silty clay	1.30	28.7	18.0	10.7	61	4.82	3.02	1.80
Clay	1.25	29.4	20.1	9.3	68	4.94	3.38	1.56

Hops Irrigation Guidelines Through the Season for Western Colorado



Hops Irrigation Guidelines through the season for western Colorado

Date	% application	Low application rate (inches) Total 25 inches	High application rate (inches) Total 32 inches
1-May	3	0.75	1.00
15-May	4	1.00	1.25
1-Jun	9	2.25	2.75
15-Jun	20	5.00	6.25
1-Jul	32	8.00	9.75
15-Jul	50	12.50	15.25
1-Aug	65	16.25	20.00
15-Aug	85	21.25	26.00
1-Sep	92	23.00	28.00
15-Sep	98	24.50	30.00
1-Oct	100	25.00	32.00

Cool & wet early season

normal July & August

Normal early season

Dry and hot conditions

in July & August

Mid Season Tissue Testing & Foliar Fertilization

Approximately 1st week in June take petiole samples, 60 PETIOLES from each variety send to lab for analysis of:

Nitrogen (N)

Phosphorus (P)

Potassium (K)

Zinc (Zn)

Boron (B)

Youngest fully developed leaf

Petiole

Remove petiole from leaf
Collect 60 petioles

Hop Petiole Nutrient Levels for Cascade and Chinook Hops

Samples taken from youngest fully developed leaf

Sample Time	Nutrient	Cascade	Nutrient	Chinook
Early June	NO_3-N*	>10,000 ppm	NO_3-N	5 - 7000 ppm
Mid June	NO_3-N	>15,000 ppm	NO_3-N	7 - 9000 ppm
Late June	NO_3-N	>20,000 ppm	NO_3-N	> 9000 ppm
	P	> 0.25%	P	> 0.25%
	K	> 2.0%	K	> 2.0%
	Ca	> 1.5%	Ca	> 1.5%
	Mg	> 0.6%	Mg	> 0.6%
	S	> 0.3%	S	> 0.3%
	Zn	> 25ppm	Zn	> 25ppm
	Fe	> 45 ppm	Fe	> 45 ppm
	Mn	> 25 ppm	Mn	> 25 ppm
	Cu	> 5 ppm	Cu	> 5 ppm
	B	> 30 ppm	B	> 30 ppm

*NO_3-N= nitrate -nitrogen

Mg/kg = ppm; % x 10,000 = ppm

Fertilization Schedule

Spring – Fertilize after training according to soil test results

Summer – Petiole test 1st week of June

Foliar fertilize (upper leaves) until last week of June – first week of July

Foliar fertilize once* with

- 1 - 2 lb N/ac (8 gal fish @ 2.5% = 2 lbs N)
- 1 – 1.5 lb Zn/ac (4.5 lbs $ZnSO_4$ @32%=1.5lbs Zn)
- ¼ lb B/ac (1.25 lbs Solubor @ 20.5% B = ¼ lb B)

Mix in 25 – 100 gal water per acre (add ½ H_2O before ingredients)

* If petiole levels low apply foliar 1 or 2 more times at 5 – 7 day intervals


CROPLINER
CROPLANDS
400

Checklist

- ☐ Dig rhizomes (optional)
- ☐ Soil Test & Fertilize
- ☐ Shoot pruning
- ☐ Training and trimming
- ☐ Weed control!!!!
- ☐ Field Scouting (aphids & spider mites)
- ☐ Petiole testing and foliar fertilizing
- ☐ Cone ripeness evaluations

HARVESTING!

Market Your Hops and Hop Yard

*Good practice: If brewers have pre-purchased or will be purchasing your hops – invite them to see your hop yard and how wonderful your hop yard looks a week or two before harvest! Most brewers have not seen or been to a hop yard

-Walk the hop yard with them and let them look at and smell the hops

*This is a good chance to show the brewer how much effort goes into growing hops and why your Colorado hops are worth every penny. Show them you are growing the best quality hops on the market!

Pre-Harvest Preparations make sure all equipment is working properly before you start harvesting!!!!!

- Harvesting Tools

Mechanical Checks

- Mechanical Picker Maintenance
  - Bearings greased
  - Chains oiled
  - Blower functional
  - Turn picker on to check all belts & mechanical parts are moving and in good repair

Dryer Check

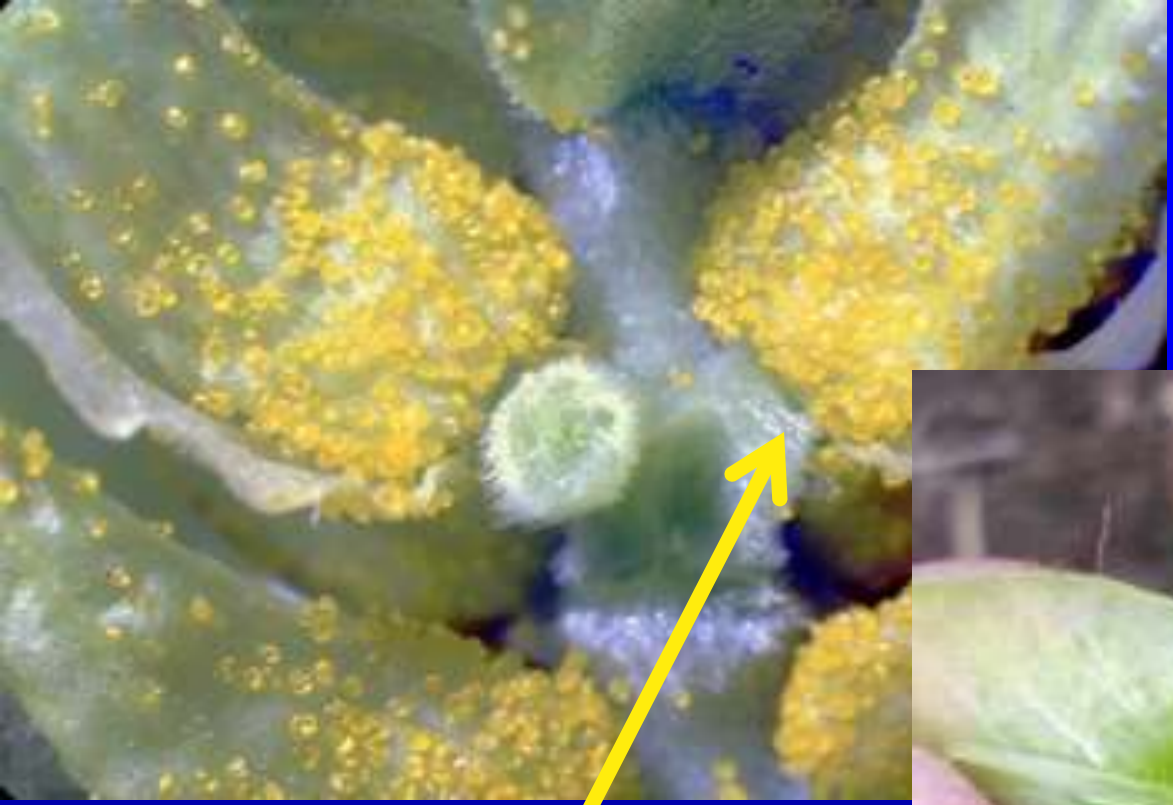
- Fan & heater operational?
- Air movement unrestricted?
- Sufficient bins for harvest?

Conditioning

- Conditioning fan (non-heated) operational

Cone Development & Cone Ripeness

Look: Lupulin glands turns golden yellow
Bract tips start to turn brown
Feel: Bracts become papery
Smell: Crushed cones have no grassy smell
Dry Weight: 20% - 25% dry weight



Lupulins

Apply compost in fall after harvest
2 shovels full per plant on crown

Putting your hops to bed for the winter: Like kids remember to give them a drink of water before bed!

Do a light to moderate irrigation as late as possible to be sure the roots have sufficient water to last the winter!

Have a beer & rest!

Questions?

Thank You!

ron.godin@colostate.edu