Hop Fertigation and Nutrient Management

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Fertigation:

Fertilizing through the irrigation system

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www.hops-super-styrian.eu

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weblinfarm.com

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www.ontariohopgrowersassociation.ca

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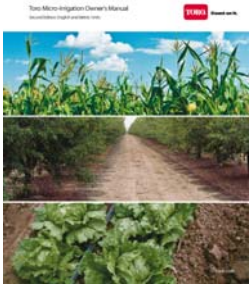
http://www.toro.com/en-us/agriculture/pages/drip-irrigation-education/financing/payback-wizard.aspx



This does not constitute an endorsement. This is just a good site for information.

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TRICKL-EEZ COMPANY
Irrigation Engineering & Equipment

http://www.trickl-eez.com/

This does not constitute an endorsement.
This is just a good site for information.

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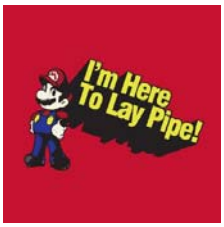
You will become a plumber!



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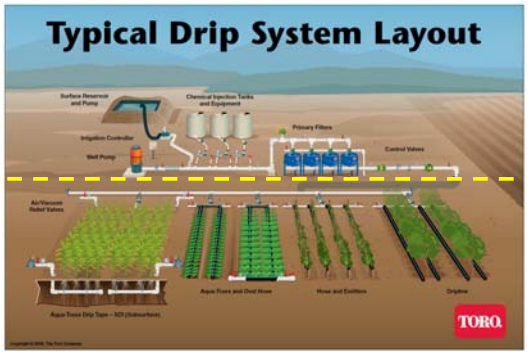

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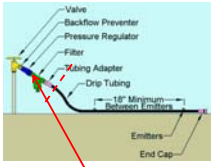

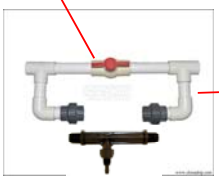

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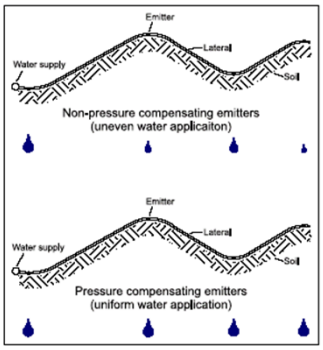
Pressure?



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Influence of Soil Type on Irrigation Strategy

Course Soil (sand): **Rapid uptake, High permeability, Low retention**

Therefore, Prone to leaching

Fine Soil (clay): **Slow uptake, Low permeability, High retention**

Therefore, Prone to run-off

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Factors Influencing Water Application

Climate: Rainfall, Wind, Temperature, Light Level

Soil Type: Sand – Loamy Sand – Sandy Loam - Loam

Clay Silt Organic Matter

CEC: Cation Exchange Capacity (Indirect measurement of water holding capacity)

Plant Growth Stage: Vegetative – Flowering - Fruiting

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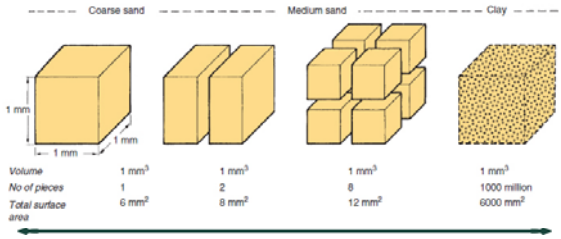
CEC is an Indirect Measurement of Soil Surface Area



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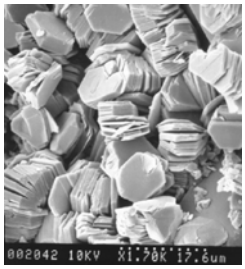
Sand

pubs.usgs.gov

Kaolinite Clay



www.azonano.com

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CEC is a direct indication of:

- The soil's ability to hold water
- Water infiltration rate
- The soil's ability to retain nutrients
- The soil's ability to change pH
- Herbicide activity in the soil

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Element (Symbol)	Form taken up by the plant	Soil Mobility
Nitrogen (N)	(NH4)+ Ammonium form	Somewhat imm.
	(NO3)- Nitrate form	Mobile
Phosphorous (P)	(H2PO4)-, (HPO4)-2, PO-3	Immobile
Potassium (K)	K+	Somewhat mob.
Calcium (Ca)	Ca+	Somewhat mob.
Magnesium (Mg)	Mg+2	Somewhat mob.
Sulfur (S)	(SO4)-2	Mobile
Chlorine (Cl)	Cl-	Mobile
Iron (Fe)	Fe+2	Immobile
Boron (B)	(BO3)-	Mobile
Manganese (Mn)	Mn+2	Immobile
Zinc (Z)	Zn+2	Immobile
Molybdenum (Mo)	(MoO4)-	Mobile

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Wherever Water Goes - So Do Nutrients

www.agric.wa.gov.au www.tankonyvtar.hu

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Irrigation Strategy???

Depends Mainly on Soil Type

More critical for young plants

Sand: **a little at a time, but often, fast application**

Silt/Clay: **slow application, longer time period, less frequently**

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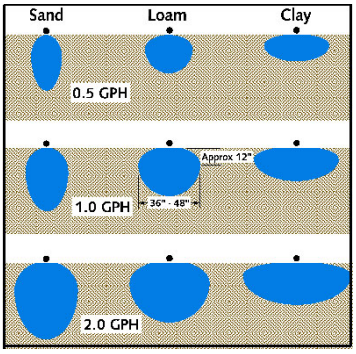

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When do I start and stop irrigating?

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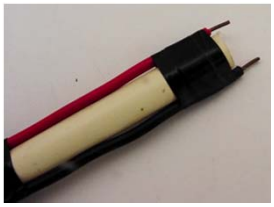

Resistance

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Want to maintain soil moisture between 65% and 100% capacity

Below 65% you run the risk of economic loss

Above 100% you run the risk of leaching and runoff

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Hops have a fairly extensive root system

Attaining a depth of 15-feet (most in the top 2 to 4-feet) and spreading

Don't confuse rhizomes with roots

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www.homebrewtalk.com

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Need an understanding of the hop growth phases (See handout)

9 phases: 0 - 9

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1: Leaf development	11	First pair of leaves unfolded
	12	2nd pair of leaves unfolded (beginning of twining)
	13	3rd pair of leaves unfolded
	1 .	Stages continuous till . . .
	19	9 and more pairs of leaves unfolded
2: Formation of side shoots	21	First pair of side shoots visible
	22	2nd pair of side shoots visible
	23	3rd pair of side shoots visible
	2 .	Stages continuous till . . .
	29	Nine and more pairs of side shoots visible (secondary side shoots occur)
3: Elongation of bines	31	Bines have reached 10% of top wire height
	32	Bines have reached 20% of top wire height
	33	Bines have reached 30% of top wire height
	3 .	Stages continuous till . . .
	38	Plants have reached the top wire
	39	End of bine growth

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Fertilizer has its greatest affect during phases 1, 2 and 3 and should be complete by the time flowers become visible (stage 5)

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Total N demand 100 - 150 lbs./A

Total P demand 20 – 100 lbs./A

Total K demand 80 - 150 lbs./A

Boron (B), Zinc (Zn), Sulfur (S)

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Levels depend on age and expected yield.

www.farmanddairy.com en.wikipedia.org

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Flowering in hops is dependent on day length and number of nodes and varies with cultivar.

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The day length signal happens 7 – 14 days after June 21

Vegetative growth greatly slows and fertilizer will have minimal affect after July 1.

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All P and K can be applied as a broadcast early

Split K applications on light soils

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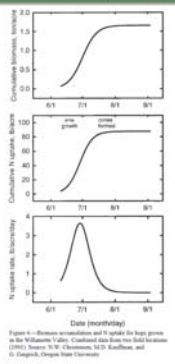
Highest N demand is from late April to late June



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Early N applications can be applied as a broadcast – up to 25%

Prior to a rain event

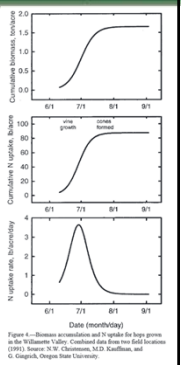

Figure 4.—Biomass accumulation and N uptake for hops grown in the Willamette Valley. Combined data from two field locations (1991). Source: N.W. Christensen, M.D. Kauffman, and G. Gingrich, Oregon State University.

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150 lbs. N total
40 as a broadcast early

110 in 8 weeks = 13.75lbs./week
1.7 lbs./day

Done by July 1 when flowers become evident

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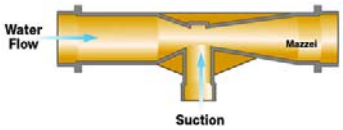
www.water.dk



mazzei.net

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Determine how long it takes for water to move through your system

Charge the system

Inject the fertilizer

Flush the system and apply enough water to move it into the soil but not out of the root zone

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TABLE 4-12. SOLUBILITY OF SELECTED FERTILIZER MATERIALS

Fertilizer Material	Chemical Formula	Solubility (lb/100 gal)	Salt index (relative effect on the soil solution)
Ammonia	NH_3	750	47.1
Ammonium nitrate	NH_4NO_3	983	104.7
Ammonium sulfate	$(NH_4)_2SO_4$	592	69.0
Borax	$Na_2B_4O_7{\cdot}10H_2O$	25	
Calcium carbonate (limestone)	$CaCO_3$	0.050	4.7
Calcium metaphosphate	$Ca(PO_3)_2$	0.008	
Calcium nitrate	$Ca(NO_3)_2{\cdot}4H_2O$	1,117	52.5
Calcium sulfate	$CaSO_4{\cdot}2H_2O$	2	8.1
Copper sulfate	$CuSO_4{\cdot}5H_2O$	267	
Diammonium phosphate	$(NH_4)_2HPO_4$	209	29.9
Dicalcium phosphate	$CaHPO_4{\cdot}2H_2O$	0.168	8
Magnesia	MgO	0.005	1.4
Magnesium sulfate	$MgSO_4{\cdot}7H_2O$	709	44
Manganese sulfate	$MnSO_4{\cdot}4H_2O$	875	
Monoammonium phosphate	$NH_4H_2PO_4$	358	34.2
Monocalcium phosphate	$CaH_4(PO_4)_2{\cdot}H_2O$ *	15.4	
Potassium chloride	KCl	233	116.3
Potassium nitrate	KNO_3	108	73.6
Potassium sulfate	K_2SO_4	67	46.1
Sodium nitrate	$NaNO_3$	608	100.0
Urea	$CO(NH_2)_2$	559	75.4
Zinc sulfate	$ZnSO_4{\cdot}6H_2O$	584	

* It decomposes with a small amount of water and is soluble in a large amount. The solubility varies with the conditions.

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