

Canopy Health is Highly Important for HLB Tolerance

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Our goal: finding a good way to determine HLB status in trees

• The important factor for HLB status is fruit yields- do the trees produce more crop

• Have a faster and easier testing

So that:

- Test new therapies
- Better grove management
- Find better ways to fight HLB





Take home messages:

- Ct values, as they are measured today, are not good in predicting tree yield
- Taking care of the canopy health is very important



The easiest and most common way to measure HLB is with Ct value, to determine the amount of Clas cells (lower Ct=more Clas)



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Disease is always combination of the pathogen and the plant response:

The pathogen (releasing toxins, using the tree energy etc.) <u>The plant response</u> (Immune response, phloem plugging, developmental response etc.)

Which play the major role for HLB disease???



We hardly saw any bacteria at hundreds of phloem cells in leaves

Healthyopen pores no CLas



HLB Non-symptomatic mixed pores, no CLas

HLB Symptomaticclosed pores, no CLas



From the plant side, one of the most known plant response is callose plugging



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Callose accumulation decrease the transport of sugars-

can cause disease symptoms







Ct value

phloem

Look for CLas in the



	Ct value	Number of phloem analyzed	CLas cells detected
C mac	32.09	10	8
C mac	31.2	25	0
C mac	32.75	14	0
Grapefruit	34.9	45	0
Grapefruit	34.7	31	0
Grapefruit	28.5	31	2
			JF IFA

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Is the tree response more important than how much bacteria you have?



	Canopy volume (m ³)	Disease index	Root density (g/L)	SPAD	Leave area index	%INT	Fruit size (mm)	Fruit detachment force (Kgf)	Yield kg/tree)	Ct value of qPCR	Clas population /g of fresh tissues
Canopy volume (m ³)		#	#	#	#	#	#	[#]	#	#	#
Disease index	#	1	#	#	#	#	#	#	#	#	#
Root density (g/L)	#	-0.456 <i>0.015</i>	1	#	#	#	#	#	#	#	#
SPAD	-0.402 <i>0.034</i>	-0.464 <i>0.013</i>	#	1	#	#	#	#	#	#	#
Leave area index	-0.518 <i>0.005</i>	-0.404 <i>0.033</i>	0.483 <i>0.009</i>	0.476 <i>0.010</i>	1	#	#	#	#	#	#
%INT	#	-0.678 <i>0.000</i>	0.412 <i>0.029</i>	#	0.424 <i>0.024</i>	1	#	#	#	#	#
Fruit size (mm)	#	#	#	#	#	0.695 0.000	1	#	#	#	#
Fruit detachment force (Kgf)	#	-0.547 <i>0.013</i>	0.465 <i>0.039</i>	#	0.464 <i>0.040</i>	0.738 <i>0.000</i>	0.615 <i>0.004</i>	1	#	#	#
Yield (kg/tree)	0.542 0.003	#	#	#	#	0.427 0.024	#	0.468 <i>0.038</i>	1	#	#
Ct value of qPCR	0.389 <i>0.041</i>	#	#	#	#	#	#	#	#	1	#
Clas population /g of fresh tissues	#	#	#	#	#	#	#	#	#	#	0

Plain font= r value (correlation) Italicized font= p value #=no correlation



Light interception by the canopy



CI-110; CID Bio-Science

- Leaf Area Index (LAI)
- PAR- Photosynthetically Active Radiation levels = <u>LIGHT</u>





Light interception by the canopy



2. Measure PAR on inside the canopy





Healthy/mild tree-Most of light is intercepted by the canopy-%INT is HIGH





Healthy/mild tree-Most of light is intercepted by the canopy-%INT is HIGH



Severe tree-Most of light is NOT intercepted by the canopy-%INT is LOW



Healthy/mild tree-Most of light is intercepted by the canopy-%INT is HIGH



Severe tree-Most of light is NOT intercepted by the canopy-%INT is LOW





		%INT
Valencia on Swingle, 10- year-old	Severe	85.28
	Mild	94.18
Hamlin on Swingle, 20- year-old	Severe	79.01
	Mild	92.23
Valencia on Swingle, 21- year-old	Severe	80.83
	Mild	91.14





		%INT	Yield pound/tree
Valencia on Swingle, 10- year-old	Severe	85.28	52.2
	Mild	94.18	90.4
Hamlin on Swingle, 20- year-old	Severe	79.01	83.8
	Mild	92.23	133.9
Valencia on Swingle, 21- year-old	Severe	80.83	80.5
	Mild	91.14	138.3





		%INT	Yield pound/tree	Clas cells/gram plant tissue	
Valencia on Swingle, 10- year-old	Severe	85.28	52.2	4.87E+09	
	Mild	94.18	90.4	7.82E+09	
Hamlin on Swingle, 20- year-old	Severe	79.01	83.8	8.34E+09	
	Mild	92.23	133.9	4.15E+09	
Valencia on Swingle, 21- year-old	Severe	80.83	80.5	2.50E+09	
	Mild	91.14	138.3	2.37E+09	





1. Ct values, as they are measured today, are not good in predicting tree yield

<u>Why??</u>

Because the measurements, as done today, are not sensitive enough/ we don't pick up the right tissue <u>OR</u> Because the levels of CLas are not related to the HLB disease severity



2. Light interception is recommended to test the HLB severity of the



- 1. Can give a strong prediction for the yield
- 2. It is a relative measurement:
 - 1. not dependent on the canopy volume
 - 2. Not dependent on the weather on the day of measurements
- 3. Its easy!





3. Taking care of the canopy health is very important (maybe more than killing CLas)







Thank you!

