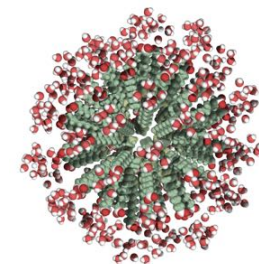


# Sustainable Crop Protection with Organic Colloidal Concentrate

2018



# About Organic Colloidal Concentrate, or OCC

## Category & Function:

- A surfactant adjuvant developed to encapsulate, penetrate and deliver active substances of liquid agrochemicals to plant cells.

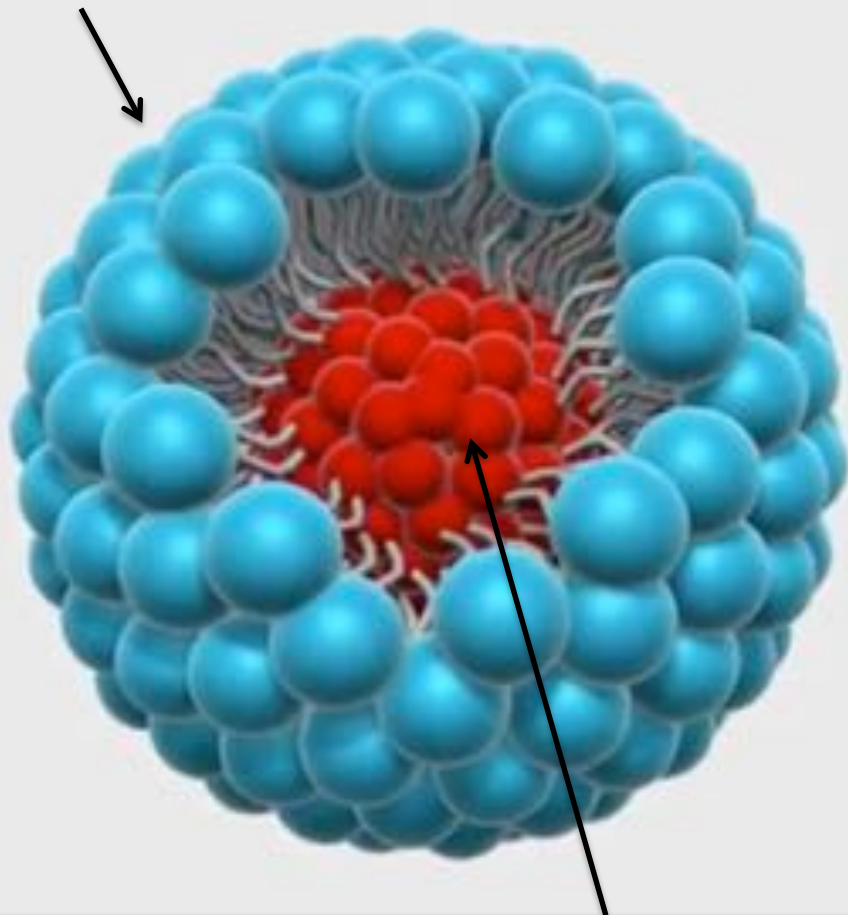
## Characteristics:

- mode of action is physiochemical in nature.
- able to enhance active compounds efficacies of nutrients and chemicals by between 50% to 100%.
- pre-mix micelle sizes between 4nm to 20nm. post-mix less than 400nm.
- high effective dilution rate of 1:10k (0.01%) to 1:15k (0.007%).
- presents wetting & spreading functions at 1:3k (0.03%) to 1:5k (0.02%)
- non-toxic, safe to human, animal, marine life and environment.

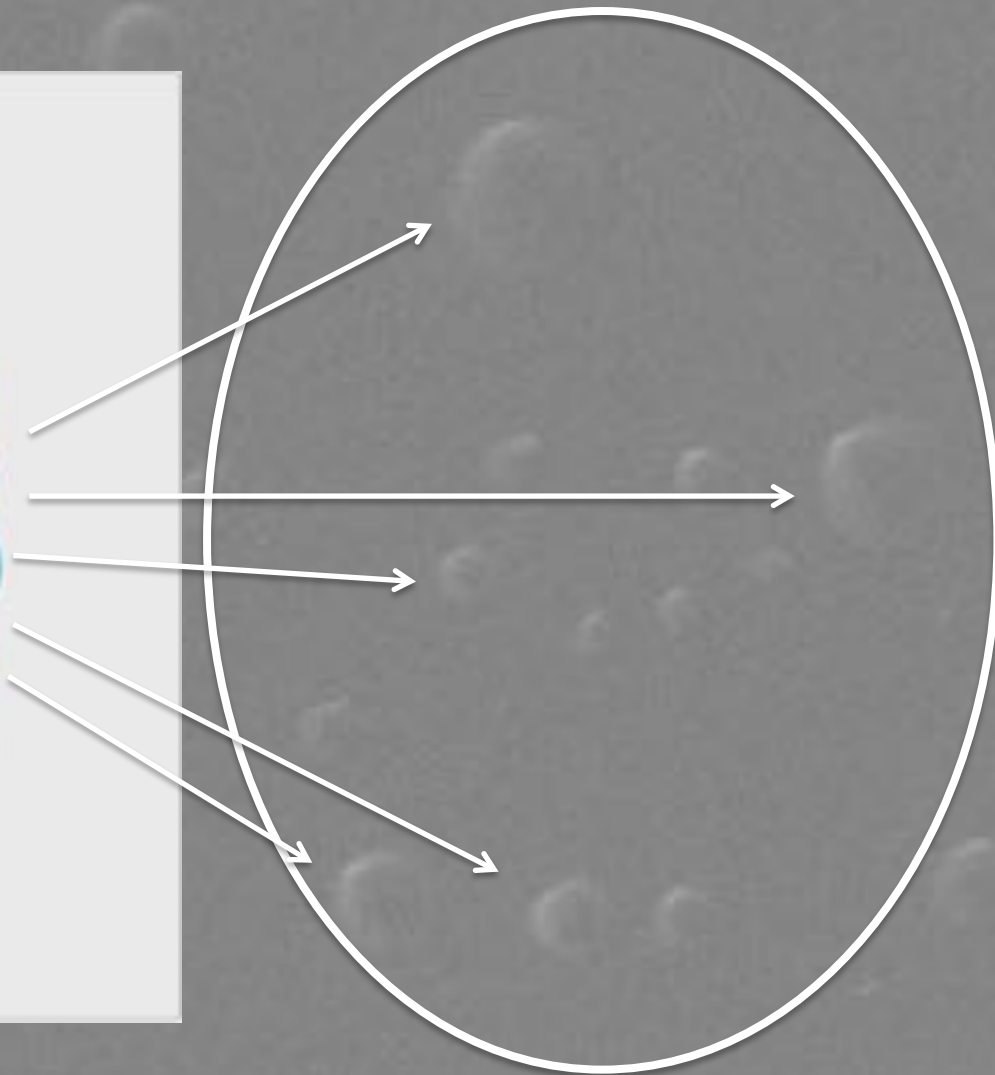
# Structure of Encapsulated OCC under SEM

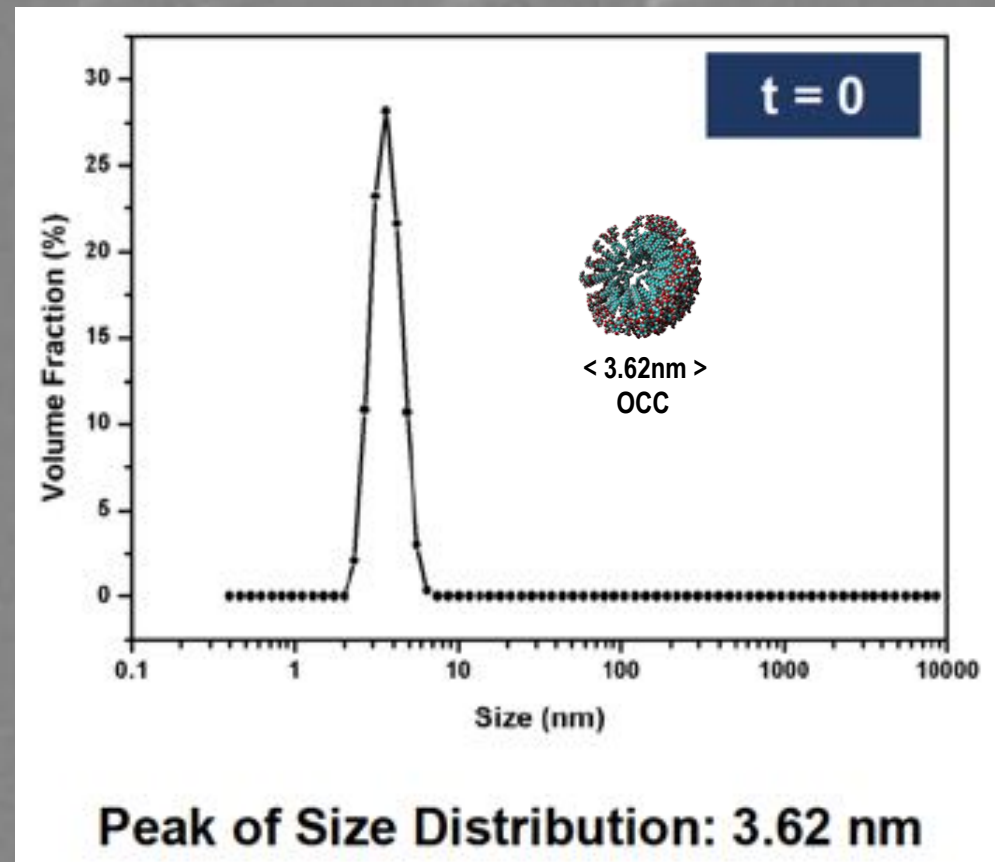
...organic lipid molecules encapsulate active substances in aqueous environment...

Outer Shell [blue & white, charged lipids]



Inner Core [red, active compounds]





### Characteristics of OCC's Electrokinetic Charge

1 x 10 dilution in H<sub>2</sub>O : -10.9mV

1 x 1,000 dilution in H<sub>2</sub>O : -25.07mV

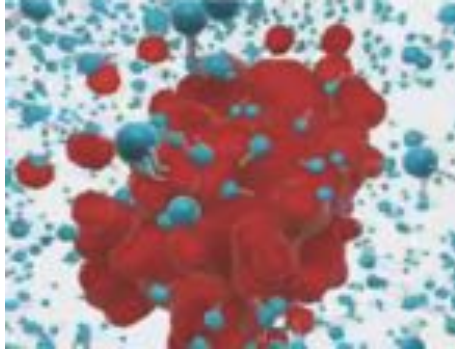
1 x 10,000 dilution in H<sub>2</sub>O : -34.0mV

The higher the dilution, the greater the Electrokinetic charge

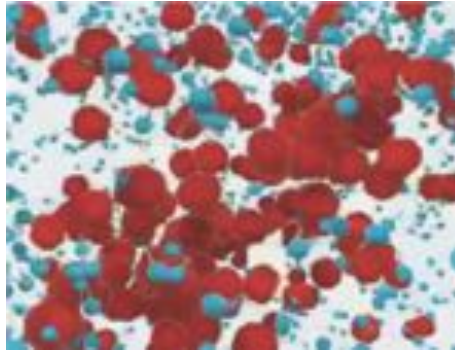


# Mode of Action

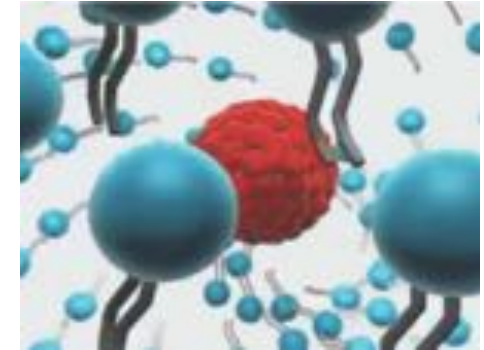
....when OCC™ (blue) is mixed with active compounds in aqueous environment.....



1. Charged lipids in aqueous solutions diffuse & surround active compounds.



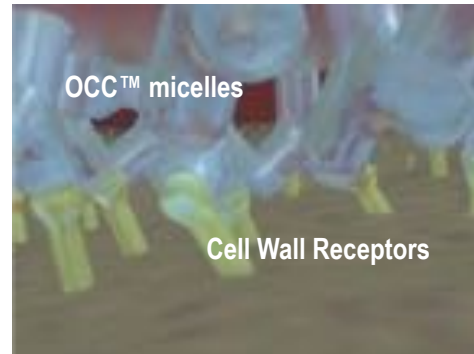
2. Active compounds disintegrated as charged lipids surrounds them.



3. Charged lipids + active compounds combine to form micelles



6. Cell walls efficiently absorb micelles with compounds into plant cells.



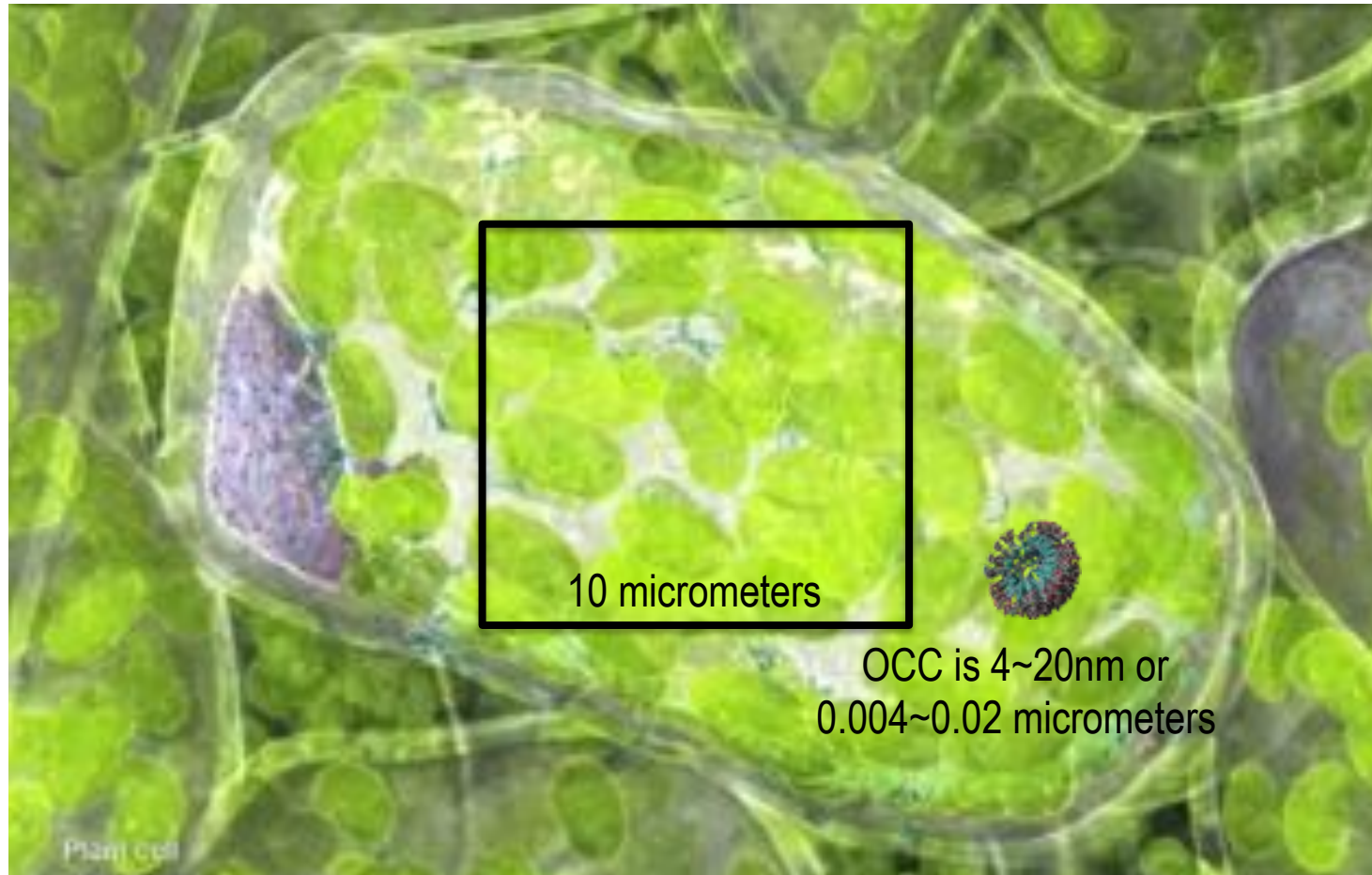
5. Charged micelles triggers receptors on cell walls.



4. Charged nanoscale micelles formed, encapsulating active compound

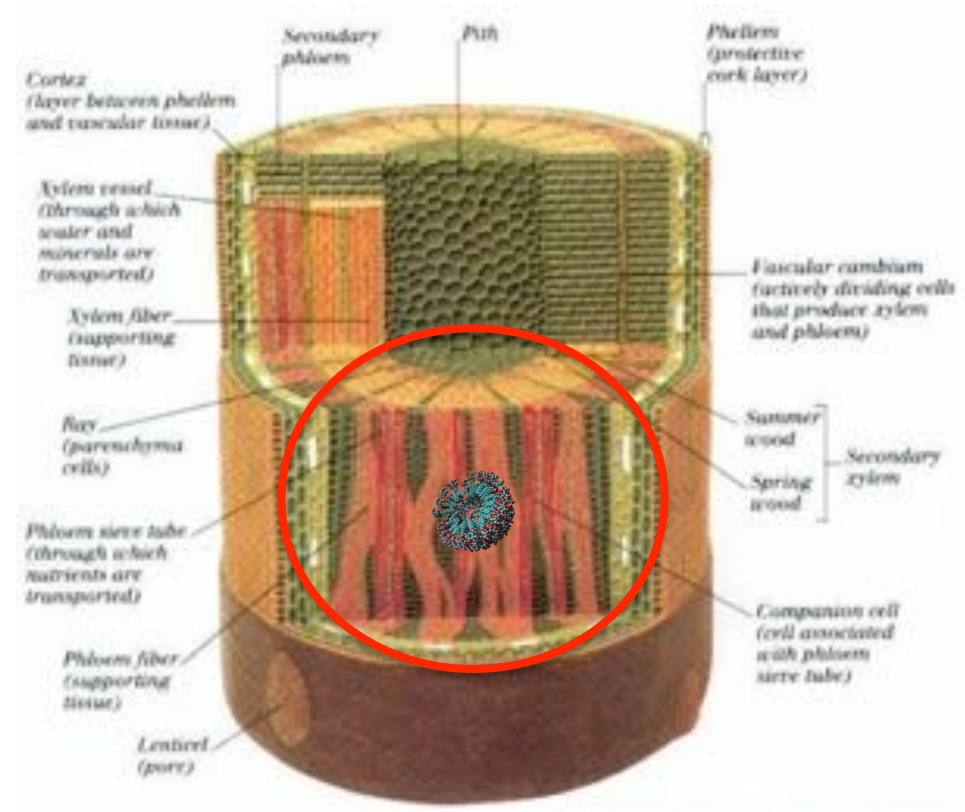
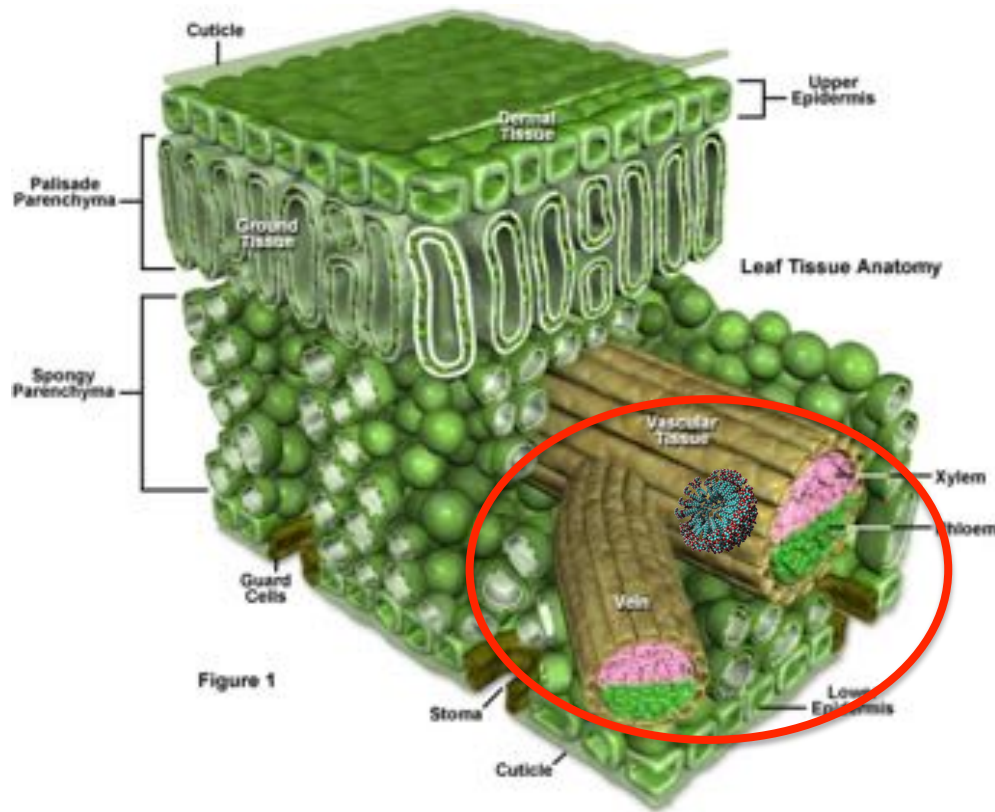
# Mode of Action – Another Look

OCC with highly charged nanoscale lipids is effective in penetrating dual lipids membrane plant cell walls



# Different from Typical Adjuvant

Commercial penetrant adjuvant can typically only penetrate just beyond waxy cuticle surface of foliage,  
OCC is effective in penetration of all 3-types of plant cells,  
and can deliver active substances to xylem and phloem, both via foliage or direct trunk application



OCC + H<sub>2</sub>O<sub>2</sub>

An Effective & Sustainable  
Crop Protection Solution



# Benefits of Hydrogen Peroxide in Agriculture

Benefits in uses of Hydrogen Peroxide ( $H_2O_2$ ) in Agriculture is well documented, which includes as agents for;

1. Seed Germination
2. Soil Conditioning
3. Rooting
4. Insect Repellent
5. Disinfectant
6. Crop Protection

$H_2O_2$  decomposes to release Oxygen that contributes to aforementioned functions

# OCC + H<sub>2</sub>O<sub>2</sub>

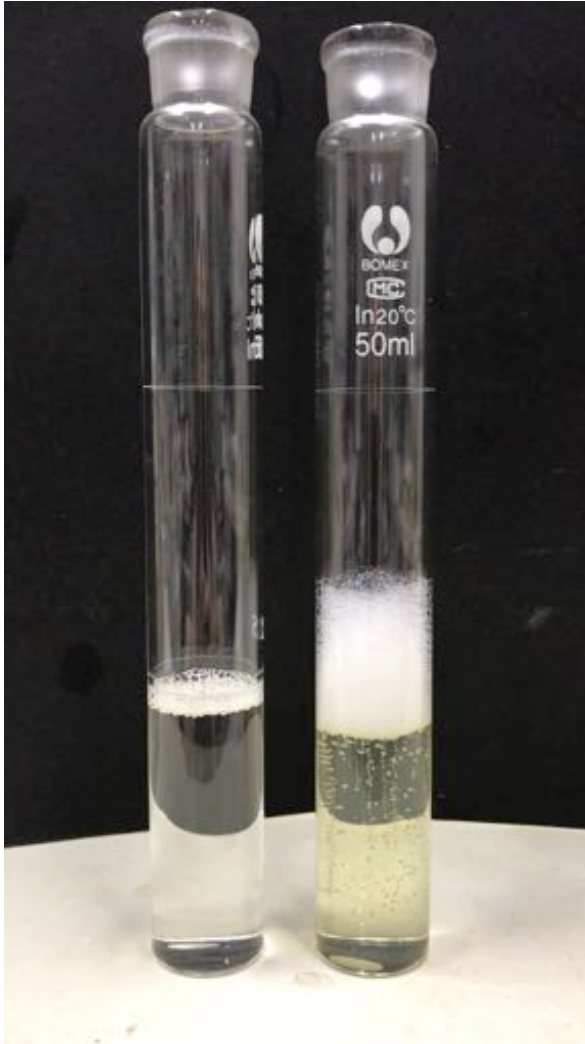
When OCC + H<sub>2</sub>O<sub>2</sub> is mixed with water, Oxygen are released...  
**a powerful combination for sustainable crop protection**



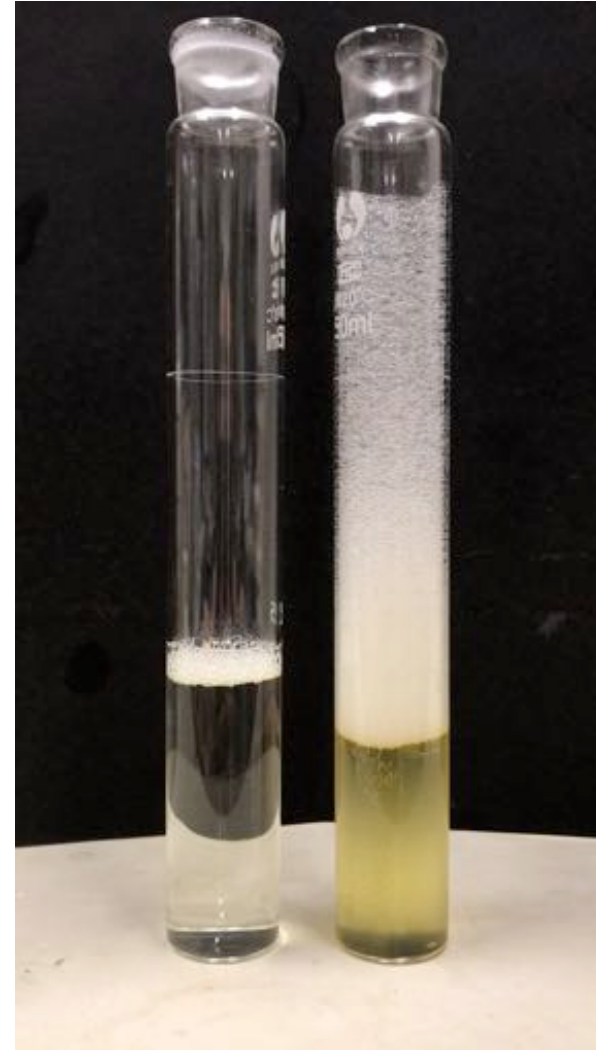
# OCC + H<sub>2</sub>O<sub>2</sub>

OCC™ (right of photos) releases much more Oxygen than Tween 20 (left of photos) when mixed with H<sub>2</sub>O<sub>2</sub>

Lower  
Concentration



Higher  
Concentration



# OCC + H<sub>2</sub>O<sub>2</sub>

*Oxygen are also released when OCC formulated liquid nutrients are mixed with H<sub>2</sub>O<sub>2</sub> in Tank Mix...  
making liquiid nutrients with OCC as formulant  
both a nutrient provider as well as a defense against diseases when combine with H<sub>2</sub>O<sub>2</sub> in tank mix*



EU Group 4 Organic Liquid Fertilizer



EU Group 1 (CE) NPK Liquid Fertilizer



# OCC + H2O2

## Effective EU Field Results & Dosages

# OCC + H2O2 against Fungal Diseases

with OCC formulated agrochemicals (OCC @ 6% ~ 8% v/v) at 1:1,000 dilution rate or 0.1% in Tank Mix

<u>Pathogens</u>	<u>% v/v</u> <u>Concentration of</u> <u>H2O2*</u>	<u>Application Rates based</u> <u>on 5 litres Hectares</u>		Remarks
		<u>Weekly</u>	<u>Bi-Weekly</u>	
Fungal Diseases or Pathogens				
Alternaria solani	1.0 ~ 1.5%		✓	Application in accordance to typical crop protection protocol
Athelia rolfsii				
Botrytis cinerea				
Colletotrichum gloeosporioides				
Curvularia sp.				
Erysiphe cichoracearum				
Leveillula taurica / powdery mildew				
Passalora fulva				
Pestalotiopsis sp.				
Phellinus igniarius				
Phytophthora				
Pseudoperonospora cubensis				
Rhizoctonia solani				
Sclerotium rolfsii				
Stereum hirsutum				
Verticillium				
Fusarium oxysporum		✓		

# OCC + H2O2 against Bacterial Diseases

with OCC formulated agrochemicals (OCC @ 6% ~ 8% v/v) at 1:1,000 dilution rate or 0.1% in Tank Mix

<u>Pathogens</u>	<u>% v/v</u> <u>Concentration of</u> <u>H2O2*</u>	<u>Application Rates based</u> <u>on 5 litres Hectares</u>		Remarks
		<u>Weekly</u>	<u>Bi-Weekly</u>	
<b>Bacterial Diseases or Pathogens</b>				
Xanthomonas campestris, Ralstonia solanacearum, Pseudomonas corrugata	1.0 ~ 1.5%		✓	Application in accordance to typical crop protection protocol
Clavibacter michiganensis		✓		
Pectobacterium carotovorum	3% ~ 5%	<b><u>Application on bark only</u></b> at the beginning of dormancy period (at 5%) and at the beginning of fruiting period (at 3%)		
Pseudomonas solanacerum	3% ~ 5%			

# OCC + H2O2 against Viral Diseases

with OCC formulated agrochemicals (OCC @ 6% ~ 8% v/v) at 1:1,000 dilution rate or 0.1% in Tank Mix

<u>Pathogens</u>	<u>% v/v</u> <u>Concentration of</u> <u>H2O2*</u>	<u>Application Rates based</u> <u>on 5 litres Hectares</u>		Remarks
		<u>Weekly</u>	<u>Bi-Weekly</u>	
Viral Diseases or Pathogens				
Bacilliform virus	1.0 ~ 1.5%	✓		Application in accordance to typical crop protection protocol
Mosaic virus				
Tomato yellow leaf curl virus (TYLCV)				
Sharka or Plum Pox				
New delhi leaf curl virus (TLCNDV)				



# OCC + H2O2

## Tank Mix Dosages for Other Application

Application	% v/v Concentration of H2O2	% v/v of OCC ROCPA or ROC1K	Remarks
<b>Seed Germination</b>	0.8 ~ 1.2%	0.1%	Eliminate seed borne pathogens
<b>Soil Conditioning</b>	0.8 ~ 1.2%	0.1~0.15%	Aerate soil with oxygen and colloids
<b>Rooting Agent</b>	0.8 ~ 1.2%	0.1~0.15%	Treating root rot & facilitate root growth
<b>Insect Repellent</b>	1.0 ~ 1.5%	0.15~0.20%	Repel insects & destroy eggs and numphs
<b>General Disinfectant</b>	0.5 ~ 1.0%	0.1%	Disinfection & adding colloids to water

# OCC as Tank-Mix Co-Adjuvant In Combination with Pesticides for Crop Protection

# OCC Improves Efficacies of Active Compounds for Crop Protection

<u>Types</u>	<u>Active Compounds / Nutrient Inputs</u>	<u>Improvement of Efficacies</u> *	<u>Tested Field Crops</u>	<u>Types</u>	<u>Active Compounds / Nutrient Inputs</u>	<u>Improvement of Efficacies</u> *	<u>Tested Field Crops</u>
Fungicides	Bentialalcarb	~ 100%	Tomato	Insecticides	Abamectin	~ 100%	Cucumber
	Bupiramate	~ 60%	Cucumber		Acrinactrin		
	Clortanolil	~ 100%	Tomato		Azadiractin		
	Difeconazol	~ 60%	Maize		Cholarntraniliprol		Tomato
	Metalaxyl	~ 100%	Tomato		Cipermetrin + Metylclorpi		Fruit Trees
	Mancoceb	~ 60%	Fruit Trees		Cipermetrin or Cypermetrin		Tomato
	Miclobutanil				Clorpirifo		Maize
	Piraclostrobiin		Cucumber		Deltametrin		Fruit Trees, Tomato
	Triadimenol				Imidacloprid		Tomato
Herbicides	Ammonium Glufosinate	~ 100%	Tomato		Lamda Chialotryl	~ 60%	Cucumber
	Bromoxynil + MCPA		Maize		Piriproxifem		
	Desmedifam 4.7 + Etofumesato		Suger Beet		Spinosad		Fruit Trees
	Etofumesato		Maize		Pimetrocyne		Cucumber
	Imazamox				Defeconazol		
	Isoxaflutol 20% + Ciprosulfamide 20%		Tomato		Enamectine		50% ~ 100%
	Metribucin			Water Soluble Nutrients	Macro-Nutrients, Amino Acids, Seaweed Extracts, Humic & Fulvic, etc		
	Quizalofop						
	Rimsulfuron						
	Difulfenican 20% + Flufenacet 40%	Barley					
	Piorasuram 1.42% + Piroxsuram 7.08%	~ 60%	Wheat				

Note \*: Improvement of Efficacies was measured by comparing commercial output data against normal protocol with a reduction of either 30% (60% improvement) or 50% (100% improvement) of chemical input or dosage.

# Selected OCC Case Studies As Tank-Mix Adjuvant or In-Can Formulant



## Tank Mix: OCC + Pesticides – Plum Orchard (Spain)

OCC™ was used as adjuvant in crop protection tank mix on **Japanese Plum** with Sharka-Plum Pox Virus (PPV) in Murcia, Spain. **RESULT: Infected rate reduced to 4% from usual 30% when OCC is added in Tank Mix.**



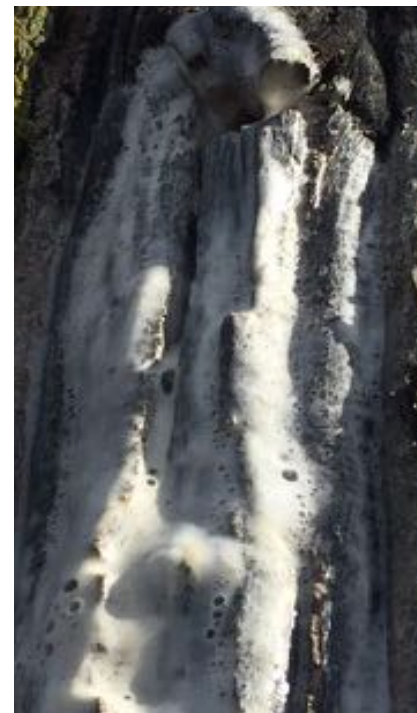
Damaged Fruits

# In-Can: OCC + H2O2 – Treating Tinder Disease @ Vineyard (Spain)

In 2003, when EU banned the use of **sodium arsenate** in agriculture, growers of vineyard did not have a solution to contain the tinder disease brought on by two fungal strains – *Stereum hirsutum* Per & *Phellinus igniarius* Fr. In 2017, Viticulturist **Abdon Segovia** developed a protocol combining H2O2 with a CE fertiliser with OCC as in-can formulant. **RESULT: A two-stage cost effective preventive & curative protocol to contain the YESCA Tinder disease.**



From 2015 to 2017, each vine tree has to be cracked open to apply H2O2 (above). As of December 2017, OCC +H2O2 as tank mix could apply directly onto affected area (right, left photo) to penetrate for both curative and preventive measures, resulting in vibrant and healthy vine trees. (right, right photo).





# Tank Mix: OCC + H<sub>2</sub>O<sub>2</sub> – Treating Frost Damaged Young Plants (Spain)



Young plants damaged by early spring frost in March 2018



Recovered 10 days later after one application of OCC + H<sub>2</sub>O<sub>2</sub>



## Tank Mix: OCC + H<sub>2</sub>O<sub>2</sub> – Treating Fungus infested Maple (Spain)



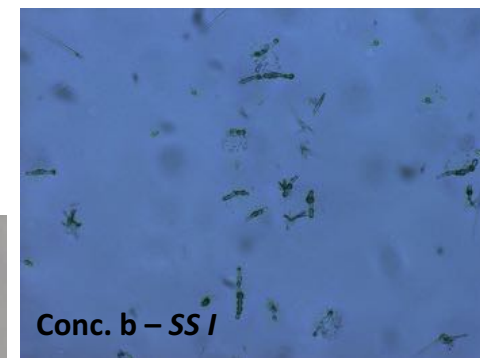
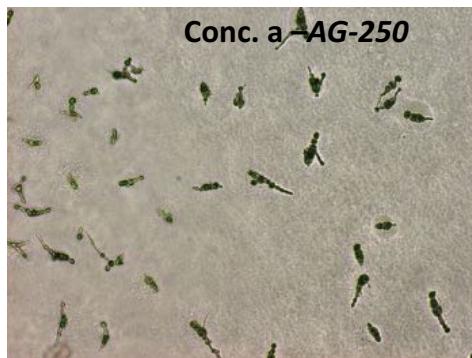
Fungus infested Maple was sprayed with OCC + H<sub>2</sub>O<sub>2</sub>



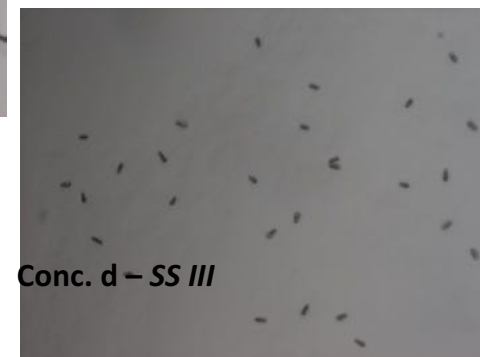
Maple 1.5 months after sprayed with OCC + H<sub>2</sub>O<sub>2</sub>

# In-Can: OCC + Fungicide to Contain Black Sigatoka (Ecuador)

Black Sigatoka is a leaf spot fungal disease that plagues banana plantations in Ecuador. Plants with leaves damaged by the disease may have up to 50% lower yield of fruit. Original fungicide AG-250 was not effective in containing the diseases. OCC™ was integrated into original AG-250 as formulants in 3 ratios; SS-I, SS-II and SS-III. All displayed improved efficacy against Black Sigatoka over AG-250 in laboratory test with SS-II being the best performer.



Control absoluto





# In Summary

- ✓ Like plasma in human blood, OCC is effective in delivery of nutrients and chemicals within the plant system.
- ✓ OCC excels when plant/crop growth is under biotic and/or abiotic stresses. It complements appropriate nutrients and crop protection management to optimize plant growth.
- ✓ OCC raises efficacies of substances, and can help reduce input dosages of chemical substances over time.
- ✓ OCC is effective when complements H<sub>2</sub>O<sub>2</sub> for sustainable crop protection that is safe, and cost effective.

*For more information, please contact us at [info@inergigroup.com](mailto:info@inergigroup.com)*

## Thank You!