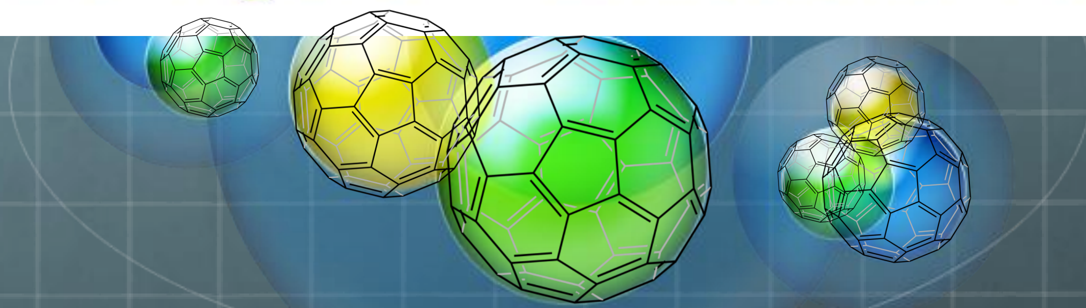
N/C Quest Inc.

Bio-Agtive™ Emissions Technology



2019 PP-BA-2

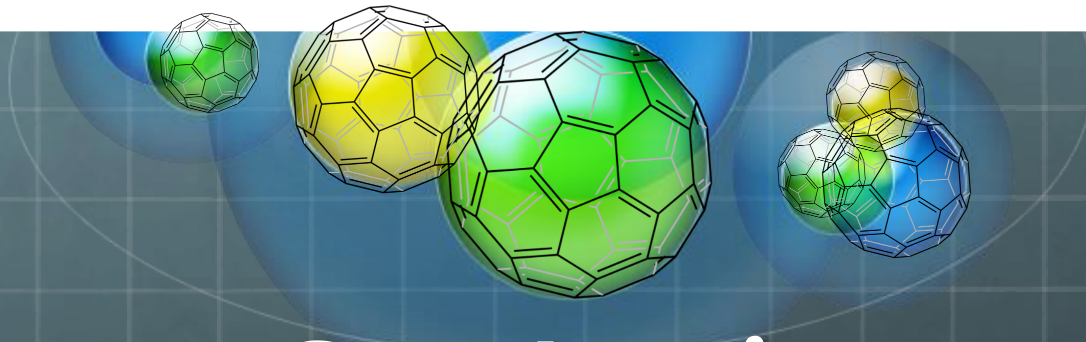
2020 Bio-Agtive™ Fusion Tank Solubilizing

CARBON FARMING PROJECT

Agriculture helping the planet breathe easier™

N/C Quest Inc.

Bio-Agtive™ Emissions Technology



Gary Lewis

gary@bioagtive.com

Office: 403 628 2106

Mobile: 403 627 8864

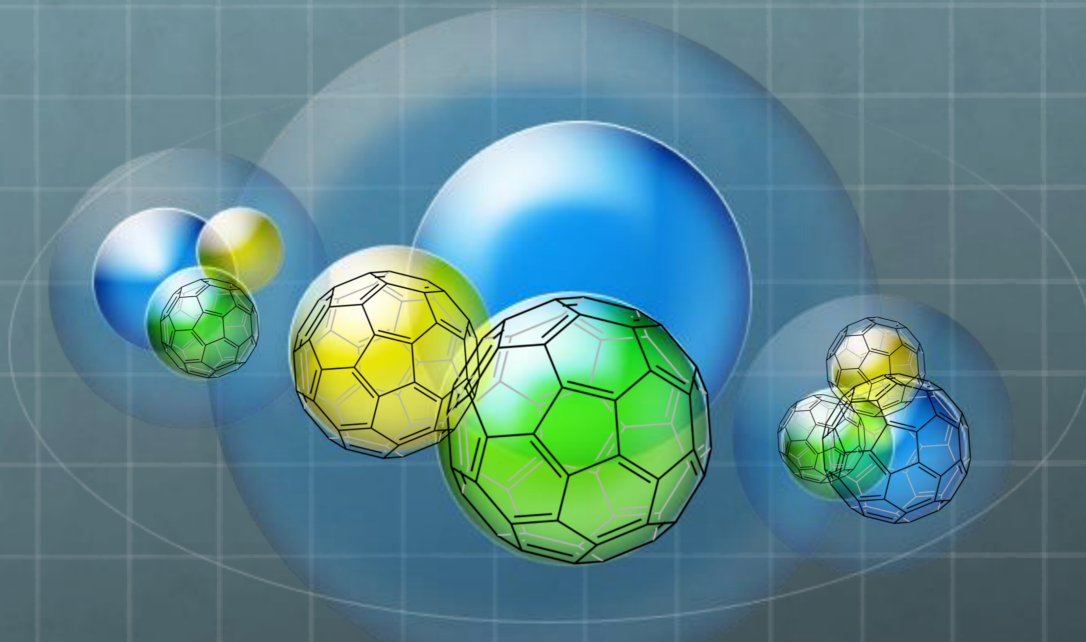
www.bioagtive.com

Olin Creek Ranch 1984

N/C Quest Inc. 2005 Bio-Agtive™ Emissions Technology History

- Irrigation patented method 2001
- Tractor and air seeder patented method 2005
- Carbon Nanotube Production Method 2013
- Solubilized Nano Carbon Method 2017

N/C Quest Inc.



S-OIL HEALTH

?

Agriculture helping the planet breathe easier™

Microorganisms

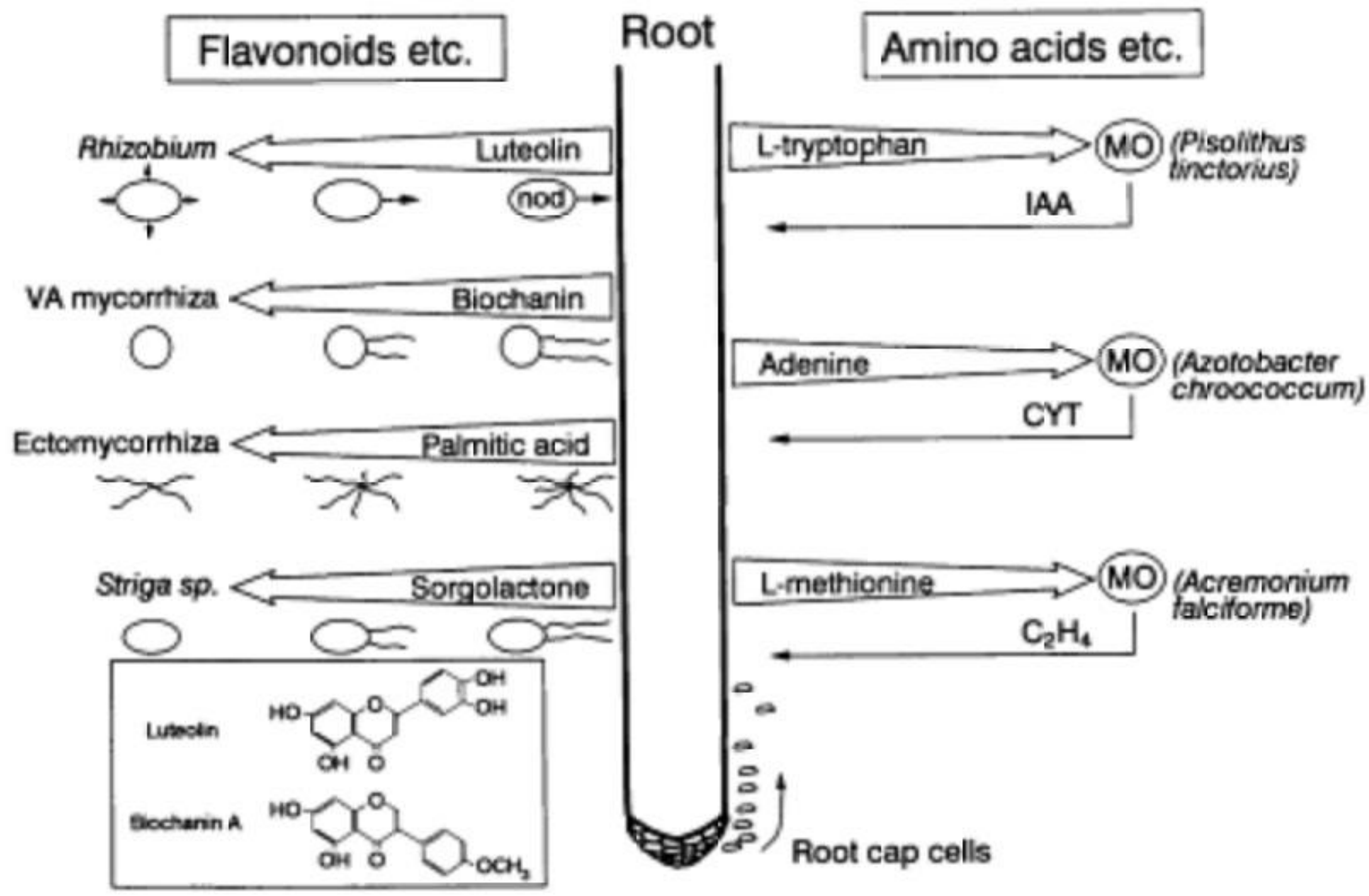
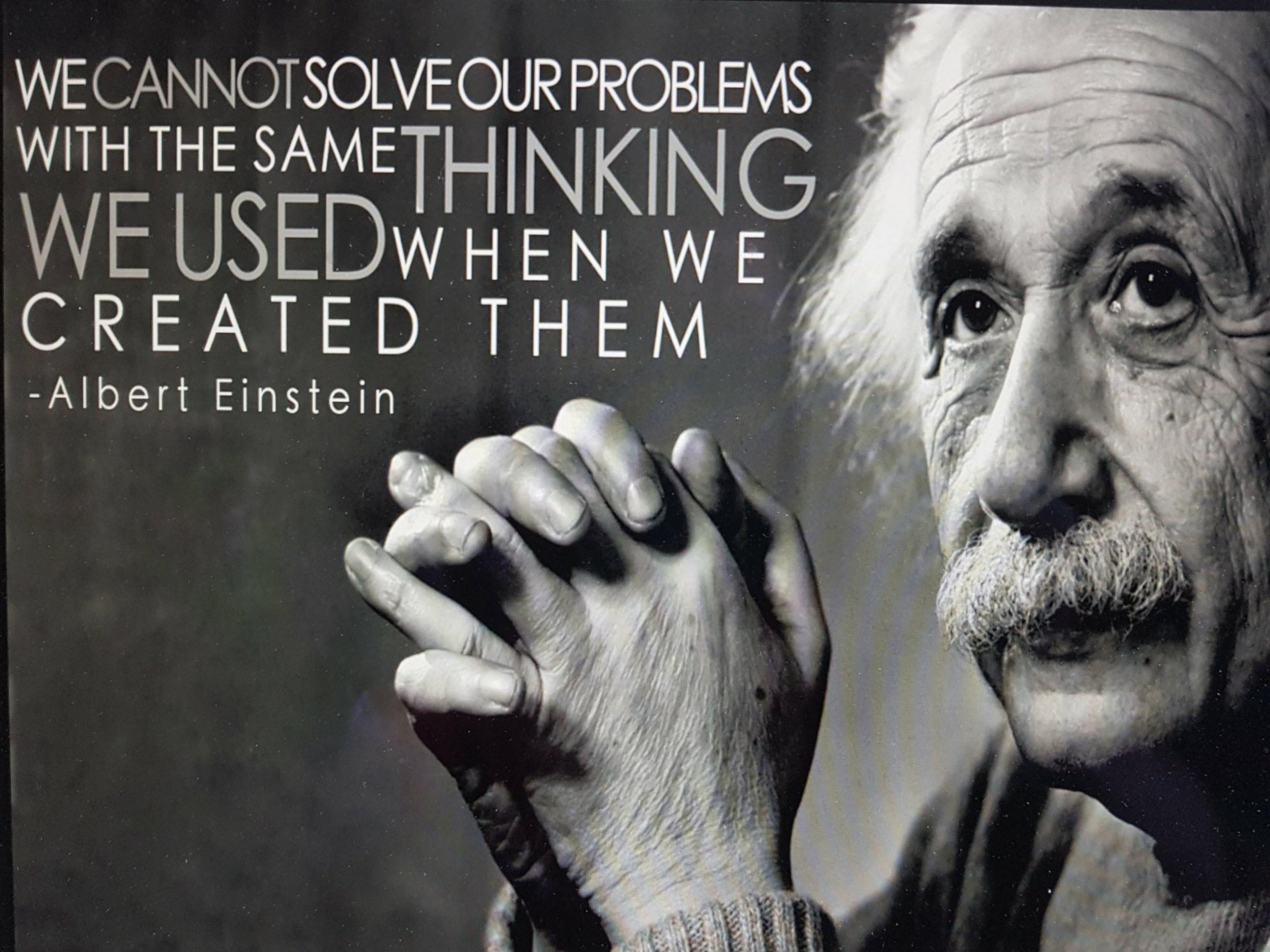


Fig. 15.17 Possible role of certain low-molecular-weight root exudates as 'signal' or as sources (precursors) for phytohormone production for microorganisms (MO) in the rhizosphere.

S-Oils around the world



WE CANNOT SOLVE OUR PROBLEMS
WITH THE SAME THINKING
WE USED WHEN WE
CREATED THEM
-Albert Einstein

N/C Quest Inc.

Scientific Research and Experimental Development

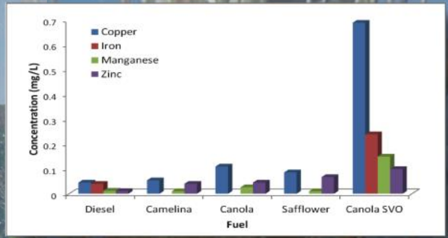
Montana State University Northern Bio-Energy Center

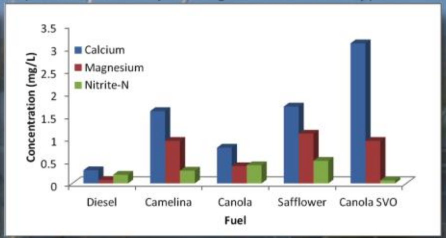
2012 Research Results

Soil Treatment with Different Fuels

-Engine load testing conducted by Nestor U. Soriano Jr. PhD

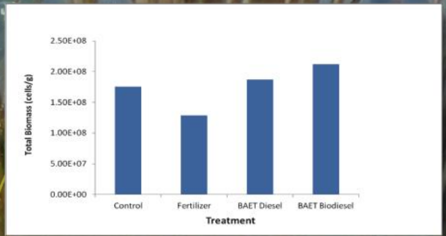
The concentratiod of some metals and anions in the "water trap" were affected by the engine load and fuel type.

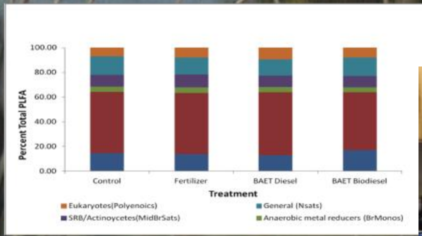




Total Bio-Mass of Soils

"The results show that putting exhaust emissions onto the seed and into the soil does affect the soil microbiology".
-Dr. Jill Clapperton PhD



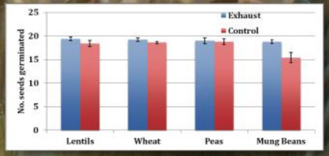


Yield of Wheat with Different Treatments

Treatment/Plot	Yield (bushel/acre)	Test weight per bushel (lb/bu)	Weight of other classes %	Foreign material %	Defects %	Moisture %	Damaged Kernels total %	Shrunken and broken kernels %	Protein %
Control	16.04	62.2	6	0	1.8	10	0	1.8	12
Fertilizer	15.08	61.6	9	0	1.8	9.9	0	1.8	11.7
BAET Diesel	16.9	61.8	1.5	0	0.8	10	0	0.8	13.3
BAET Biodiesel	16.62	62.2	3	0	1.3	10.4	0	1.3	11.6

Seed Treatment

"The results showed that there was a statistically significant interaction between the seed species, and the treamtment ($p<0.05$), and that the germination of seed exposed to the exhaust was greater than seed with (control) (<0.004)". It is also likely that the amount of time the seed is exposed to the exhaust and increased would affect the efficacy of the anti-fungal affect of seed germination". *- Dr. Jill Clapperton PhD*



http://www.bio

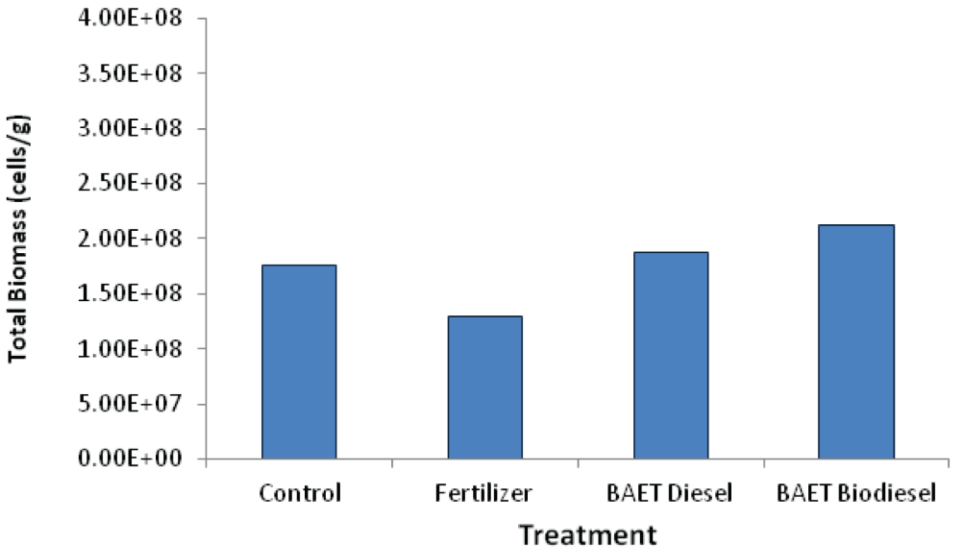


Figure 24. Results showing the total biomass content of the soil samples collected after harvesting at Field 1.

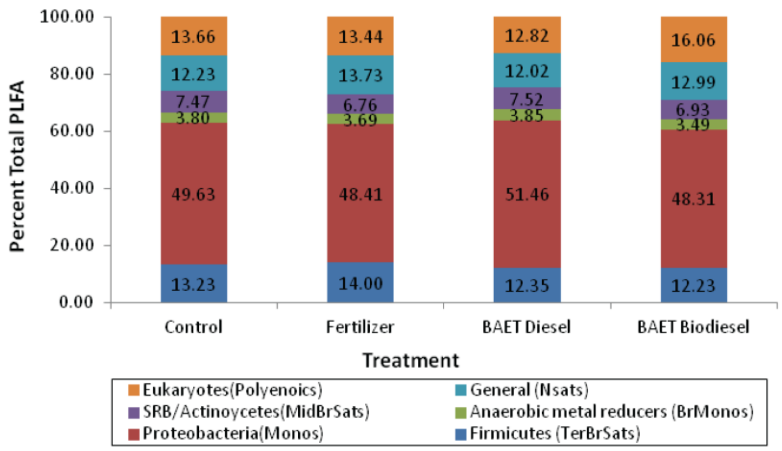


Figure 27. Results showing the percentage of total PLFA for the soil samples collected right after seeding at Field 1.

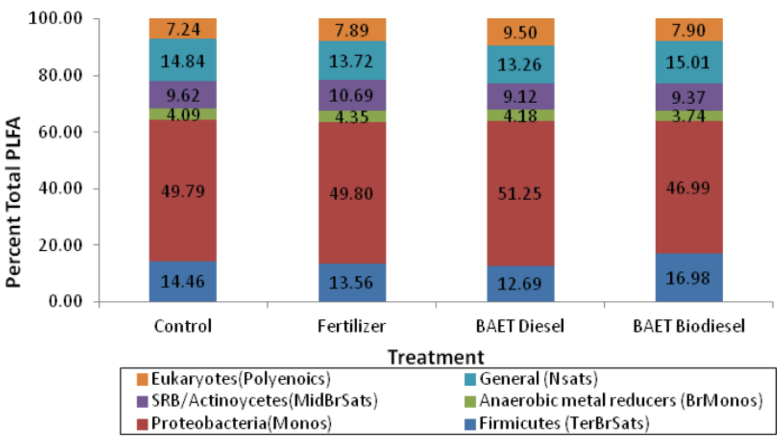


Figure 28. Results showing the percentage of total PLFA for the soil samples collected after harvesting at Field 1.

The relative percentages of total PLFA structural groups in the soil samples were also analyzed. The structural groups were assigned according to PLFA chemical structure, which is related to its fatty acid biosynthesis. Results show significant changes in the microbial profile in the soil before and after seeding (Figures 26 and 27). There was a noticeably increase in the percentage of eukaryotes. It was also observed that the proteobacteria (monos) population was greatly affected by the type of fuel used. For plots treated with BAET Diesel, proteobacteria increased in percentage while other treatments showed a decreasing trend. Proteobacteria consists of free living nitrogen fixing bacterial and its increase agrees with the increase in nitrogen content in the soil (Tables 4 and 5).

1. Nutrient and Yield Analysis of Harvested Crops

3.1 Objective

The third objective was to determine which biofuels or blends of biofuels and diesel fuels work best for supplying crop nutrients, or stimulating the soil to provide crop nutrients.

3.2 Nutrient Analysis of Spring Wheat Grains

3.2.1 CASE STUDY 1: Field 1 Results

Nutrient content of the wheat grain between different treatments and control does show significant difference. The Bio-Agtive™ diesel has the highest nutrient values, yield and protein compared to control and fertilizer. Based on the results of the tests, diesel tends to increase the activity of free living nitrogen fixing bacteria in the soil (proteobacteria) which correlates to the slight increase in nitrates in the soil, nitrogen in plant tissues, and protein content of the grains. Biodiesel tends to increase biological activity, notably fungal (eukaryotes), in the soil as illustrated by the PLFA, soil respiration (Figure 37) and emission tests.

Table 11. Nutrient content of wheat grain harvested from Field 1.

NUTRIENT	TREATMENT			
	Control	Fertilizer	BAET Diesel	BAET Biodiesel
Calcium (%)	0.032	0.032	0.039	0.032
Copper (µg/g or ppm)	<5.0	<5.0	5.5	<5.0
Iron (µg/g or ppm)	75	67	76	75
Potassium (%)	0.43	0.44	0.45	0.44
Magnesium (%)	0.15	0.15	0.16	0.15
Manganese (µg/g or ppm)	51	50	52	54
Sodium (%)	0.0044	0.0041	0.0045	0.0038
Phosphorus (%)	0.38	0.36	0.36	0.39
Sulfur (%)	0.11	0.098	0.14	0.12
Selenium (µg/g or ppm)	1.1	1.5	1.8	1.6
Zinc (µg/g or ppm)	29	30	41	30

Results of the test plots showed increase in wheat yields for treatments where the BAET system was used. Direct parallel conclusions can be drawn through the complete experiment and tests, from the mineral content of the Bio-Agtive condensate and water trap setup in the lab, soil fertility tests, plant tissue tests, soil respiration, and PLFA that supports the increase in wheat yields and quality of grain. There was no decrease in nutrient content and bushel weight, more protein, less shrunk kernels, and less defects (Table 12). Also, there was a decrease in phosphorus and iron in the plant tissues collected in fertilizer treated plots, it could be because that the fertilizer makes phosphorus and iron in the soil unavailable to the plants.

The quality of the soil was also affected by the BAET system. Field trials and treatments were conducted on a field that has had emissions only (no fertilizer) for 6 years and continues cropping wheat. The decline of soil fertility with the application of ammonium phosphate was observed from the study (Figure 41).

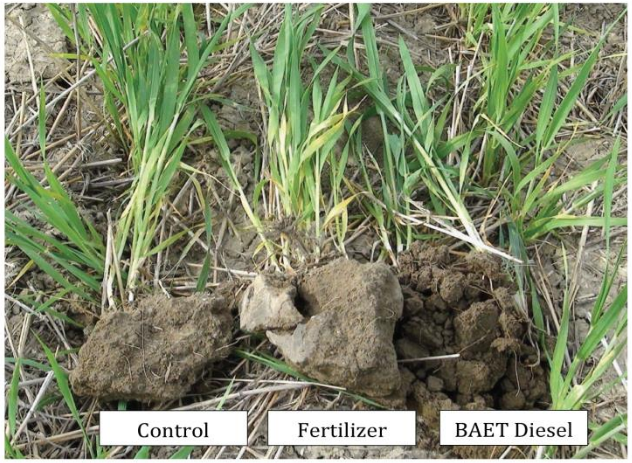


Figure 41. Soil characteristics of different treatments.

Table 12. Yield of wheat from Field 1 at different treatments.

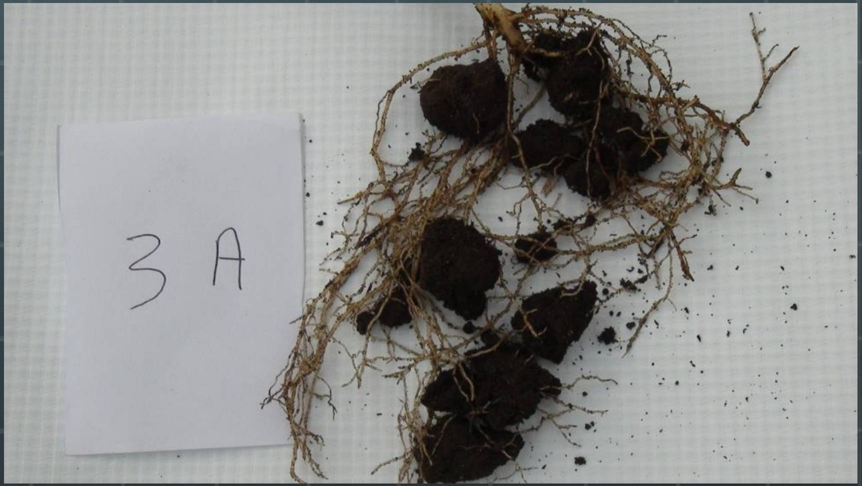
Treatment/ Plot	Yield (bushel/acre)	Test weight per bushel (lb/bu)	Weight of other classes %	Foreign material %	Defects %	Moisture %	Damaged Kernels total %	Shrunken and broken kernels %	Protein %
Control	16.04	62.2	6	0	1.8	10	0	1.8	12
Fertilizer	15.08	61.6	9	0	1.8	9.9	0	1.8	11.7
BAET Diesel	16.9	61.8	1.5	0	0.8	10	0	0.8	13.3
BAET Biodiesel	16.62	62.2	3	0	1.3	10.4	0	1.3	11.6

3.2.1 Case Study 2: FIELD 2

The results of the nutrient content and yield results are summarized in Tables 12 and 13. It should be noted that Field 2 was a transitional organic field in which conventional no-till practices were not applied and seeding was delayed until end of June due to unforeseen circumstances as discussed in section 2.3.5.

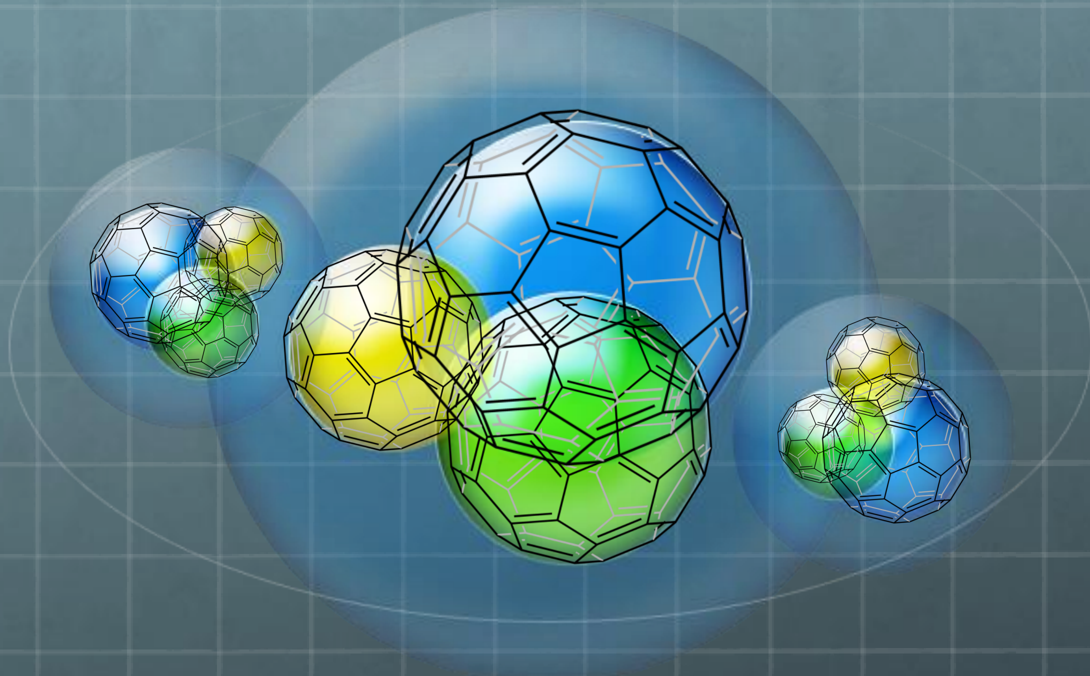
Emissions

Check



Green House

Repairing bad dirt in Jamaica solubilized carbon water restores S-oil



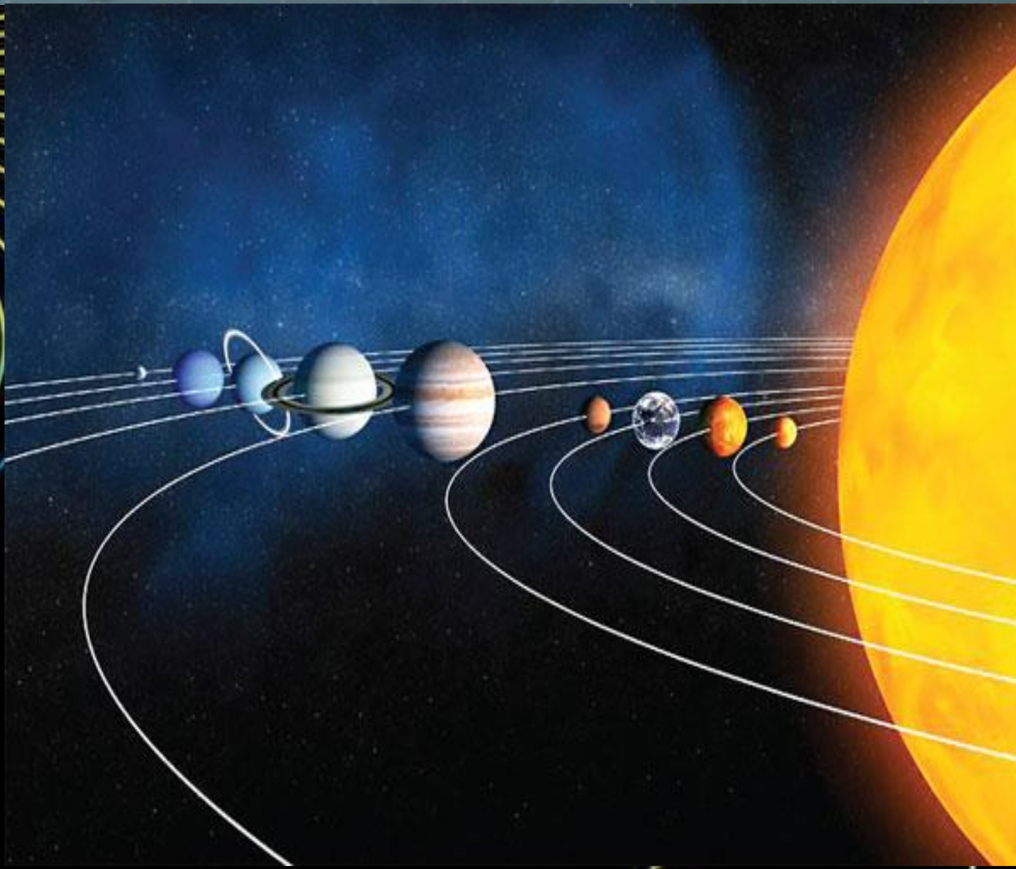
The Bio-Agtive™ Emissions Theory

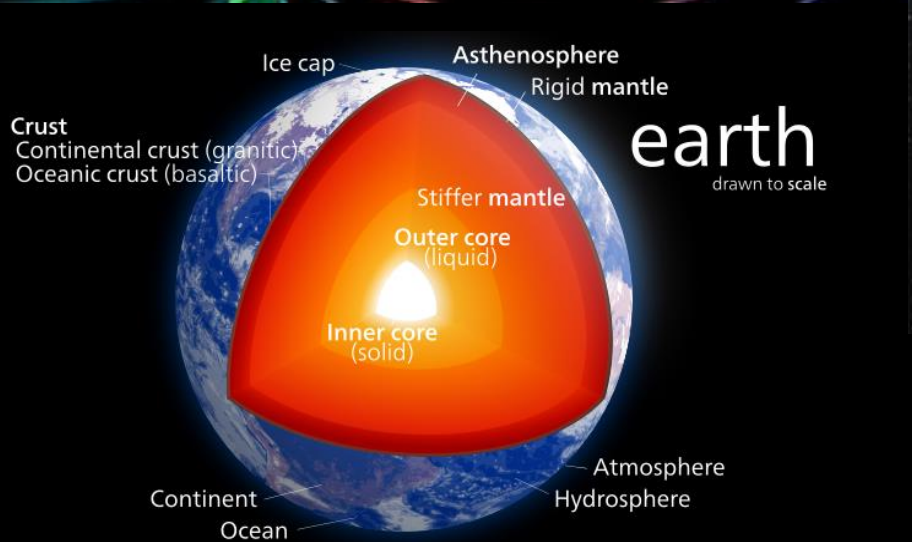
Agriculture helping the planet breathe easierTM

Earth Wind and Fire

(Energy cannot be lost or destroyed)

Light from the sun weighs 5 Lbs. per second





Earth

3 inches top soil
1 million pounds per acre
1200-1700 kilograms per sq. m

1% organic matter=1000LBS Nitrogen
300 LBS organic phosphorus
100-1000 lbs microbial life

NPKS

Nitrogen
Phosphorus
Potassium
Sulfur

Cation Exchange Capacity Soils Battery Box

Organic Matter & Clay Silicone
10 CEC Sand   50 CEC Clay

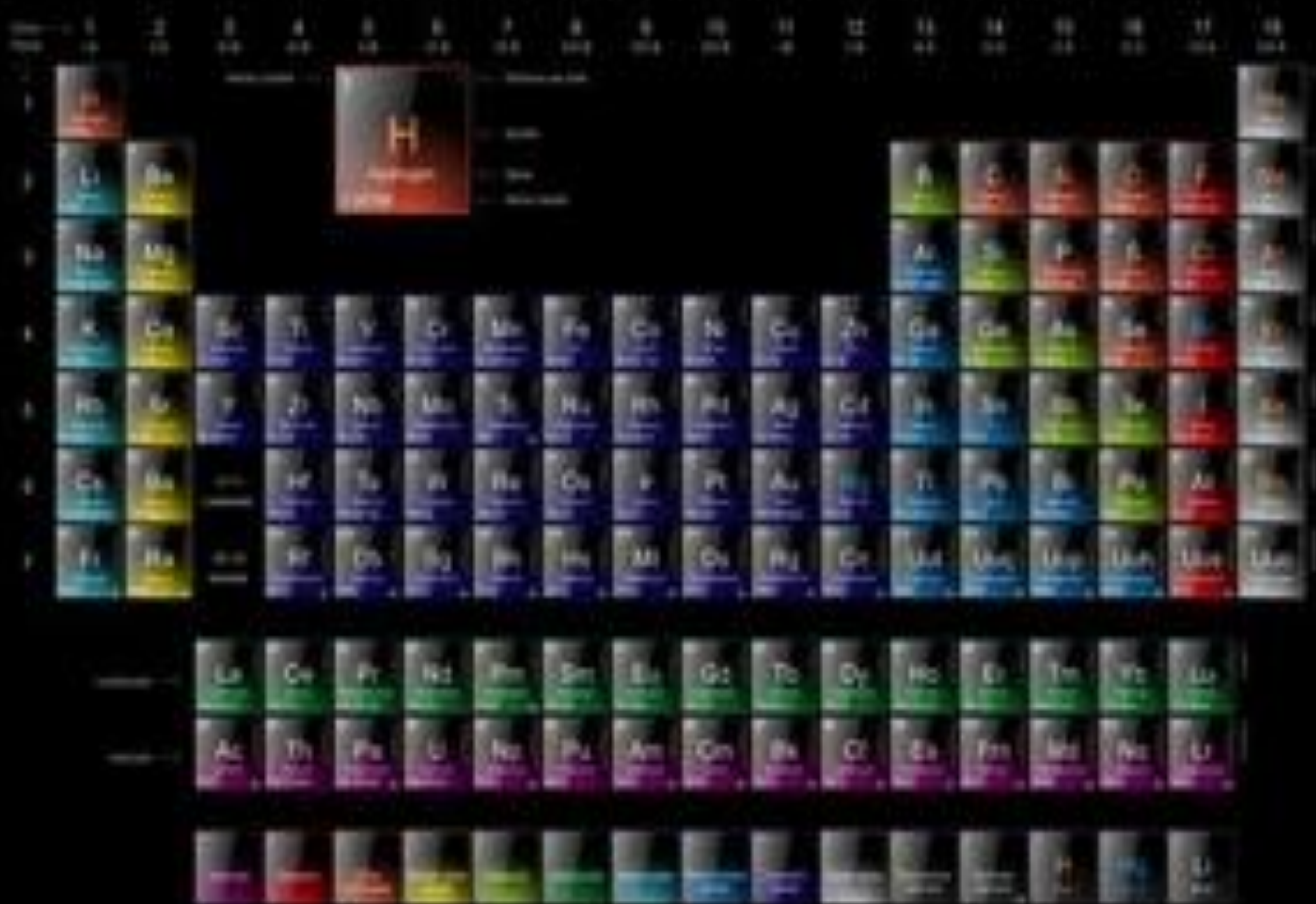
Potassium 2-5%
Magnesium 10-15%
Calcium 65-75%
Hydrogen 10-20%

Silicone
Zinc
Manganese
Iron
Copper
Boron
Aluminum
Chloride
Sodium
Molybdenum
Nickle
Water Holding Capacity

6.5 – 7 PH

Microbial life
Bacteria
Fungi
Protozoa
Nematodes
Earth Worms
Insects

THE PERIODIC TABLE OF THE ELEMENTS



Wind

78% Di-nitrogen

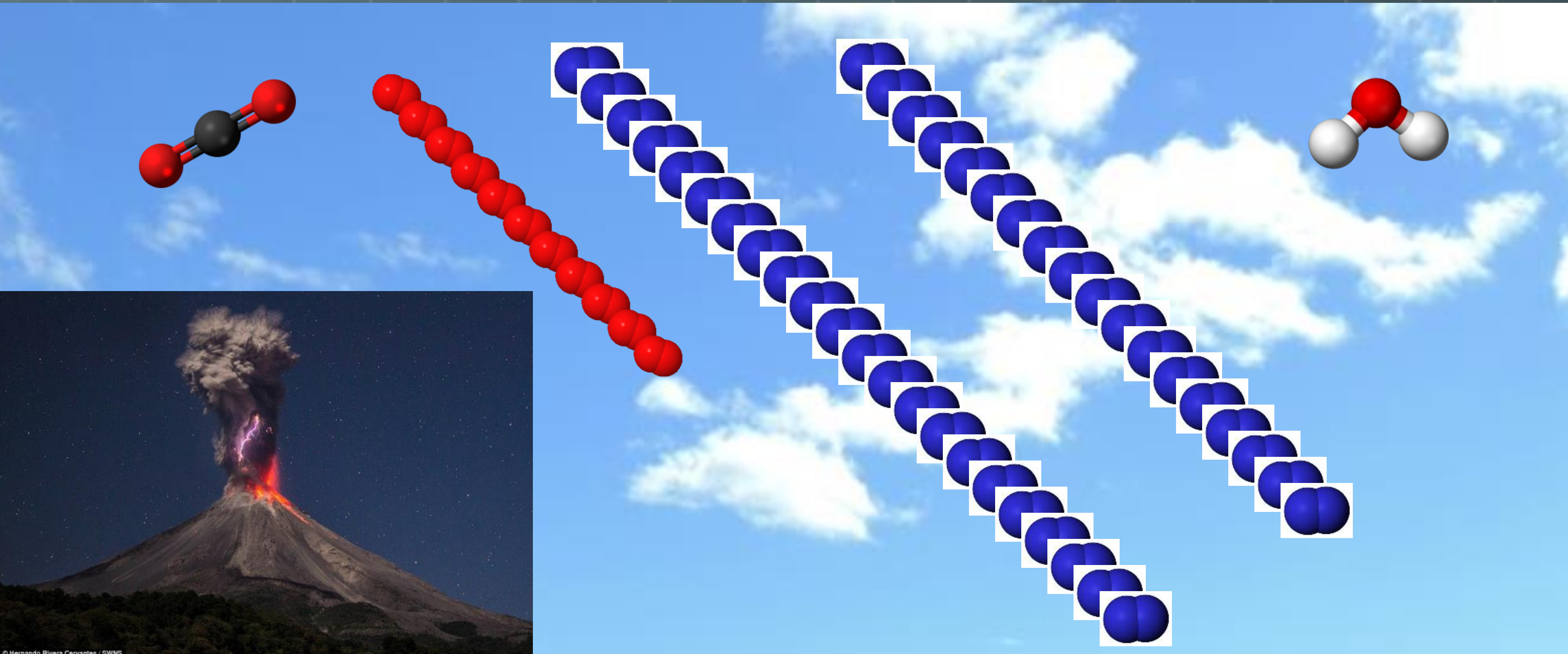
21% Oxygen

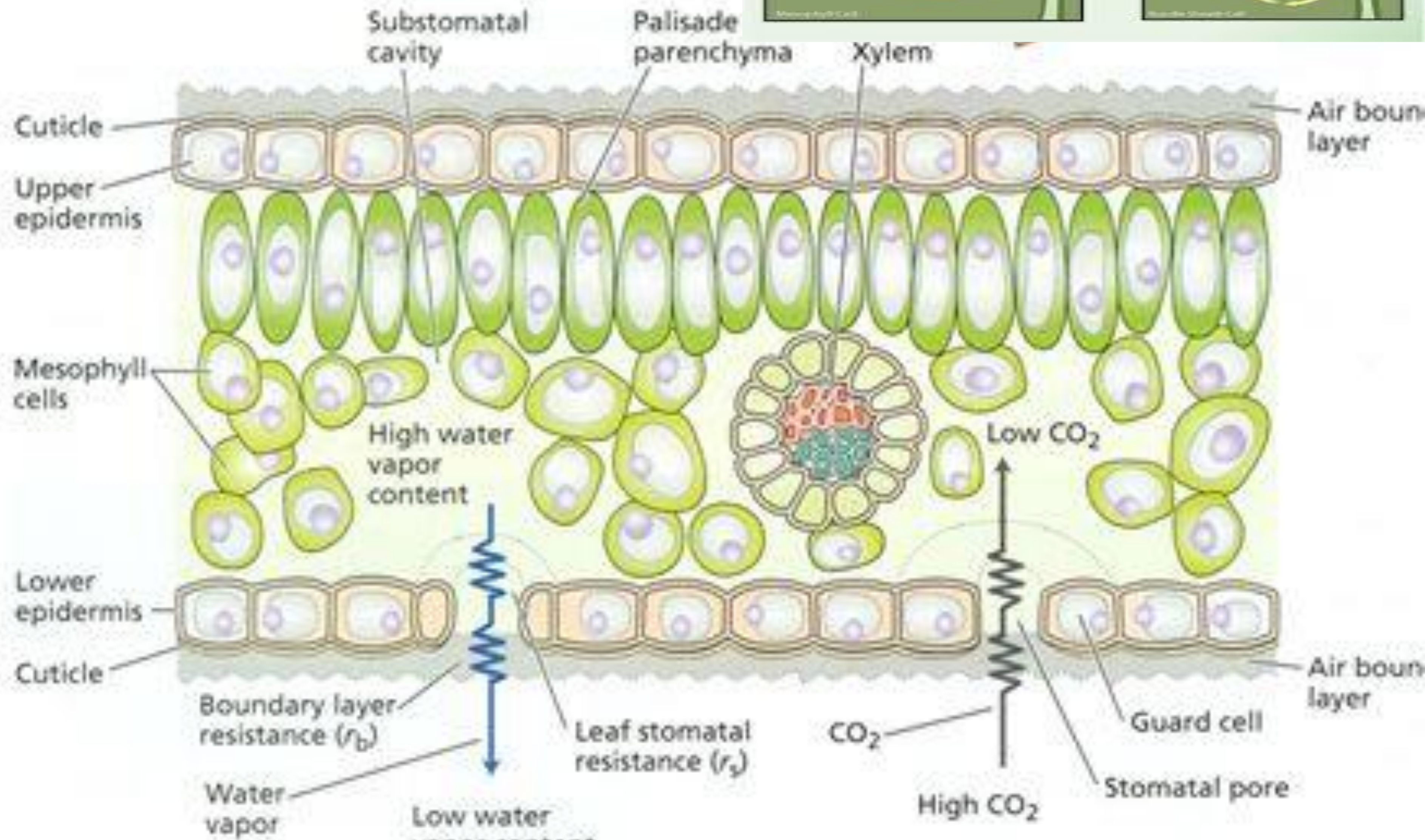
.380% Carbon Dioxide

.620% Other Gasses

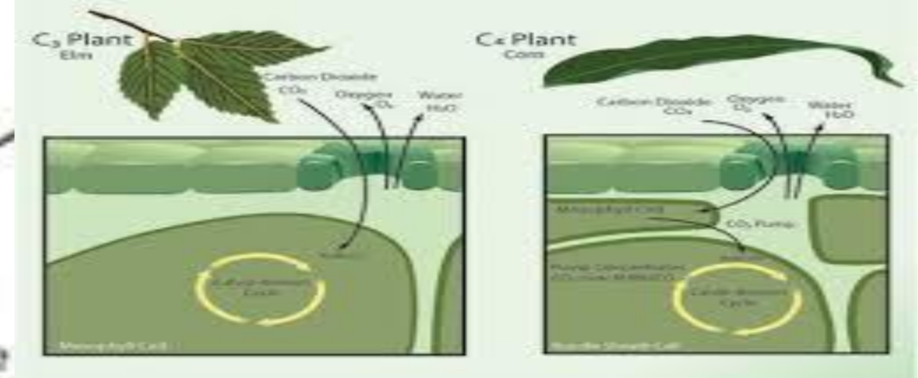
Water and Mineral Dust

Mass 1.229 Kilograms per square meter





Substomatal cavity
Palisade parenchyma
Xylem
Cuticle
Upper epidermis
Air boun
layer
Mesophyll cells
High water vapor content
Low CO$_2$
Lower epidermis
Cuticle
Air boun
layer
Boundary layer resistance (r_b)
Leaf stomatal resistance (r_s)
CO$_2$
Guard cell
Stomatal pore
Water vapor
Low water
High CO$_2$

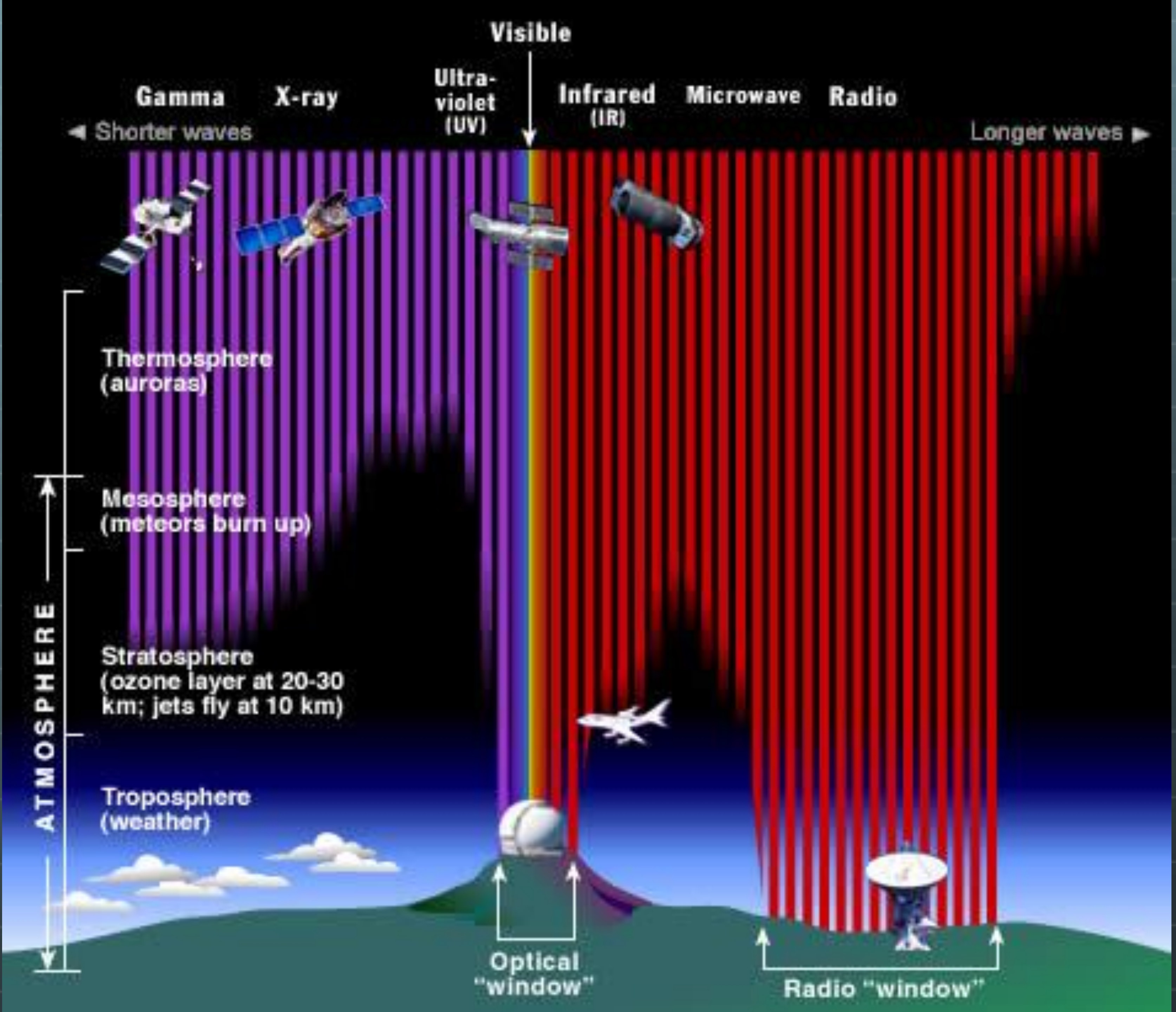


C$_3$ Plant
C$_4$ Plant

Fire = Light = Energy

$E=Mc^2$


Sr
Ba
Li
Na
Cu
Ca

Visible
Gamma
X-ray
Ultra-
violet
(UV)
Infrared
(IR)
Microwave
Radio
◄ Shorter waves
Longer waves ►
Thermosphere
(auroras)
Mesosphere
(meteors burn up)
Stratosphere
(ozone layer at 20-30
km; jets fly at 10 km)
Troposphere
(weather)
ATMOSPHERE
Optical
"window"
Radio "window"

PARTS PER MILLION in wheat grain

Earth = 2% Wind = 98% Fire = mc^2

TOTAL PARTS	1 MILLION (PPM)	100 %
Carbon Dioxide	900,000 ppm	90%
Hydrogen	60,000 ppm	6%
Water	8,334 ppm	0.8334%
Nitrogen	20,000 ppm	2%
Potassium	4,500 ppm	0.45%
Phosphorus	3,600 ppm	0.36%
Magnesium	1,600 ppm	0.16%
Sulphur	1,400 ppm	0.14%
Calcium	390 ppm	0.039%
Iron	76 ppm	0.076%
Manganese	52 ppm	0.052%
Copper	5.5 ppm	0.0055%
Selenium	1.5 ppm	0.0015%

Attn: GARY LEWIS
403-628-2106

Farm: OLIN CREEK RANCH
Field: 1RR

Report Date: 2015-02-10 **Print Date:** 2015-02-15

SOIL TEST REPORT

Sample Number	Legal Land Descpt:	Depth	Lab Number	Organic Matter	Phosphorus - P ppm Bicarb	Phosphorus - P ppm Bray-P1	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	pH	pH Buffer	CEC meq/100g	% K	% Mg	% Ca	% H	% Na
													Percent Base Saturations				
#2 BOT		6	37629	5.6	8	14	240	385	2730	7.0		20.2	3.1	15.9	67.7	12.8	0.5

Sample Number	Sulfur ppm S	Sulfur lbs/ac	Nitrate Nitrogen ppm NO3-N	Nitrate Nitrogen lbs/ac	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts ms/cm	Saturation %P	Aluminum Al ppm	Saturation %Al *	K/Mg Ratio	ENR	Chloride Cl ppm	Sodium Na ppm	Molybdenum Mo ppm
#2 BOT	10	18	31	56	5.4	34	53	1.4	0.6		4	434	0.0	0.19	69		23	

OE

SOIL FERTILITY GUIDELINES (lbs/ac)

Sample Number	Previous Crop	Intended Crop	Yield Goal	Lime Tons/Acre	N	P2O5	K2O	Mg	Ca	S	Zn	Mn	Fe	Cu	B

Crop yield is influenced by a number of factors in addition to soil fertility. No guarantee or warranty concerning crop performance is made by A & L.

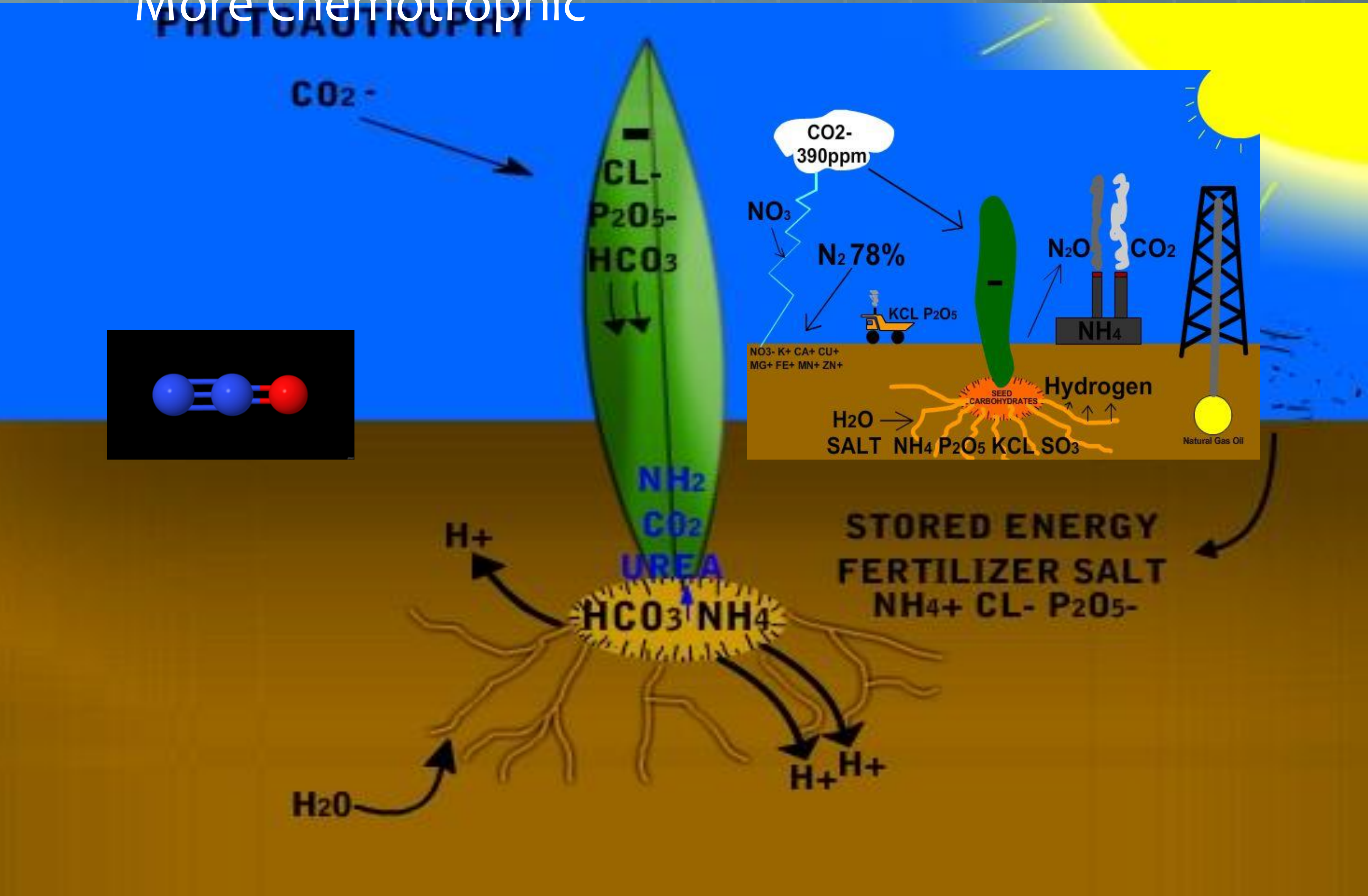
PARAMETER	AS FED	DRY	UNIT	METHOD
DRY MATTER				
Moisture	12.90	0.00	%	Wet Chemistry
Dry Matter	87.10	100.00	%	Calculation
PROTEIN				
Crude Protein	16.78	19.26	%	Wet Chemistry
MINERALS				
Calcium	0.04	0.05	%	Wet Chemistry *
Copper	5.14	5.90	ug/g	Wet Chemistry
Phosphorus	0.34	0.39	%	Wet Chemistry *
Potassium	0.29	0.33	%	Wet Chemistry
Sulphur	0.17	0.19	%	Wet Chemistry *
Magnesium	0.13	0.15	%	Wet Chemistry
Zinc	44.52	51.11	ug/g	Wet Chemistry *
Iron	37.69	43.27	ug/g	Wet Chemistry *
Manganese	25.78	29.60	ug/g	Wet Chemistry *
Sodium	0.01	0.01	%	Wet Chemistry
Selenium	BDL*		ug/g	EPA 3050/6010 (mod)

Plant Physiology

Bio-Agtive™ & Fertiliser

COAL SEAM GAS SUPPORTED AGRICULTURE

More Chemotrophic



NO3- or NH4+
Nitrate Ammonium
-Anions or +Cations

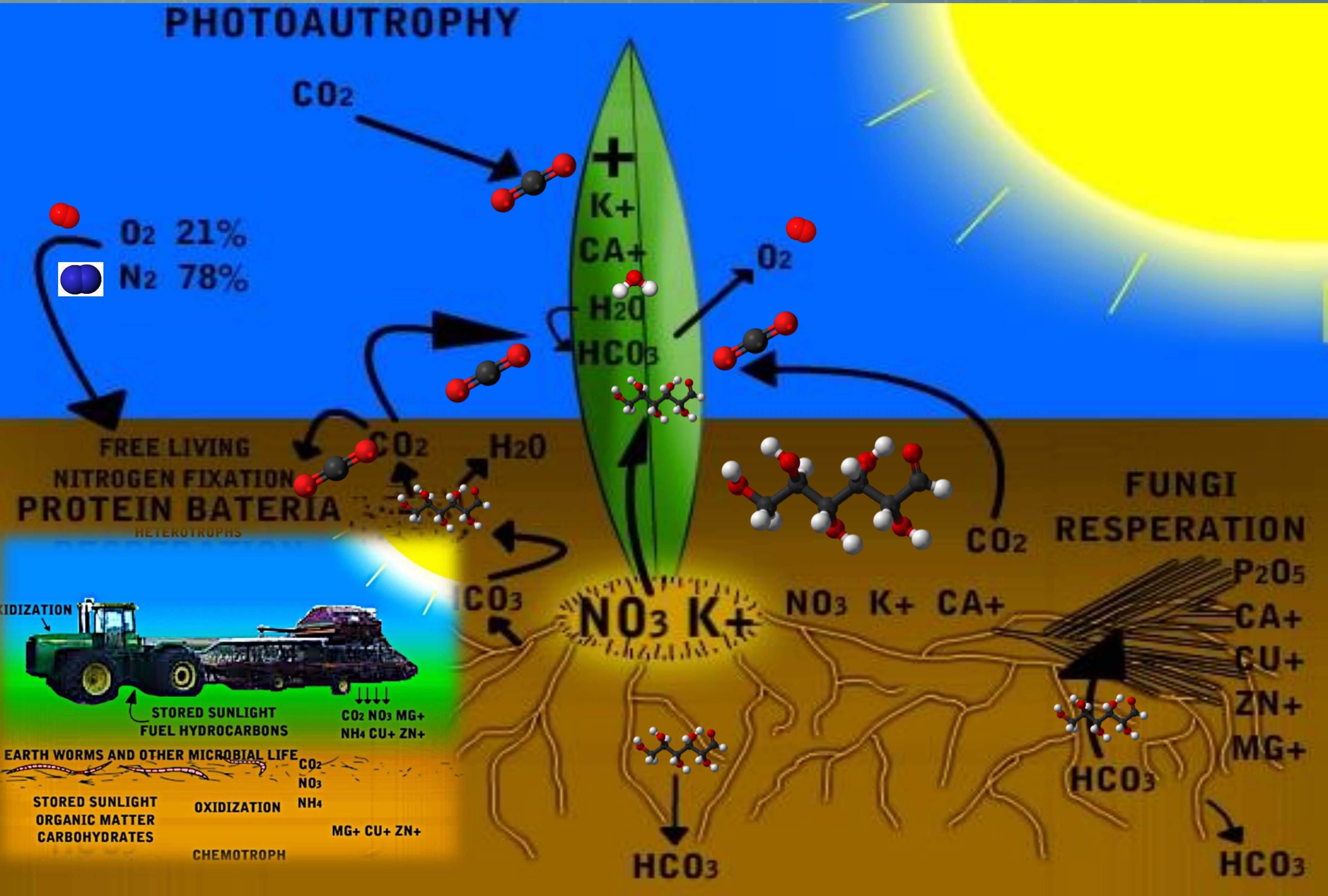
Table 2.24

Influence of the Form of Nitrogen Supply on the Ionic Balance in the Shoots of Castor Bean Plants[a]

Form of N supply	Cations				Anions					
	K^+	Ca^{2+}	Mg^{2+}	Total	NO_3^-	$H_2PO_4^-$	SO_4^{2-}	Cl^-	Organic acids[b]	Total
NO_3^-	99	85	28	212	44	18	11	2	137	212
NH_4^+	55	43	22	120	0	23	33	5	59	120

[a]Van Beusichem *et al*. (1988); data in meq $(100\ g)^{-1}$ dry wt.
[b]Calculated from the difference of Cations − Anions.

BIO-AGTIVE PLANTS USE ONLY SUN LIGHT



Fungi finds water, Phosphorus and nutrients for the plant

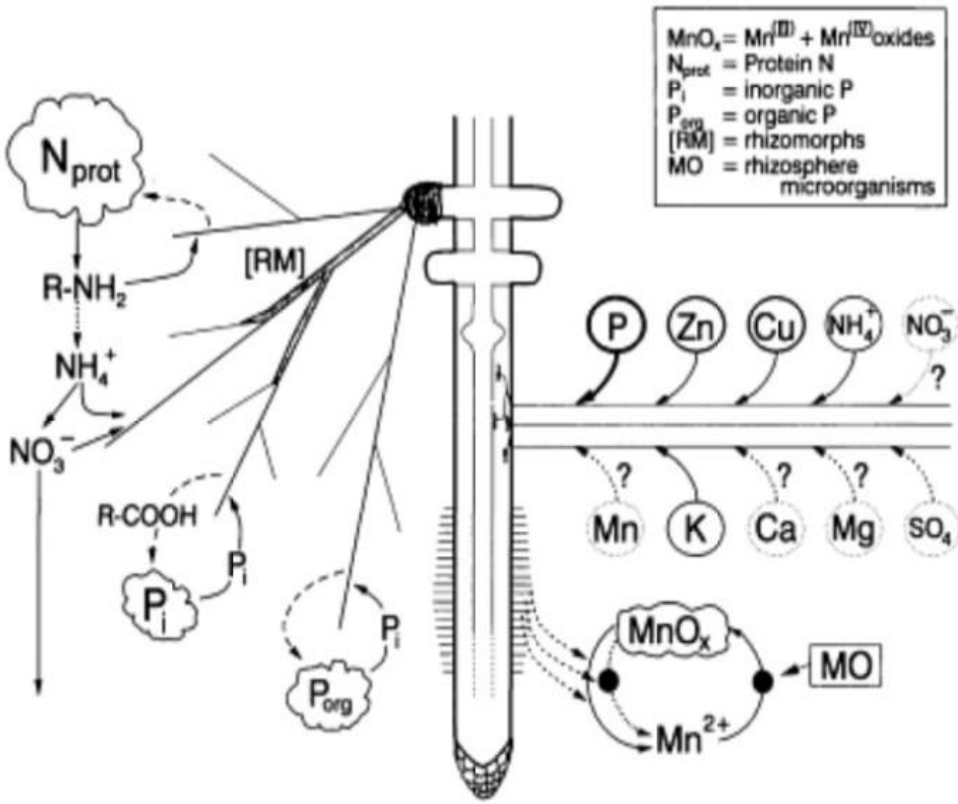


Fig. 15.25 Schematic presentation of components of the nutrient dynamics in and acquisition from the 'hyphosphere' of endo- (VA-) mycorrhizal roots and of additional components found in ectomycorrhizal roots. (Marschner and Dell, 1994.) Reprinted by permission of Kluwer Academic Publishers.

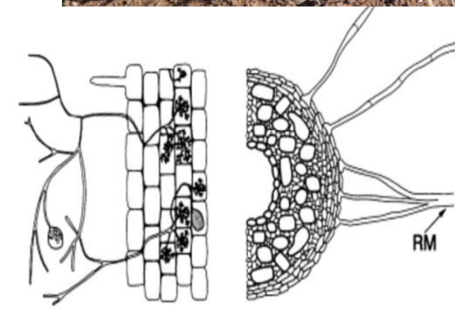


Fig. 15.18 Schematic presentation of the main structural features of the vesicular-arbuscular (VA) mycorrhizas (*left*) and of ecto- (EC) mycorrhizas (*right*). RM, rhizomorphs.

Bio-Agtive™ Soya beans Fertiliser

Free Nitrogen From Bacteria

System of N_2 fixation ($N_2 \longrightarrow NH_3$) and microorganisms involved	 Symbiosis (e.g., *Rhizobium*, *Actinomycetes*)	 Associations (e.g., *Azospirillum*, *Azotobacter*)	 Free living (e.g., *Azotobacter*, *Klebsiella*, *Rhodospirillum*)	
Energy source (organic carbon)	Sucrose and its metabolites (from the host plant)	Root exudates from the host plant	Heterotroph: Plant residues	Autotroph: Photosynthesis
Estimates of amounts fixed (kg N $ha^{-1}yr^{-1}$)	Legumes: 50–400 Nodulated non-legumes: 20–300	10–200	1–2	10–80

Fig. 7.1 Type, energy source, and fixation capabilities of biological N_2 fixation systems in soils. (Courtesy of K. Isermann; modified.)

Bio-Agtive plants resist lodging

Bio-Agtive

Fertilizer

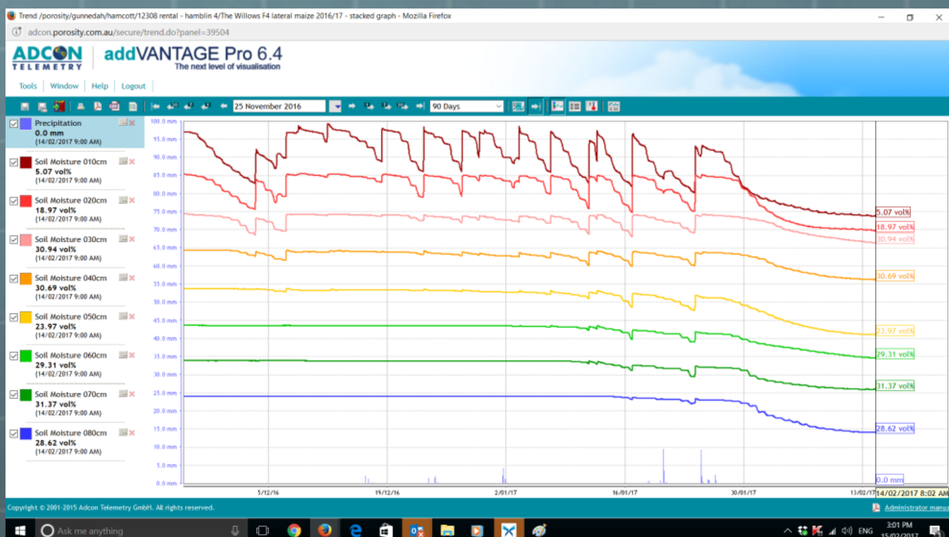
Bio-Agtive™ Irrigation Solubilizer

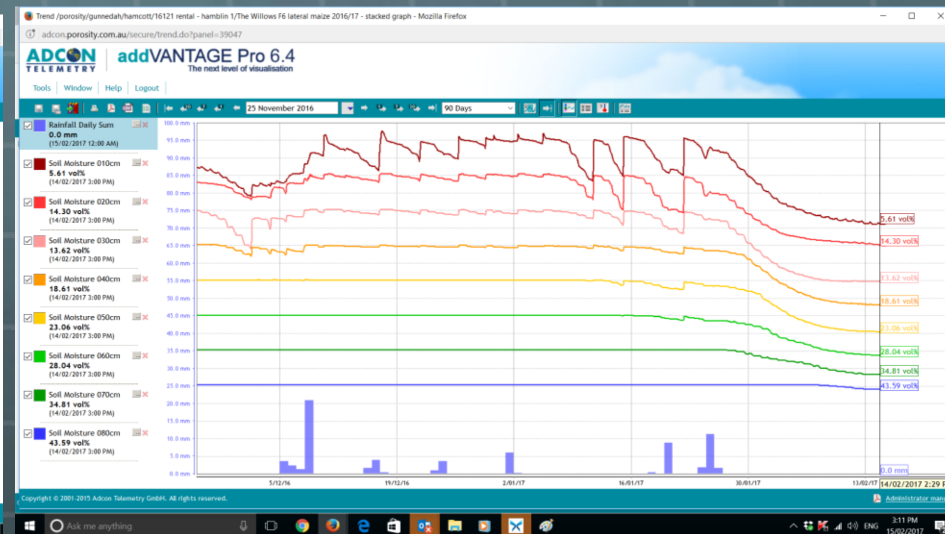
Bio-Agtive

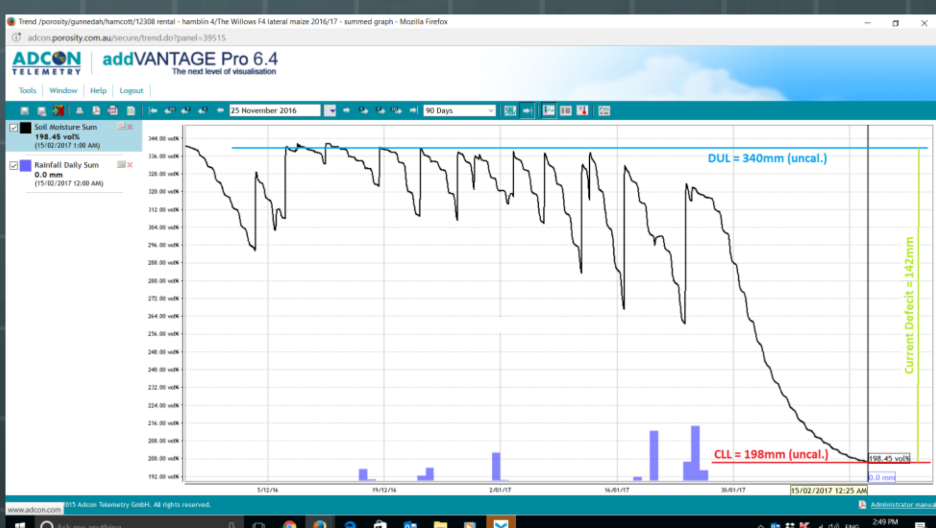
142mm

Fertilizer

173mm

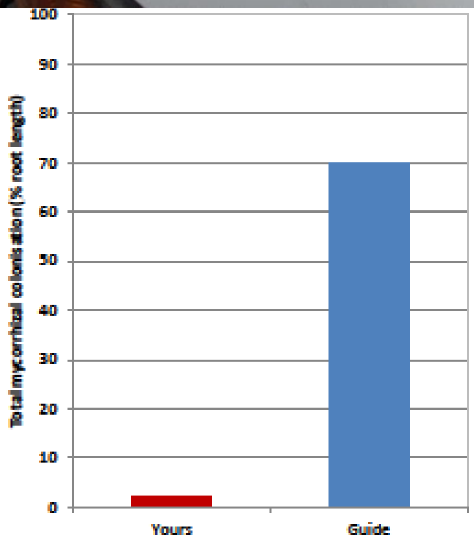






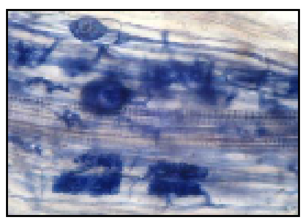
Dry Land

Irrigated



Result

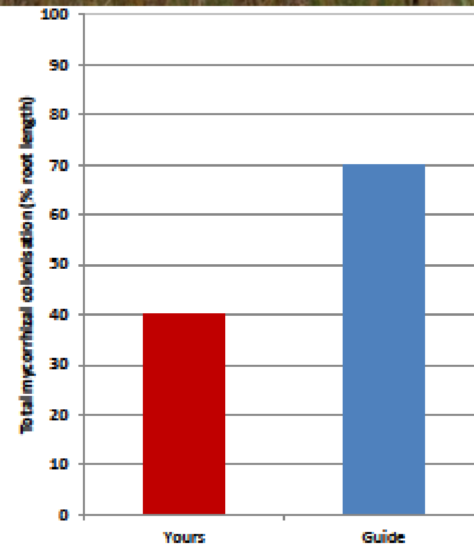
	Yours
Total colonisation (TC)	2.0



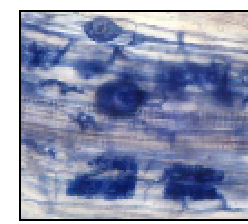
Mycorrhizal colonisation in a root sample

Comments
Total colonisation was effectively absent (< 10% root length) in this sample. This result indicates that th factors limiting mycorrhizal colonisation, such as a low presence of mycorrhizal propagules in the soil, high of fertilisers applied (particularly P and N), the use of fungicides, bare fallows before planting, previ mycorrhizal host crops or excessive tillage.

Explanations This test measures the percentage of root length colonised by mycorrhizal fungi. Mycorrhizal colonisation o



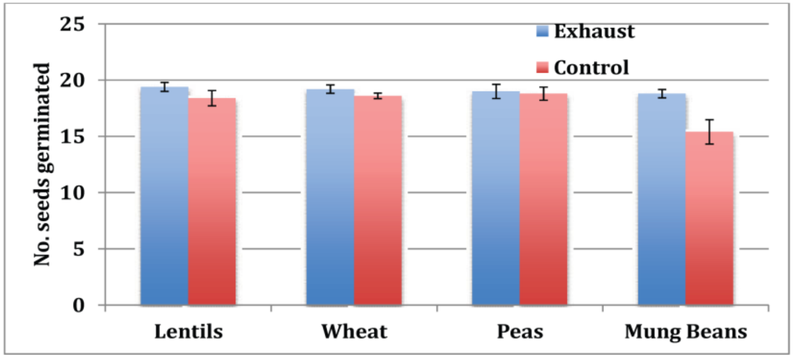
Total colonisation (TC)



Mycorrhizal colonisation in a ro

Comments
Total colonisation was a little over half of the guide value in this sample. This result indicates factors limiting mycorrhizal colonisation, such as a low presence of mycorrhizal propagules in the of fertilisers applied (particularly P and N), the use of fungicides, bare fallows before plant mycorrhizal host crops or excessive tillage.

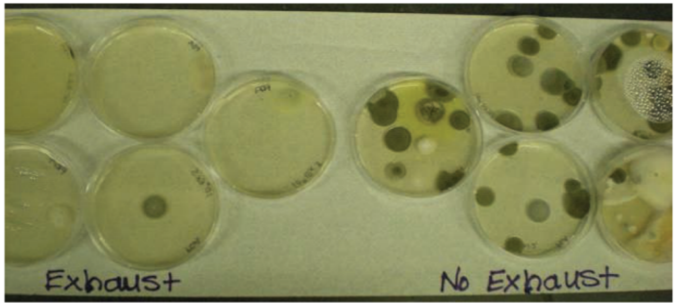
Figure 10. A comparison of the mean (± se) number of seeds that germinated on each of 5 plates of seed that had been exposed to exhaust in the air seed cart, or not.



The results showed that there was a statistically significant interaction between the seed species, and the exhaust treatment ($p < 0.05$), and that the germination of seed exposed to the exhaust was greater than seed without exhaust (control) ($p<0.004$). This suggests that seed from different crops might be more or less affected by the exhaust. For example, the mung bean seed had the greatest benefit from being treated by the exhaust in terms of improved germination.

It was consistently observed that there was fungi growing on the control germinated seed, and that this was rarely observed when the seed was treated with exhaust. This suggested that the exhaust and or the temperature of the exhaust emissions was affecting the microbiology of the seed coat, and perhaps seed-borne fungi.

Figure 11. Shows the potato dextrose agar plates growing fungi washed from seeds that were treated with exhaust emission or not.

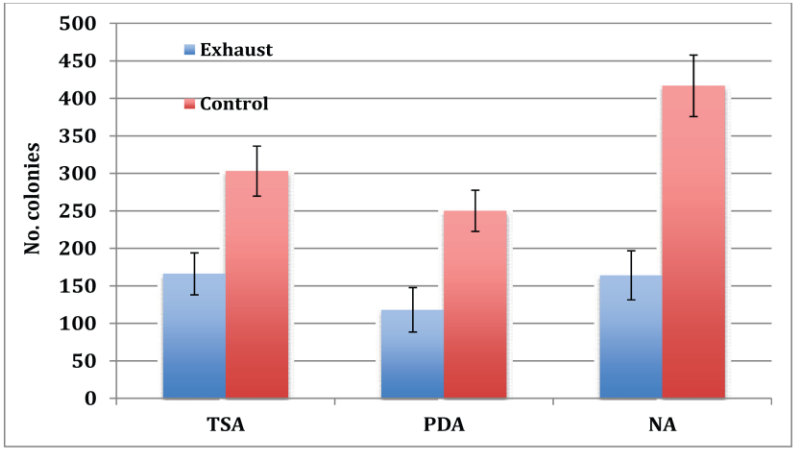


Microbiology of the seed

The microbial community on the seed was determined in 2 different ways: seed wash was plated onto different growth media in a dilution series, and seed wash was freeze dried and analysed for PLFA. Since all seeds of different plant species have different shapes and sizes, 10 g of seed was weighed into a sterile flask (instead of counting 100 seeds) with 100ml of sterile water, and swirled on a rotary shaker for 15 minutes. The wash was decanted into another sterile flask and a 10-fold dilution series was prepared, 1 ml of each dilution series was plated onto each of 10 plates of different growth media. The inoculated plates were incubated in sealed containers at room temperature for 3-5 days. Fungal colonies on potato dextrose agar (PDA) often took as many as 9 days to appear.

Few colonies appeared in any dilution after the first 10 fold dilution. It may have been better idea to use a buffer solution to wash the bacteria and fungi from the seed. I may have liberated more cells. Seed wash was plated onto Typticase Soy Agar (TSA), Nutrient Agar (NA), Potato Dextrose Agar (PDA), and Pseudomonas Minimal Media (PMM).

Figure 12. Shows the typical results for seed washes. This figure shows the results for Laird lentils exposed to canola-based diesel fuel or not (control) during field-scale seeding.



Overall, the number of growing bacteria (TSA and NA), and fungi (PDA) are less ($p<0.001$) on seed treated with exhaust emissions compared with the same seed that was not. The bacterial growth on PMM was sparse and therefore omitted. The plating data supported the observation that there were more fungi on the control seed.

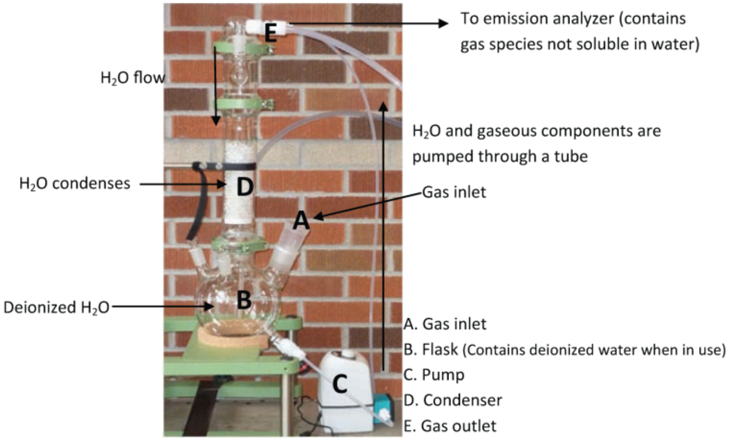


Figure 3. The Gas Scrubber used during emission monitoring.

The Gas Scrubber: The exhaust gas is introduced into the FLASK (B) containing 1.5L of deionized water through the GAS INLET (A). As the gas is bubbled into the water, water soluble gas species are incorporated into the water phase. Through PUMP (C), the contents of the FLASK (B) are introduced at the top of the CONDENSER (D). At this point the water soluble species condense together with water, which are reintroduced into the FLASK (B). The non-water soluble gas species on the other hand are pumped out from the system through the GAS OUTLET (E) and to the emission analyzer for measurement.

le 2. Experimental matrix.

Run	Trial	Engine Speed (RPM)	Torque (ft/lb)	Power (HP)	Time (mins)	Scrubber
1	1	constant	Low	Low	30	No
2	1	constant	Low	Low	30	Yes
3	1	constant	High	High	30	No
4	1	constant	High	High	30	Yes
5	1	constant	Medium	Medium	30	No
6	1	constant	Medium	Medium	30	Yes

Bubbling the exhaust gas through deionized water ("water trap") using the scrubber resulted in increased acidity to give a pH of 3.3 to 3.6 from pH 5.0 of the control deionized water. The levels of metals and anions in the control (deionized water) were all very low if not negligible (data not shown). Hence, the presence of metals and anions in the "water trap" could be attributed to the use of the scrubber during testing. The concentrations of some metals and anions in the "water trap" were affected by the engine load. For instance using diesel, higher engine load resulted in the increased levels of both calcium and magnesium by 41 to 51% and 44 to 87% respectively, compared to runs with lower engine loads (Figures 4, 5 and 6). The levels of copper and zinc on the other hand were generally highest during Run 6.

The lowest engine load gave the lowest anion levels such as chloride, nitrite and sulfate but with the highest nitrate. Increasing engine load in terms of power and torque had led to the increase in chloride, nitrite and sulfate with accompanying decrease in nitrate. In all cases, bromide and phosphate were not detected.

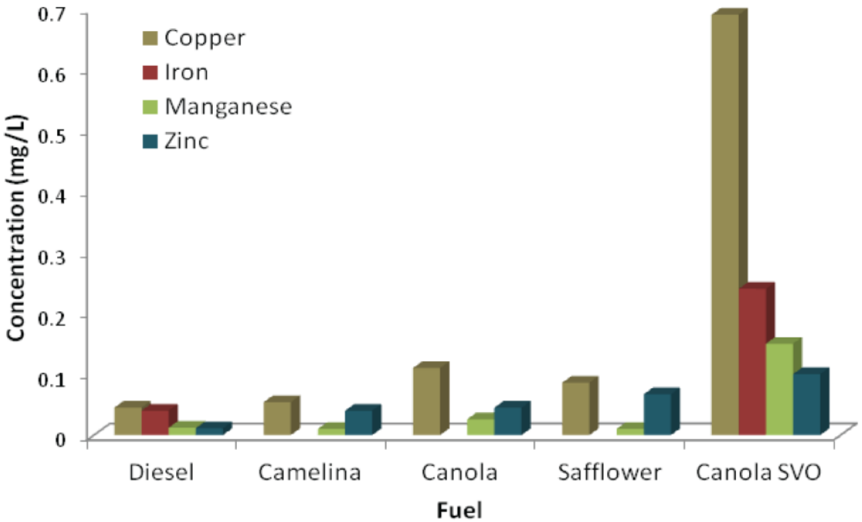
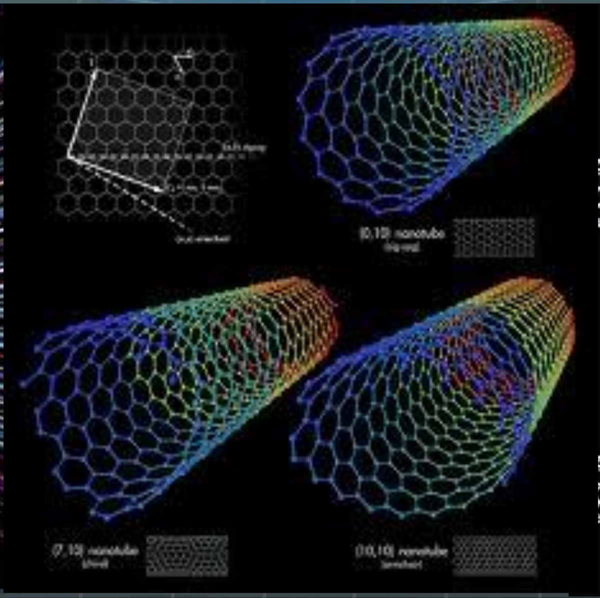
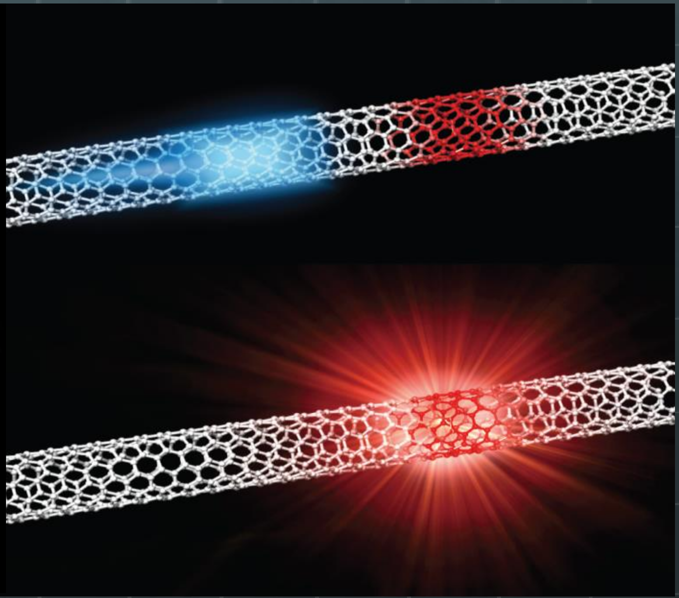


Figure 4.a. Metal content of the "water trap" obtained after bubbling with exhaust gas emissions at engine conditions Run 2.

Nano/Carbon Quest





Agriculture helping the planet breathe easier™

Nano/Carbon Tubes

1,000,000,000

One Billionth of a Meter

100,000 times smaller than human hair

Harder than Diamonds

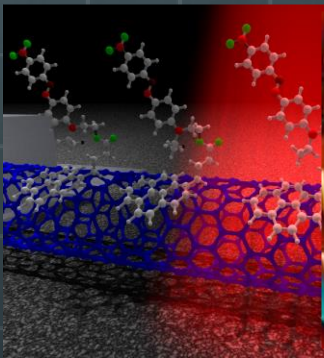
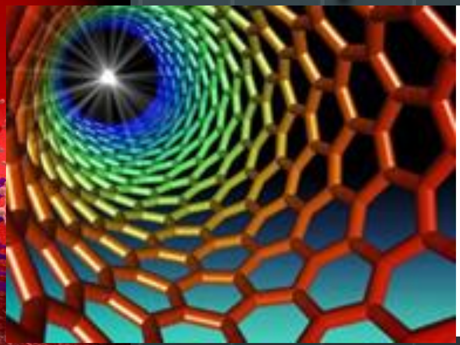
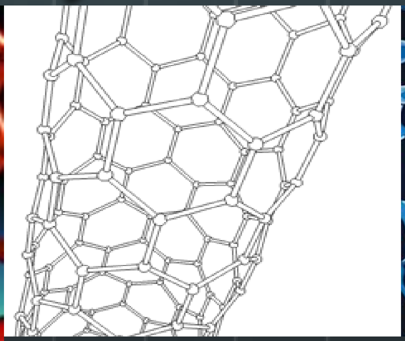
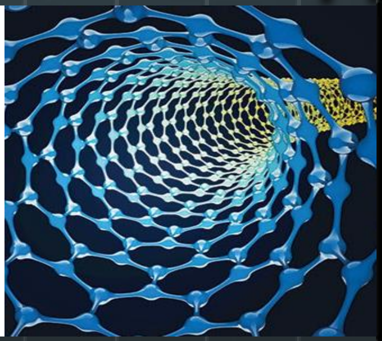
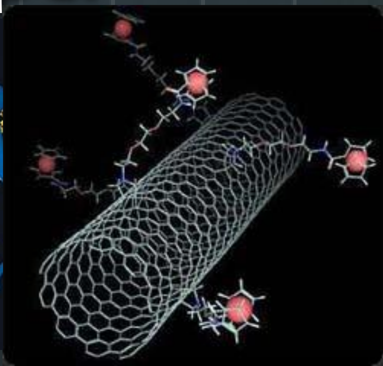
200 times stronger than steel

5 X stiffer and elastic compared to steel

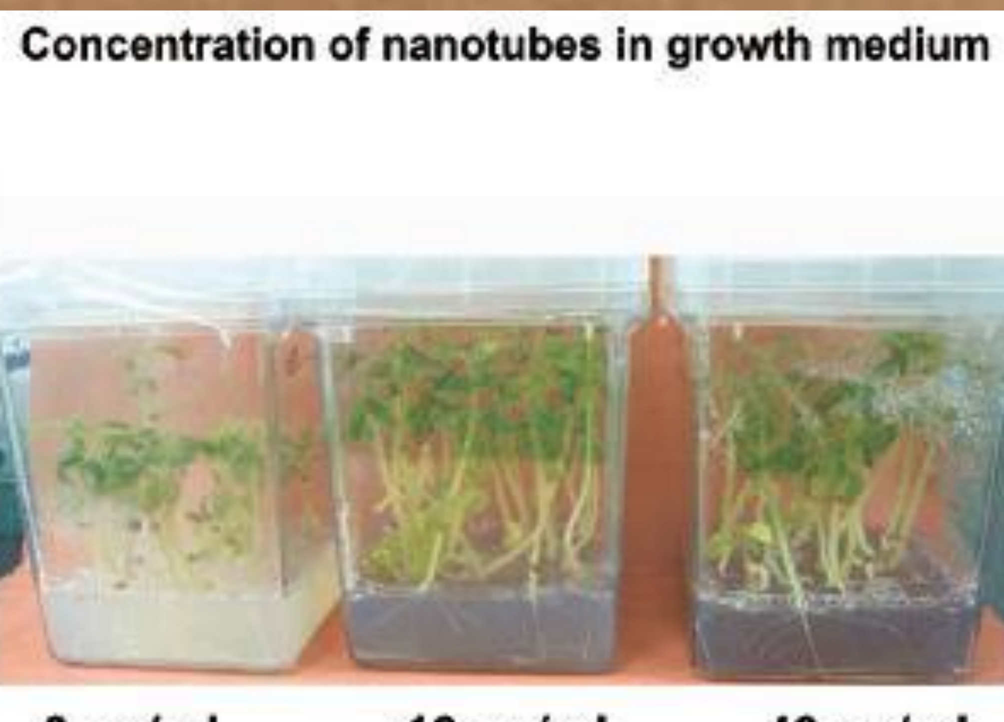
1/5 the weight of steel

Ballistic conductivity   5 X copper

current capacity   1000 x times copper

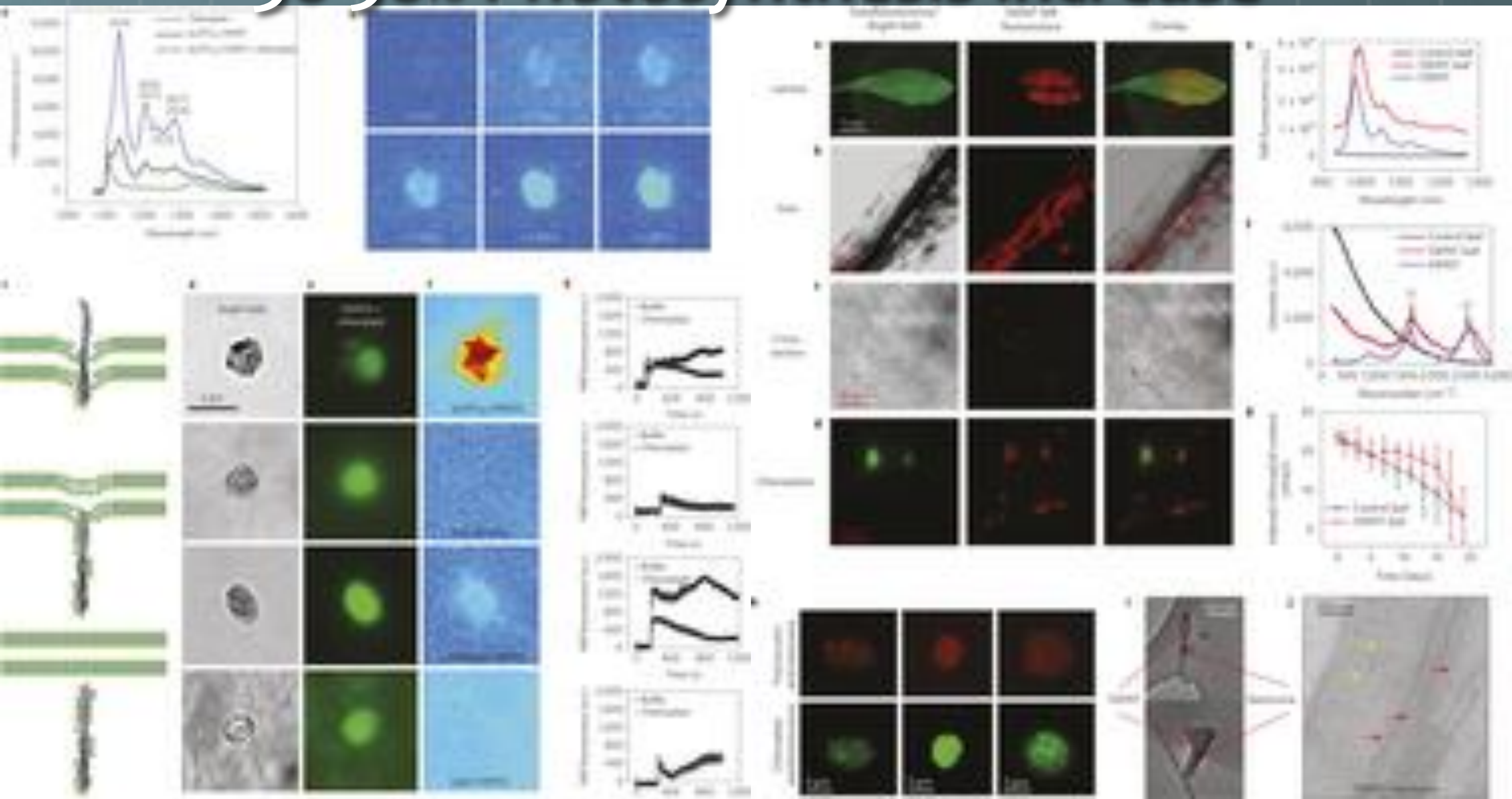






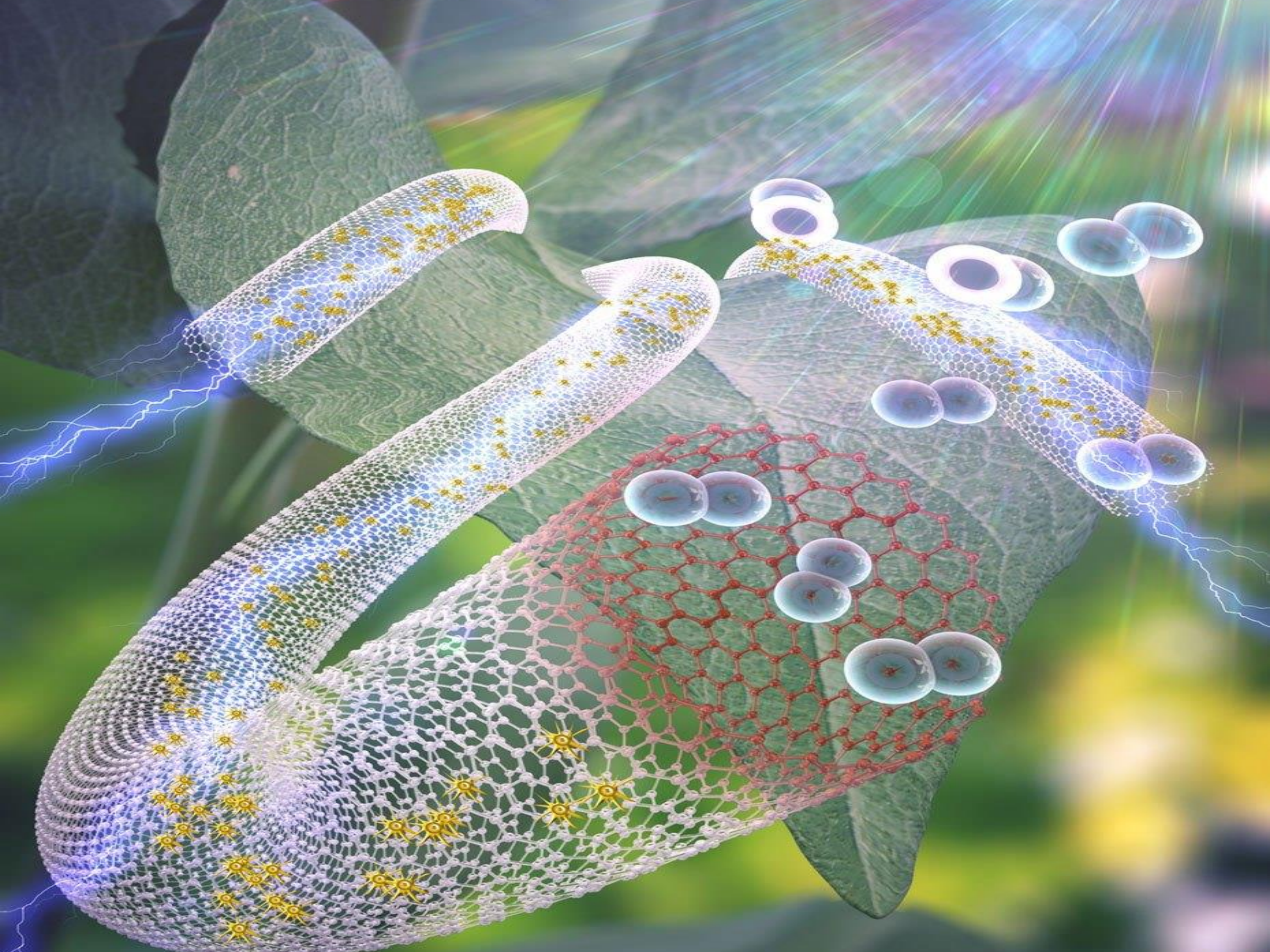

During 6 Days on Diatomite Hydroponics after Once-Through Watering Them with FWS – Aqueous Solution of Hydrated Fullerenes (HyFn) - with C60 Concentration of 10-9 mol/L (~1 ng/ml) – (A).
In positive control (B): Watering with Distilled Water.
The Weight of A Germs is More than of B Germs by 60%.
A
B


Concentration of nanotubes in growth medium

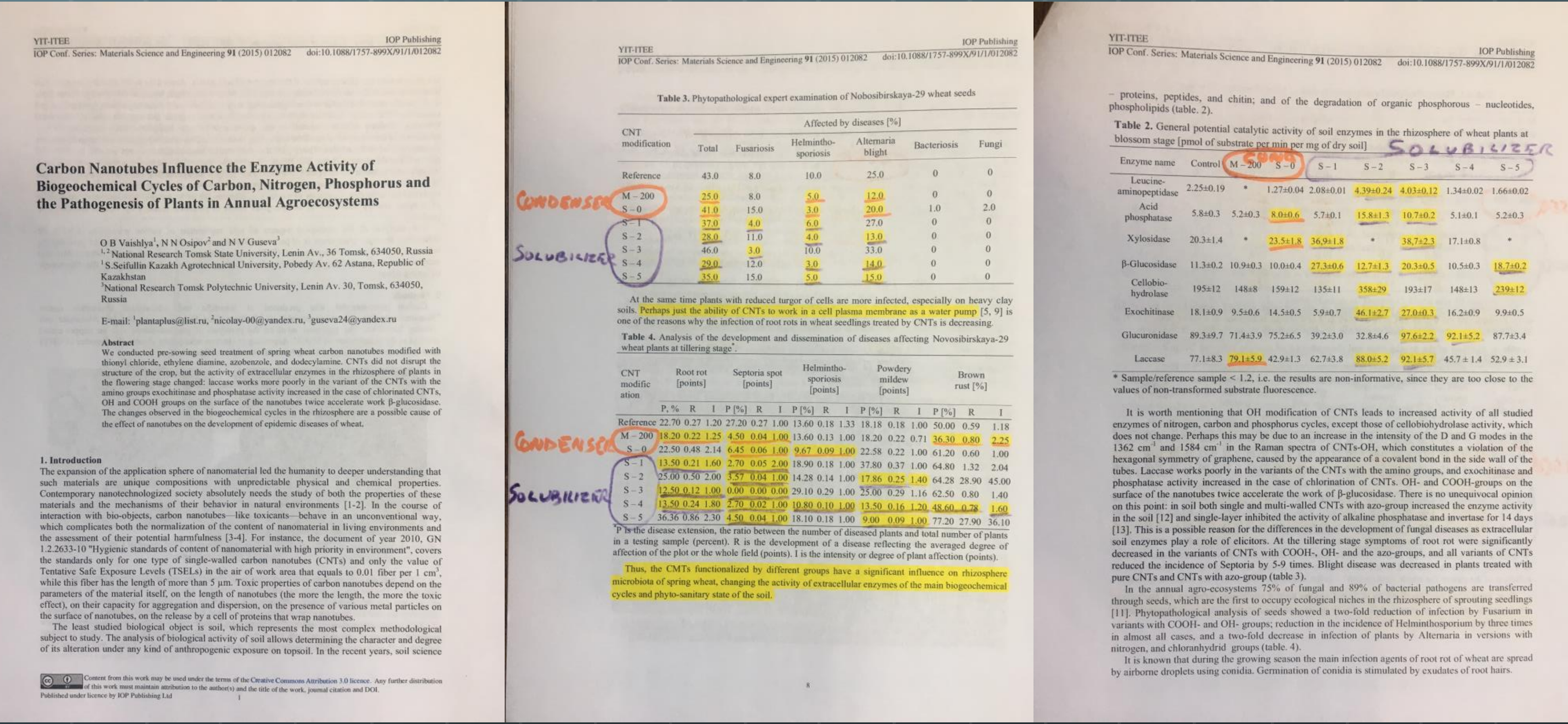

Control

Single Wall Carbon Nano Tubes (SWCNT) penetrate the leaf 30-50% Photosynthesis increase





Published papers in 2015 explain the advantage in solubilized Carbon Nano Tubes compared to active carbon and initial CNT when we just used a condenser with tractor emissions.
Our hypothesis is that solubilized CNT from tractor emissions will have a better results than using just a condenser.
Our uncertainty is that will we get a similar result with the engine that produces multiple types of CNT and chemistry that will functionalize the CNT?



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Carbon Nanotubes Influence the Enzyme Activity of Biogeochemical Cycles of Carbon, Nitrogen, Phosphorus and the Pathogenesis of Plants in Annual Agroecosystems

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Abstract
We conducted pre-sowing seed treatment of spring wheat carbon nanotubes modified with thionyl chloride, ethylene diamine, azobenzole, and dodecylamine. CNTs did not disrupt the structure of the crop, but the activity of extracellular enzymes in the rhizosphere of plants in the flowering stage changed: laccase works more poorly in the variant of the CNTs with the amino groups exochitinase and phosphatase activity increased in the case of chlorinated CNTs, OH and COOH groups on the surface of the nanotubes twice accelerate work β-glucosidase. The changes observed in the biogeochemical cycles in the rhizosphere are a possible cause of the effect of nanotubes on the development of epidemic diseases of wheat.

1. Introduction

The expansion of the application sphere of nanomaterial led the humanity to deeper understanding that such materials are unique compositions with unpredictable physical and chemical properties. Contemporary nanotechnologized society absolutely needs the study of both the properties of these materials and the mechanisms of their behavior in natural environments [1-2]. In the course of interaction with bio-objects, carbon nanotubes—like toxicants—behave in an unconventional way, which complicates both the normalization of the content of nanomaterial in living environments and the assessment of their potential harmfulness [3-4]. For instance, the document of year 2010, GN 1.2.2633-10 "Hygienic standards of content of nanomaterial with high priority in environment", covers the standards only for one type of single-walled carbon nanotubes (CNTs) and only the value of Tentative Safe Exposure Levels (TSELs) in the air of work area that equals to 0.01 fiber per 1 cm^3, while this fiber has the length of more than 5 μm. Toxic properties of carbon nanotubes depend on the parameters of the material itself, on the length of nanotubes (the more the length, the more the toxic effect), on their capacity for aggregation and dispersion, on the presence of various metal particles on the surface of nanotubes, on the release by a cell of proteins that wrap nanotubes.

The least studied biological object is soil, which represents the most complex methodological subject to study. The analysis of biological activity of soil allows determining the character and degree of its alteration under any kind of anthropogenic exposure on topsoil. In the recent years, soil science

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Table 3. Phytopathological expert examination of Nobosibirskaya-29 wheat seeds

CNT modification	Affected by diseases [%]					
	Total	Fusariosis	Helmintho-sporiosis	Alternaria blight	Bacteriosis	Fungi
Reference	43.0	8.0	10.0	25.0	0	0
M – 200	25.0	8.0	5.0	12.0	0	0
S – 0	41.0	15.0	3.0	20.0	1.0	2.0
S – 1	37.0	4.0	6.0	27.0	0	0
S – 2	28.0	11.0	4.0	13.0	0	0
S – 3	46.0	3.0	10.0	33.0	0	0
S – 4	29.0	12.0	3.0	14.0	0	0
S – 5	35.0	15.0	5.0	15.0	0	0

At the same time plants with reduced turgor of cells are more infected, especially on heavy clay soils. Perhaps just the ability of CNTs to work in a cell plasma membrane as a water pump [5, 9] is one of the reasons why the infection of root rots in wheat seedlings treated by CNTs is decreasing.

Table 4. Analysis of the development and dissemination of diseases affecting Novosibirskaya-29 wheat plants at tillering stage*.

CNT modific ation	Root rot [points]			Septoria spot [points]			Helmintho-sporiosis [points]			Powdery mildew [points]			Brown rust [%]		
	P, %	R	I	P [%]	R	I	P [%]	R	I	P [%]	R	I	P [%]	R	I
Reference	22.70	0.27	1.20	27.20	0.27	1.00	13.60	0.18	1.33	18.18	0.18	1.00	50.00	0.59	1.18
M – 200	18.20	0.22	1.25	4.50	0.04	1.00	13.60	0.13	1.00	18.20	0.22	0.71	36.30	0.80	2.25
S – 0	22.50	0.48	2.14	6.45	0.06	1.00	9.67	0.09	1.00	22.58	0.22	1.00	61.20	0.60	1.00
S – 1	13.50	0.21	1.60	2.70	0.05	2.00	18.90	0.18	1.00	37.80	0.37	1.00	64.80	1.32	2.04
S – 2	25.00	0.50	2.00	3.57	0.04	1.00	14.28	0.14	1.00	17.86	0.25	1.40	64.28	28.90	45.00
S – 3	12.50	0.12	1.00	0.00	0.00	0.00	29.10	0.29	1.00	25.00	0.29	1.16	62.50	0.80	1.40
S – 4	13.50	0.24	1.80	2.70	0.02	1.00	10.80	0.10	1.00	13.50	0.16	1.20	48.60	0.78	1.60
S – 5	36.36	0.86	2.30	4.50	0.04	1.00	18.10	0.18	1.00	9.00	0.09	1.00	77.20	27.90	36.10

*P is the disease extension, the ratio between the number of diseased plants and total number of plants in a testing sample (percent). R is the development of a disease reflecting the averaged degree of affection of the plot or the whole field (points). I is the intensity or degree of plant affection (points).

Thus, the CMTs functionalized by different groups have a significant influence on rhizosphere microbiota of spring wheat, changing the activity of extracellular enzymes of the main biogeochemical cycles and phyto-sanitary state of the soil.

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– proteins, peptides, and chitin; and of the degradation of organic phosphorous – nucleotides, phospholipids (table. 2).

Table 2. General potential catalytic activity of soil enzymes in the rhizosphere of wheat plants at blossom stage [pmol of substrate per min per mg of dry soil]

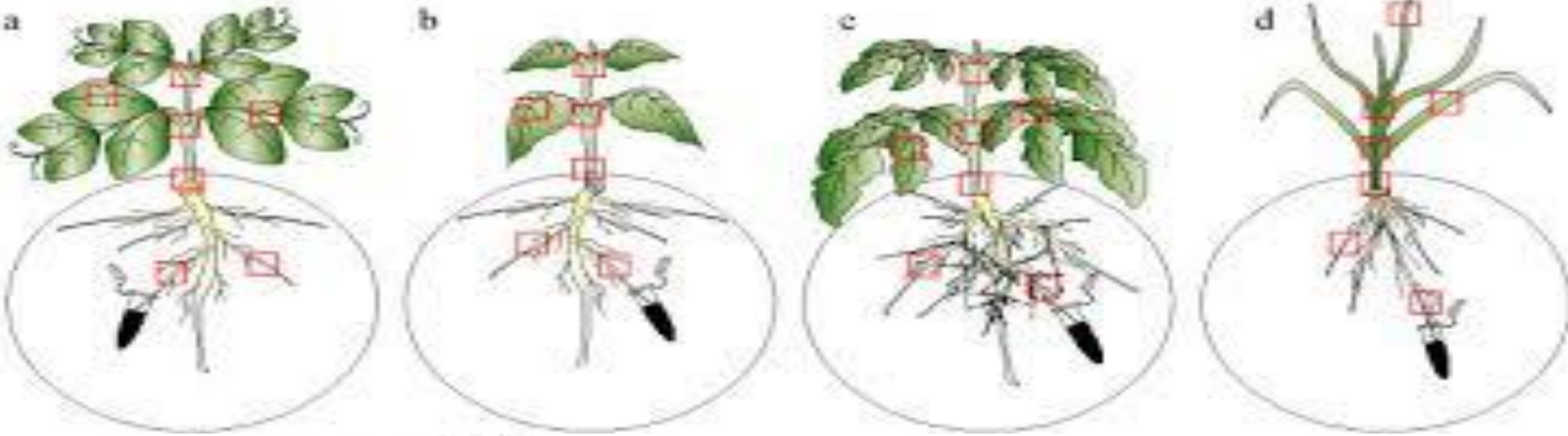
Enzyme name	Control	M – 200	S – 0	S – 1	S – 2	S – 3	S – 4	S – 5
Leucine-aminopeptidase	2.25±0.19	*	1.27±0.04	2.08±0.01	4.39±0.24	4.03±0.12	1.34±0.02	1.66±0.02
Acid phosphatase	5.8±0.3	5.2±0.3	8.0±0.6	5.7±0.1	15.8±1.3	10.7±0.2	5.1±0.1	5.2±0.3
Xylosidase	20.3±1.4	*	23.5±1.8	36,9±1.8	*	38,7±2.3	17.1±0.8	*
β-Glucosidase	11.3±0.2	10.9±0.3	10.0±0.4	27.3±0.6	12.7±1.3	20.3±0.5	10.5±0.3	18.7±0.2
Cellobio-hydrolase	195±12	148±8	159±12	135±11	358±29	193±17	148±13	239±12
Exochitinase	18.1±0.9	9.5±0.6	14.5±0.5	5.9±0.7	46.1±2.7	27.0±0.3	16.2±0.9	9.9±0.5
Glucuronidase	89.3±9.7	71.4±3.9	75.2±6.5	39.2±3.0	32.8±4.6	97.6±2.2	92.1±5.2	87.7±3.4
Laccase	77.1±8.3	79.1±5.9	42.9±1.3	62.7±3.8	88.0±5.2	92.1±5.7	45.7 ± 1.4	52.9 ± 3.1

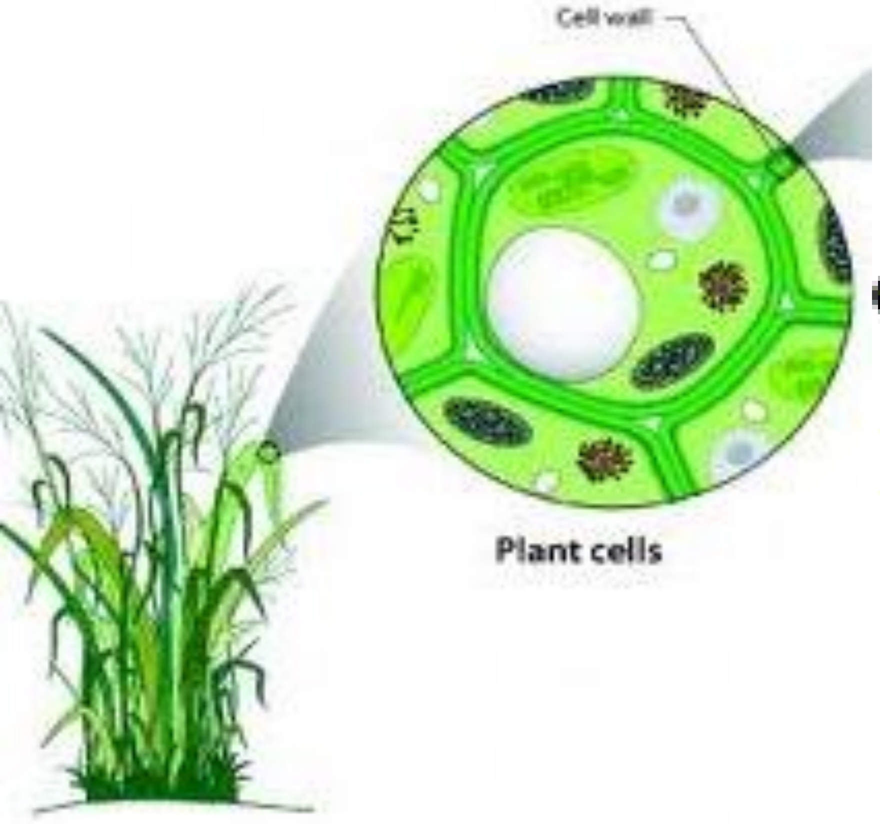
* Sample/reference sample < 1.2, i.e. the results are non-informative, since they are too close to the values of non-transformed substrate fluorescence.

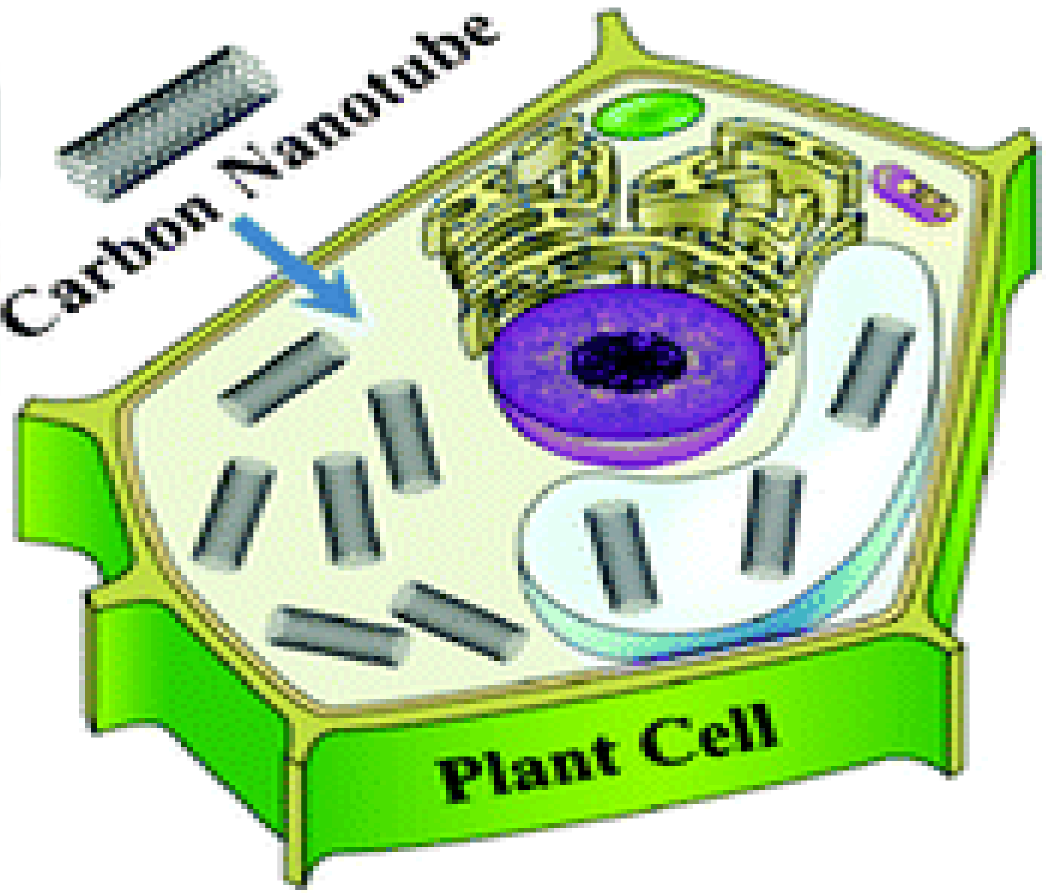
It is worth mentioning that OH modification of CNTs leads to increased activity of all studied enzymes of nitrogen, carbon and phosphorus cycles, except those of cellobiohydrolase activity, which does not change. Perhaps this may be due to an increase in the intensity of the D and G modes in the 1362 cm^{-1} and 1584 cm^{-1} in the Raman spectra of CNTs-OH, which constitutes a violation of the hexagonal symmetry of graphene, caused by the appearance of a covalent bond in the side wall of the tubes. Laccase works poorly in the variants of the CNTs with the amino groups, and exochitinase and phosphatase activity increased in the case of chlorination of CNTs. OH- and COOH-groups on the surface of the nanotubes twice accelerate the work of β-glucosidase. There is no unequivocal opinion on this point: in soil both single and multi-walled CNTs with azo-group increased the enzyme activity in the soil [12] and single-layer inhibited the activity of alkaline phosphatase and invertase for 14 days [13]. This is a possible reason for the differences in the development of fungal diseases as extracellular soil enzymes play a role of elicitors. At the tillering stage symptoms of root rot were significantly decreased in the variants of CNTs with COOH-, OH- and the azo-groups, and all variants of CNTs reduced the incidence of Septoria by 5-9 times. Blight disease was decreased in plants treated with pure CNTs and CNTs with azo-group (table 3).

In the annual agro-ecosystems 75% of fungal and 89% of bacterial pathogens are transferred through seeds, which are the first to occupy ecological niches in the rhizosphere of sprouting seedlings [11]. Phytopathological analysis of seeds showed a two-fold reduction of infection by Fusarium in variants with COOH- and OH- groups; reduction in the incidence of Helminthosporium by three times in almost all cases, and a two-fold decrease in infection of plants by Alternaria in versions with nitrogen, and chloranhydrid groups (table. 4).

It is known that during the growing season the main infection agents of root rot of wheat are spread by airborne droplets using conidia. Germination of conidia is stimulated by exudates of root hairs.

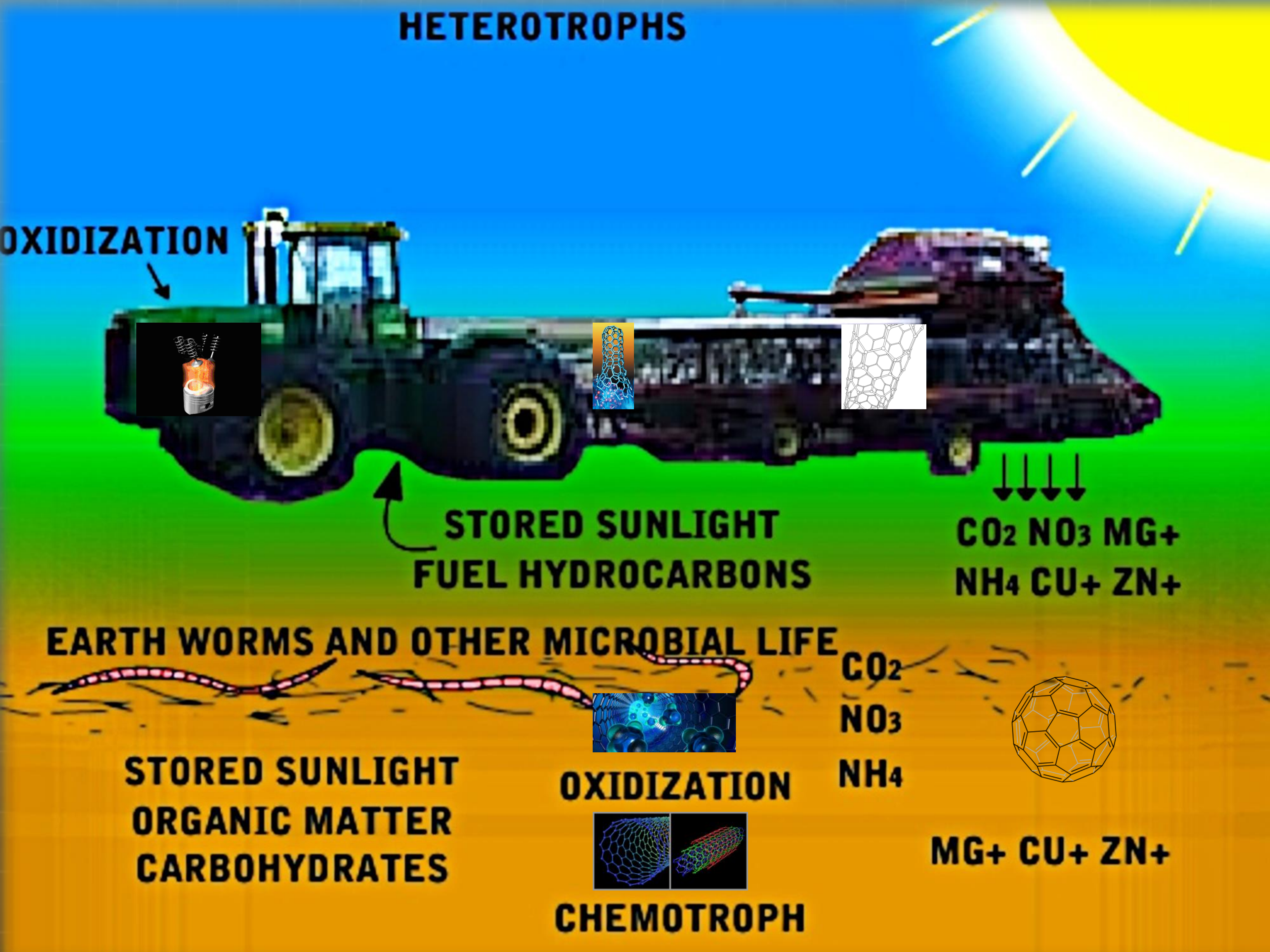

a
b
c
d

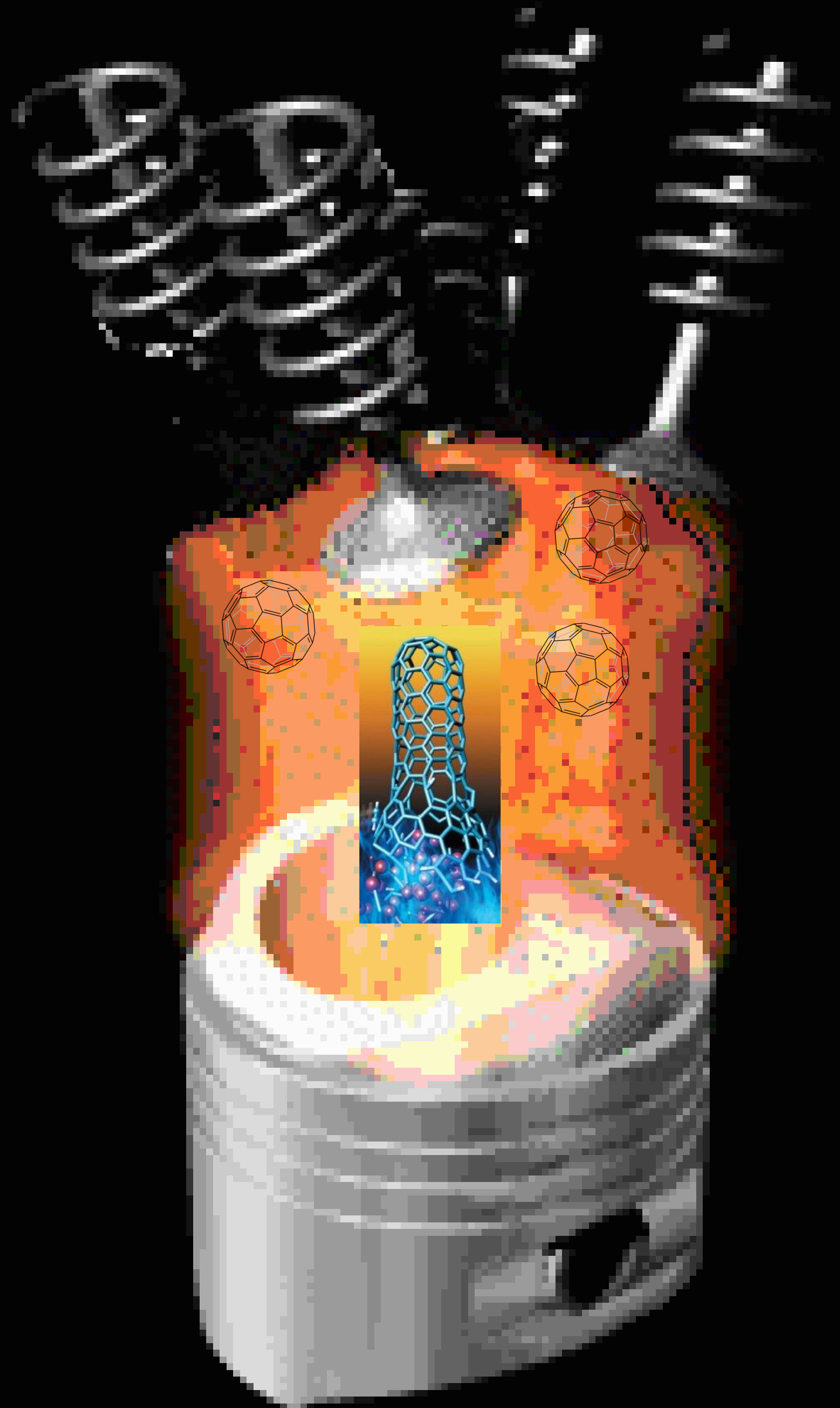

Cell wall
Plant cells

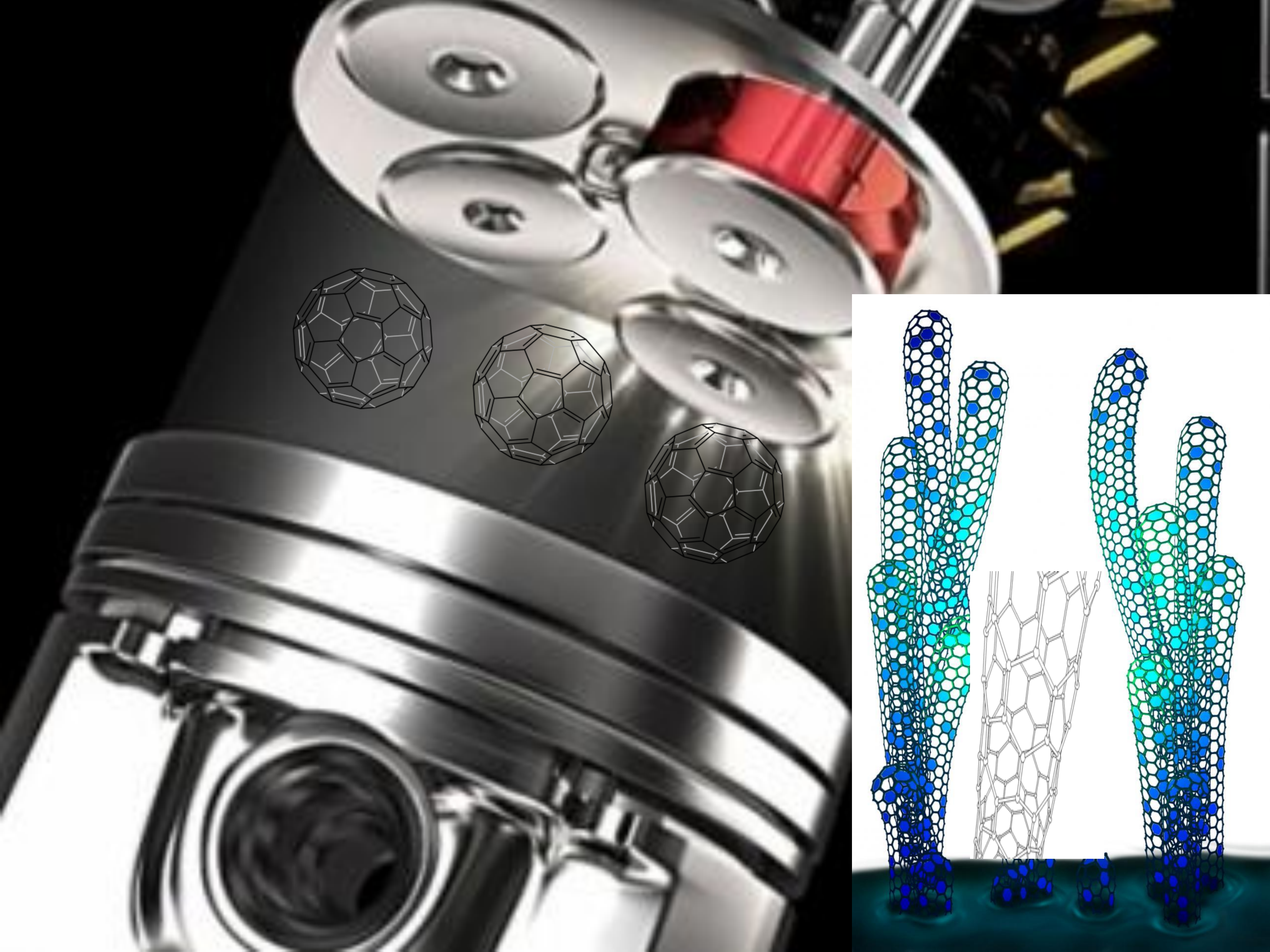

Carbon Nanotube
Plant Cell

Bio-Agtive Solubilizer Sprayer

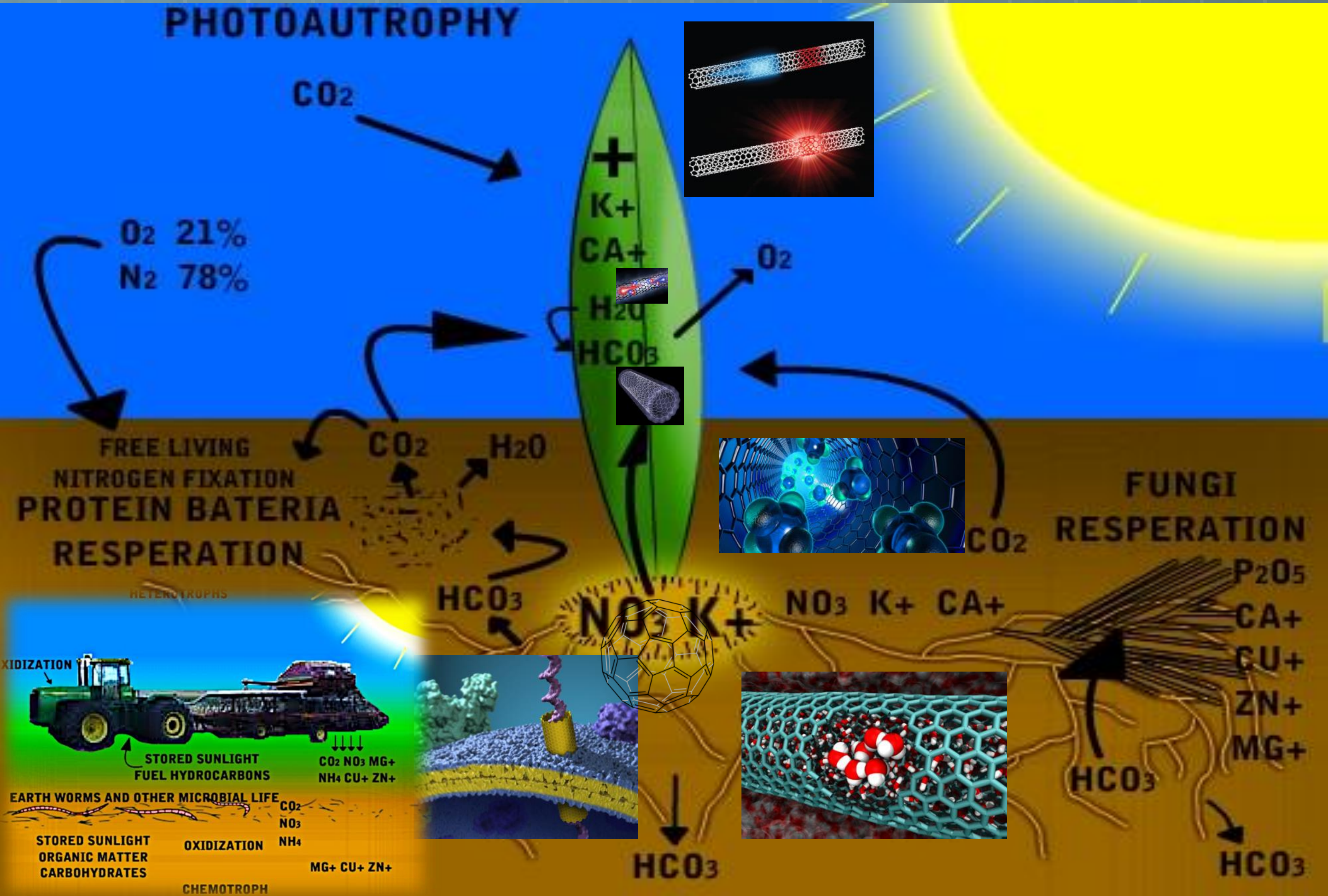
Solubilized carbon vaping controlled disease 2016 Brad Bagg's lentils when all crops in area had uncontrollable disease


HETEROTROPHS
OXIDIZATION
STORED SUNLIGHT
FUEL HYDROCARBONS
CO2 NO3 MG+
NH4 CU+ ZN+
EARTH WORMS AND OTHER MICROBIAL LIFE
CO2
NO3
NH4
STORED SUNLIGHT
ORGANIC MATTER
CARBOHYDRATES
OXIDIZATION
MG+ CU+ ZN+
CHEMOTROPH





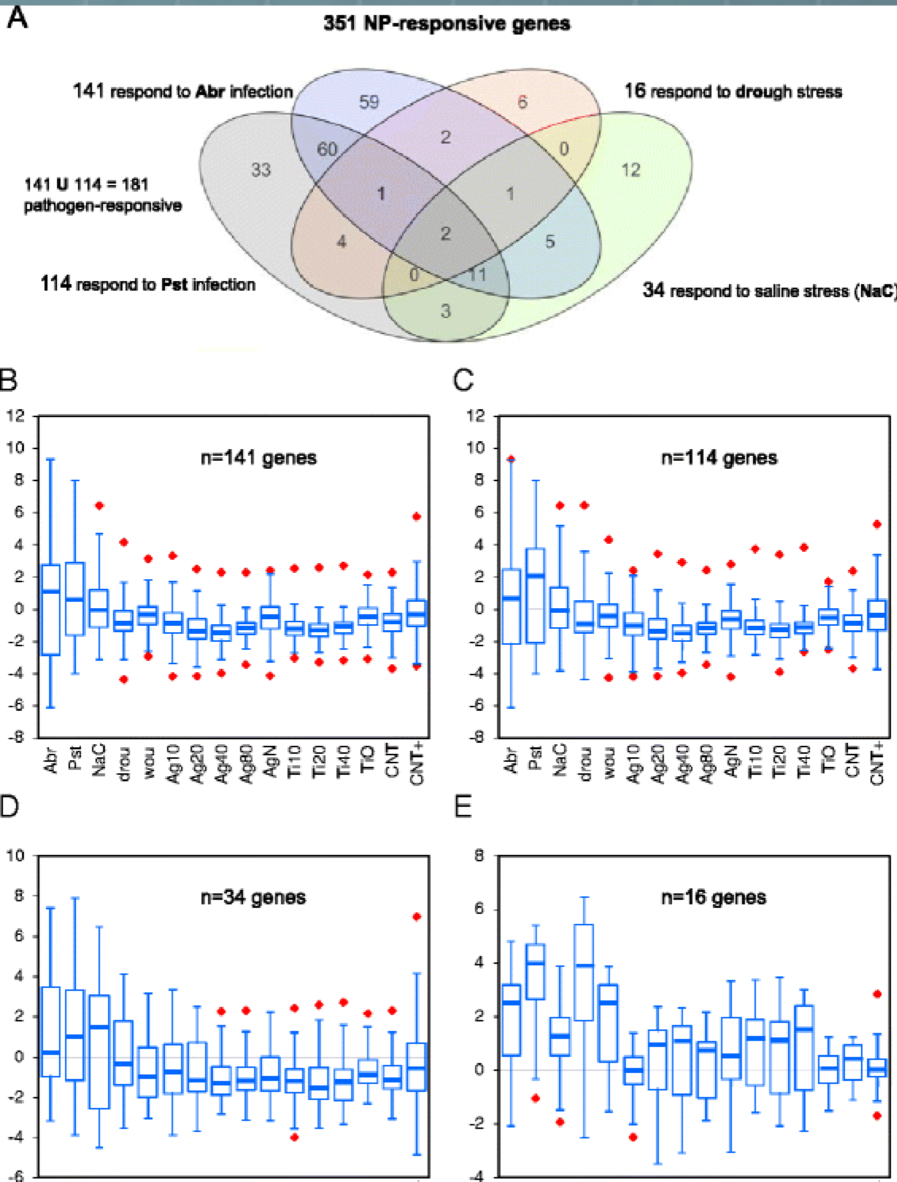
Nano/Carbon Supercharges plants

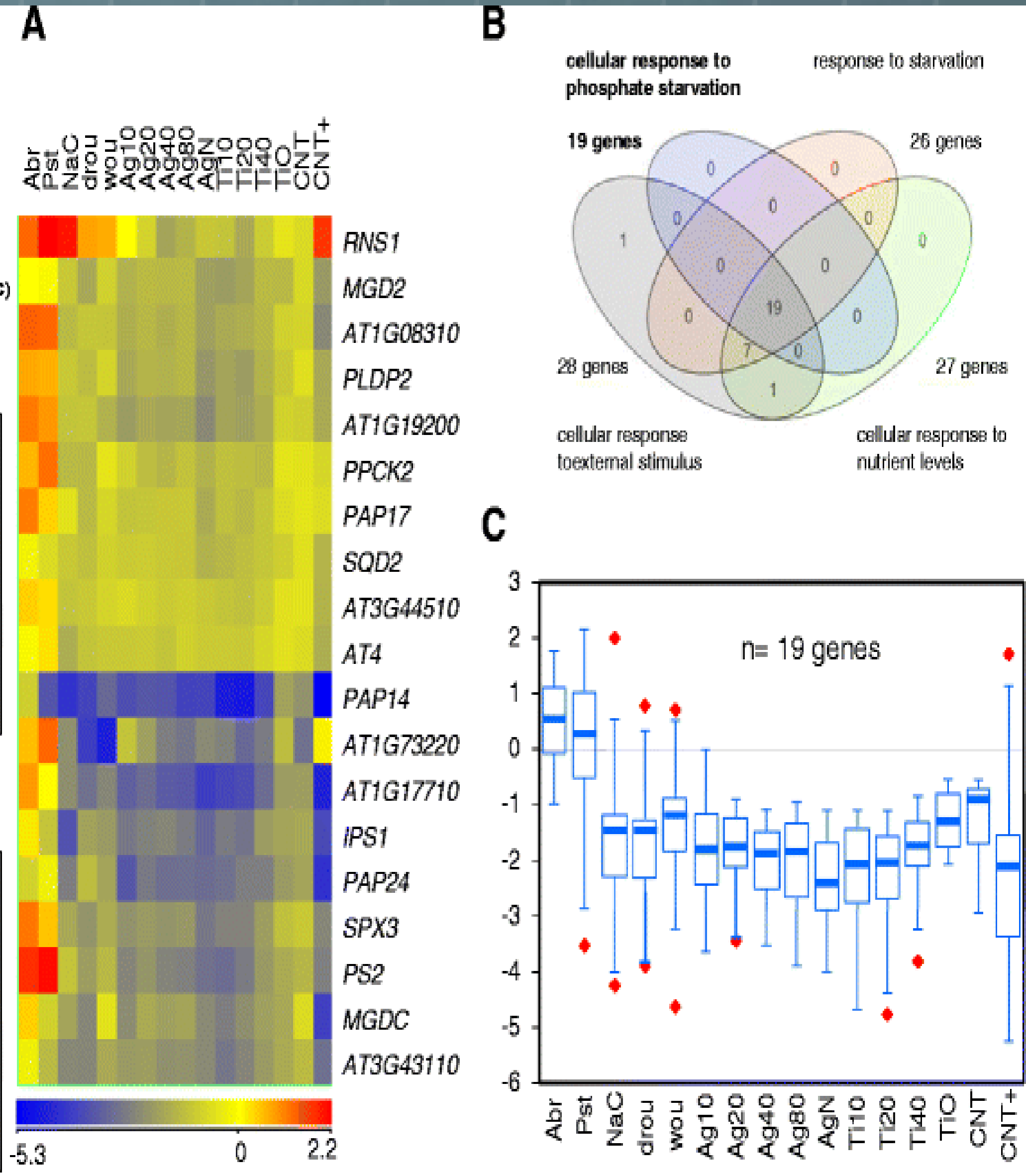


Epigenetics

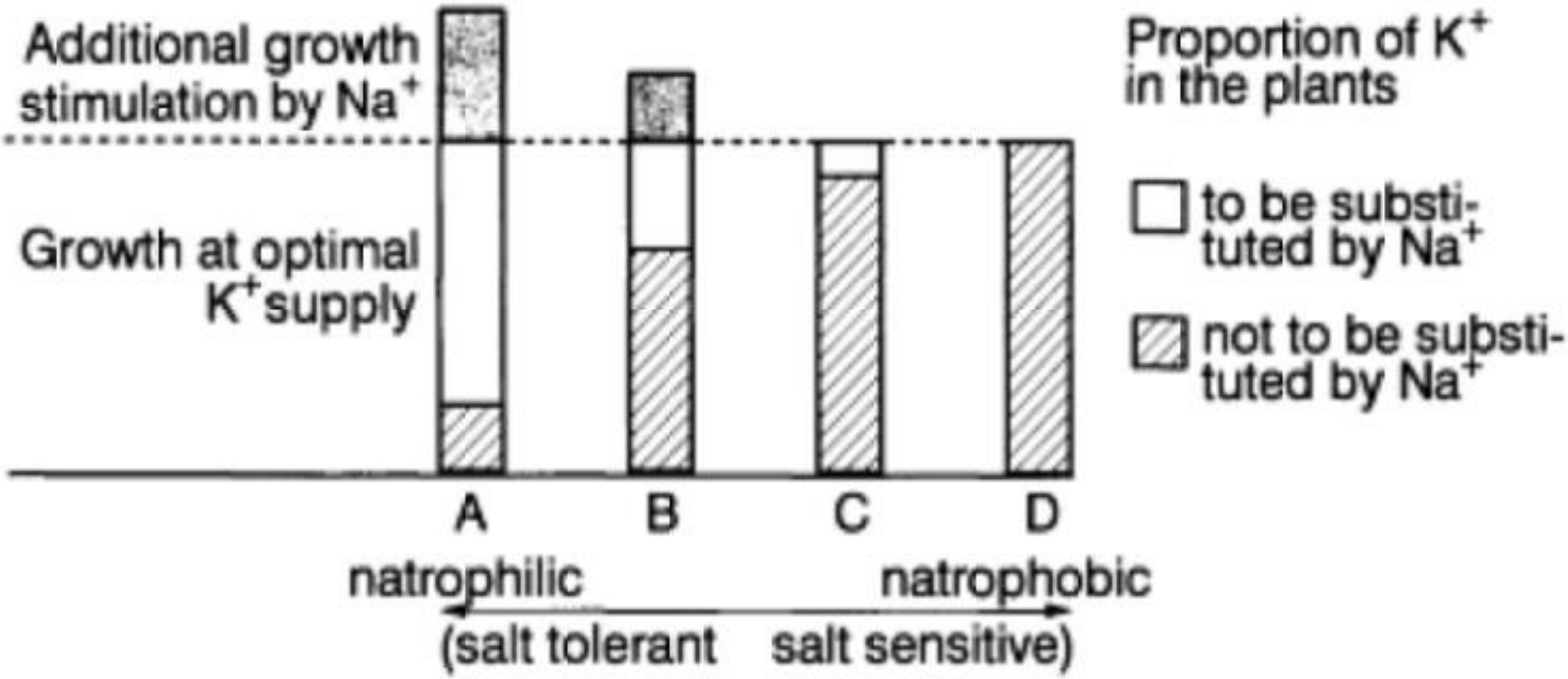
EPIGENETICS

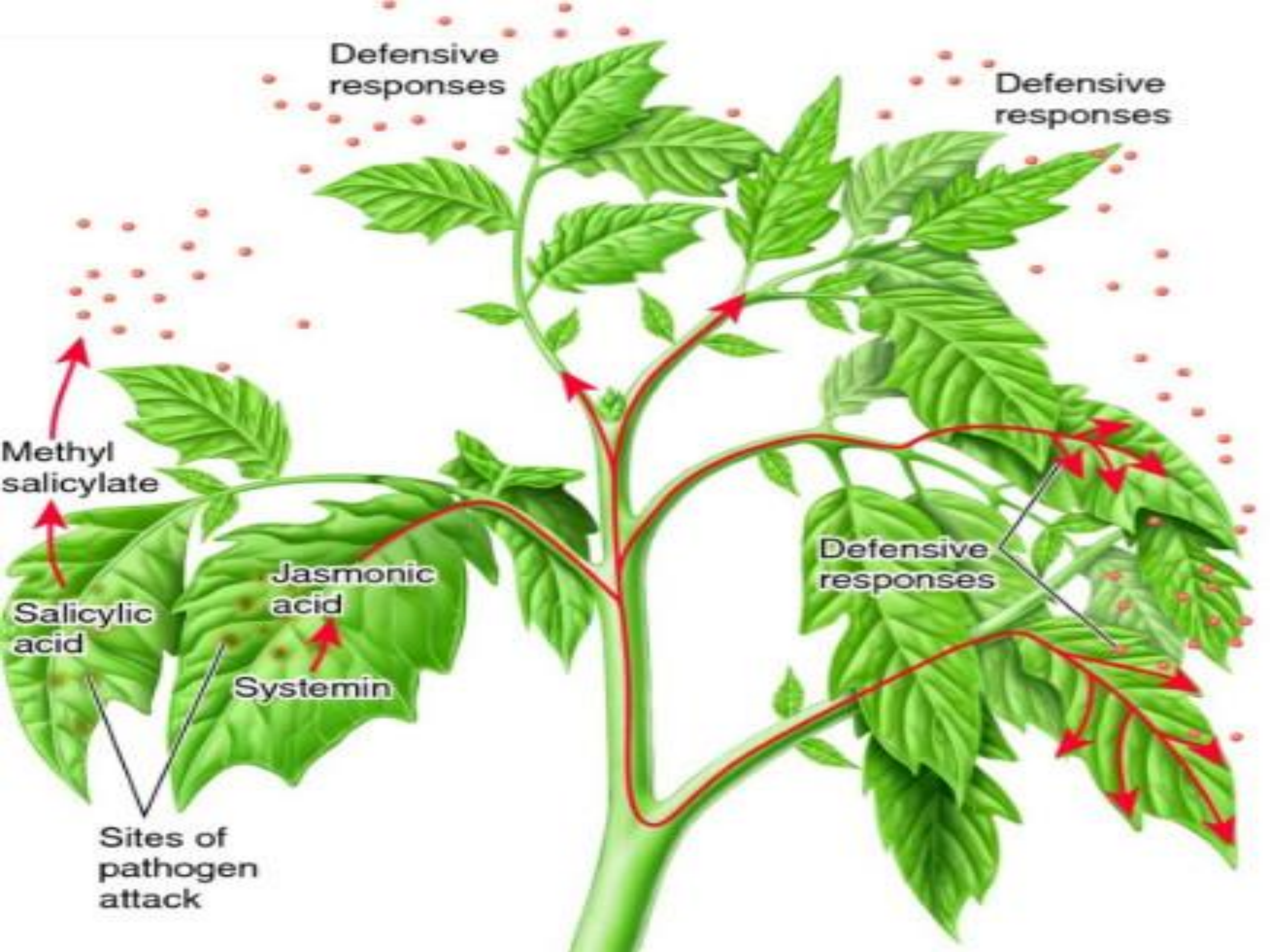
the study of changes in organisms caused by modification of gene expression rather than alteration of the genetic code itself.

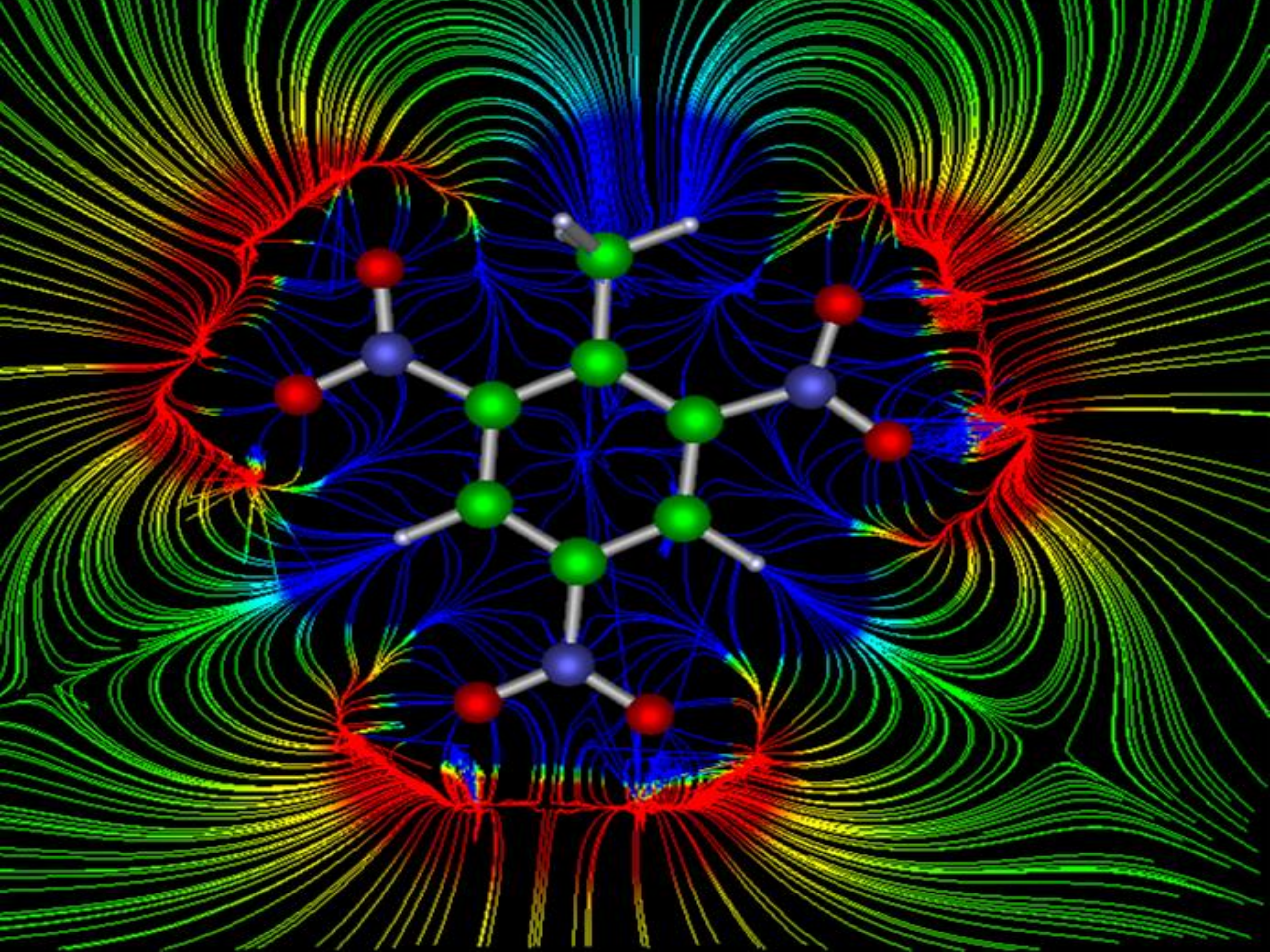


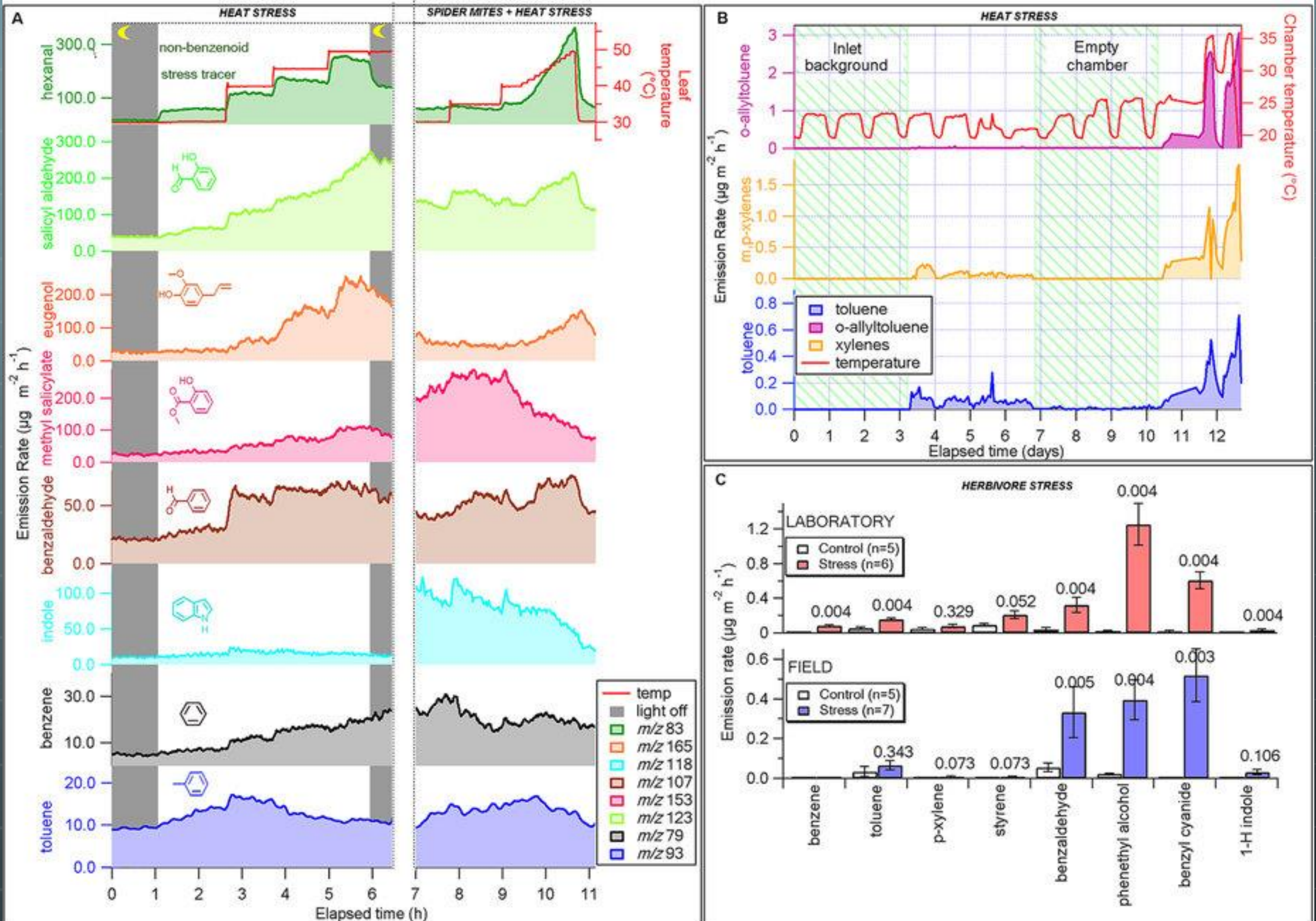


Natrophilic or Natrophobic Plants and salt tolerance

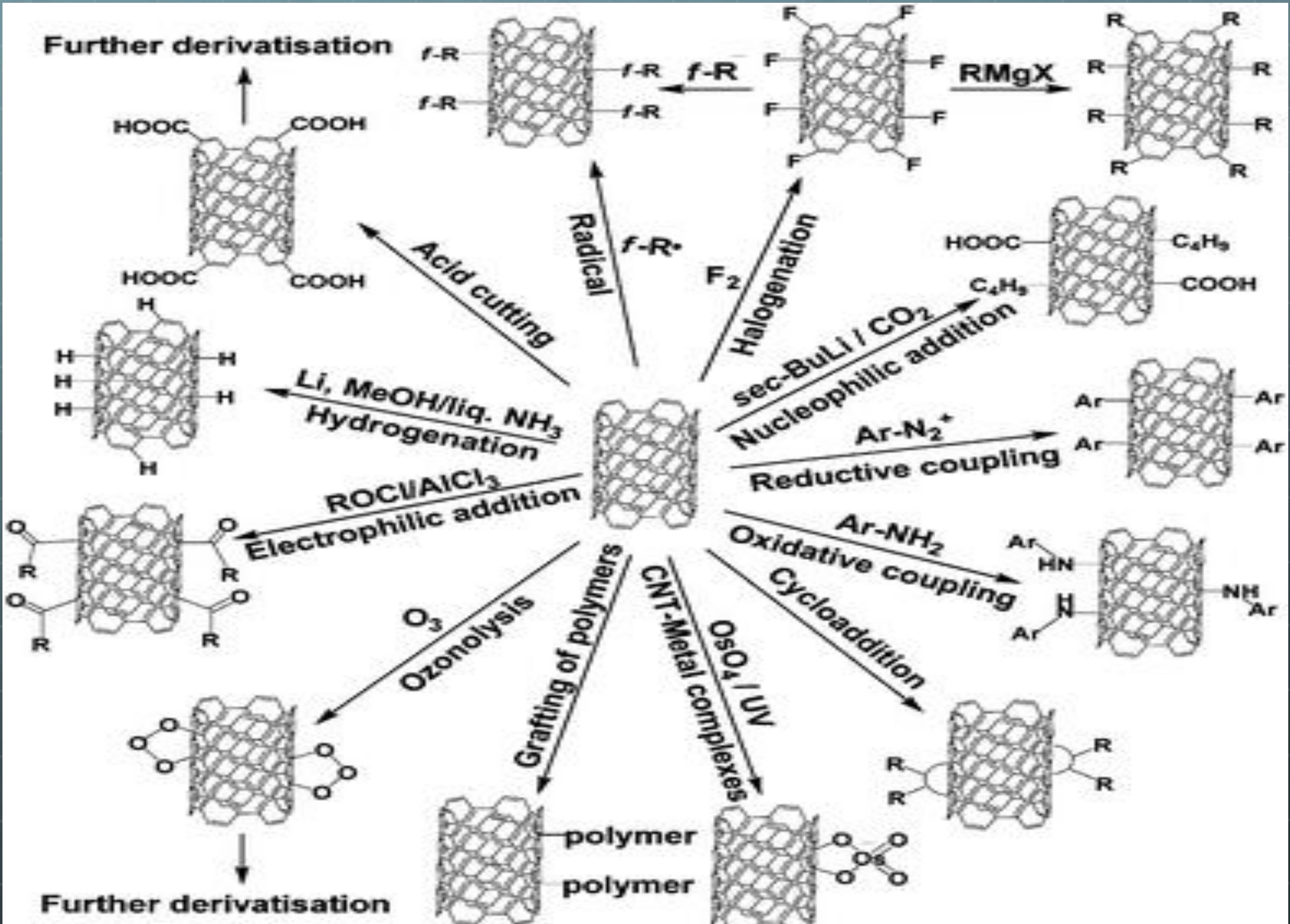


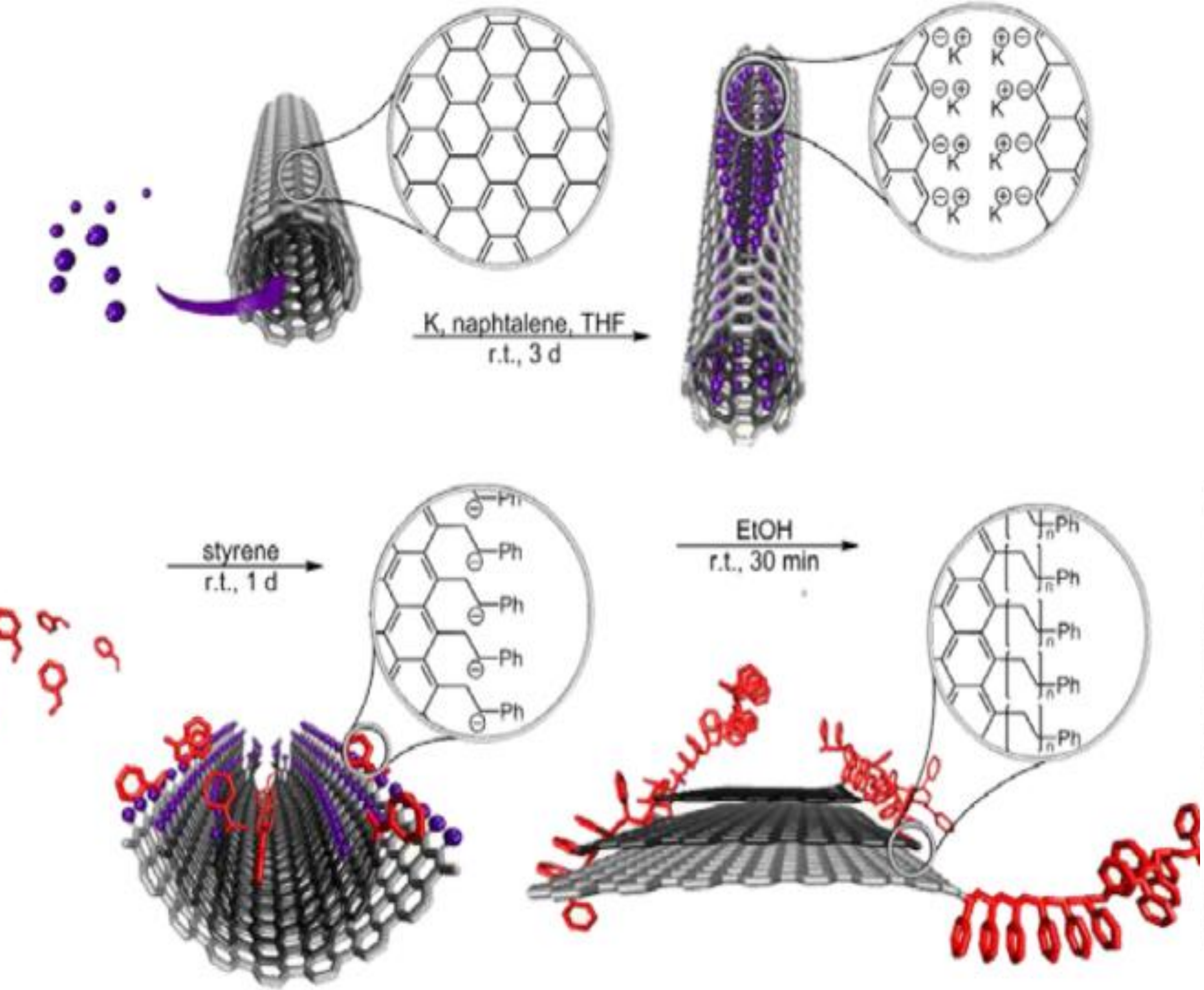

Defensive responses
Defensive responses
Methyl salicylate
Jasmonic acid
Salicylic acid
Systemin
Defensive responses
Sites of pathogen attack

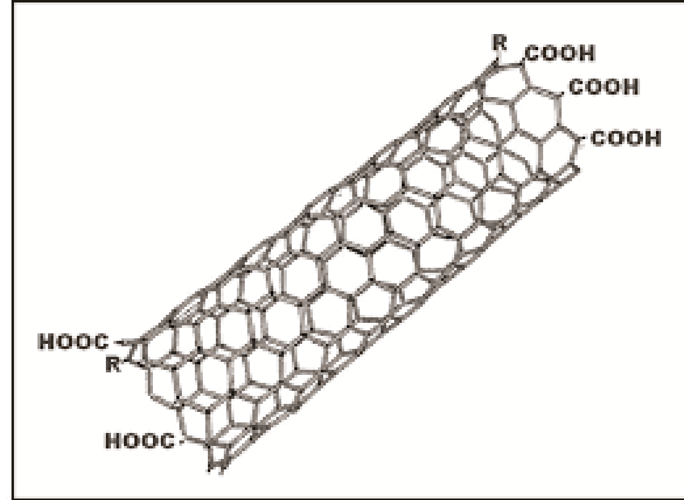


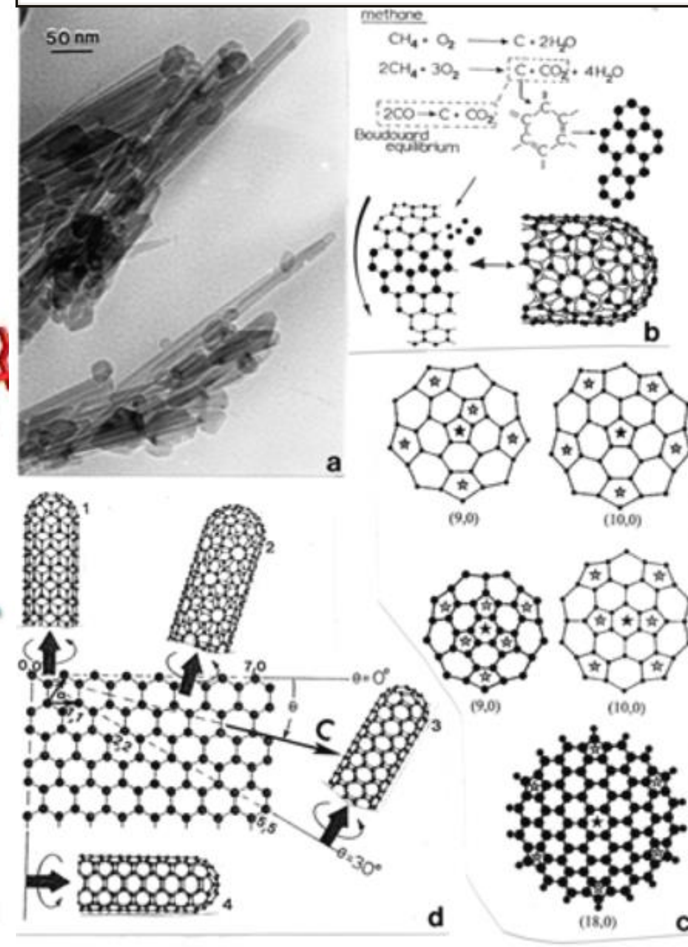


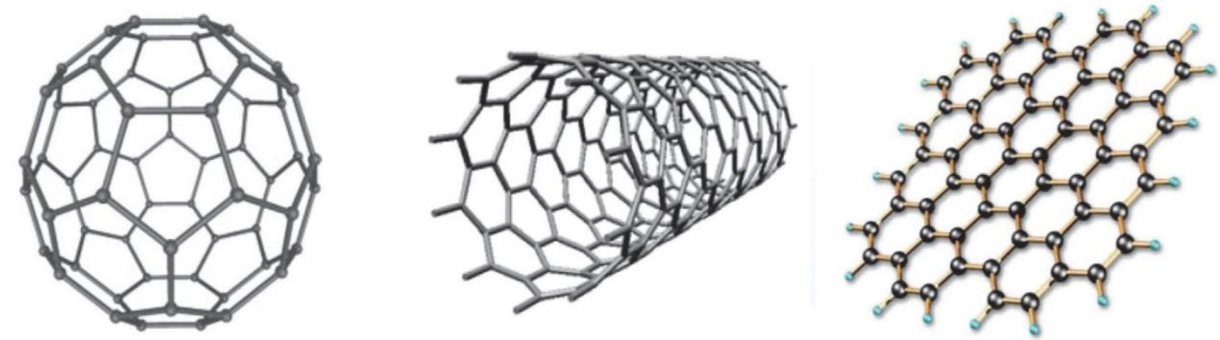
A
HEAT STRESS
SPIDER MITES + HEAT STRESS
non-benzenoid
stress tracer
hexanal
salicyl aldehyde
eugenol
methyl salicylate
benzaldehyde
indole
benzene
toluene
Emission Rate (μg m-2 h-1)
Leaf temperature (°C)
Elapsed time (h)
temp
light off
m/z 83
m/z 165
m/z 118
m/z 107
m/z 153
m/z 123
m/z 79
m/z 93
B
HEAT STRESS
Inlet background
Empty chamber
o-allyltoluene
m,p-xylenes
toluene
Emission Rate (μg m-2 h-1)
Chamber temperature (°C)
toluene
o-allyltoluene
xylenes
temperature
Elapsed time (days)
C
HERBIVORE STRESS
LABORATORY
Control (n=5)
Stress (n=6)
0.004
0.004
0.329
0.052
0.004
0.004
0.004
0.004
FIELD
Control (n=5)
Stress (n=7)
0.343
0.073
0.073
0.005
0.004
0.003
0.106
Emission rate (μg m-2 h-1)
benzene
toluene
p-xylene
styrene
benzaldehyde
phenethyl alcohol
benzyl cyanide
1-H indole


Further derivatisation
HOOC
COOH
HOOC
COOH
f-R
f-R
f-R
f-R
f-R
F
F
F
F
F
F
F
F
RMgX
R
R
R
R
R
R
R
R
Radical
f-R•
Acid cutting
F2
Halogenation
HOOC
C4H9
C4H9
COOH
sec-BuLi / CO2
Nucleophilic addition
H
H
H
H
H
H
H
H
Li, MeOH/liq. NH3
Hydrogenation
Ar-N2+
Reductive coupling
Ar
Ar
Ar
Ar
ROCl/AlCl3
Electrophilic addition
O
R
O
R
O
R
O
R
Ar-NH2
Oxidative coupling
Ar
HN
NH
Ar
H
N
Ar
O3
Ozonolysis
Grafting of polymers
CNT-Metal complexes
OsO4 / UV
Cycloaddition
R
R
R
R
polymer
polymer
Os
Further derivatisation

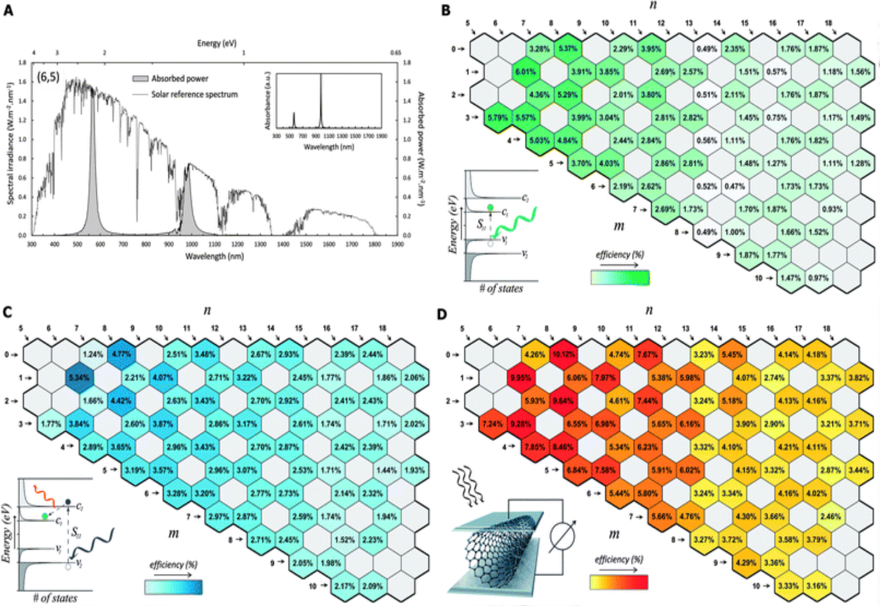


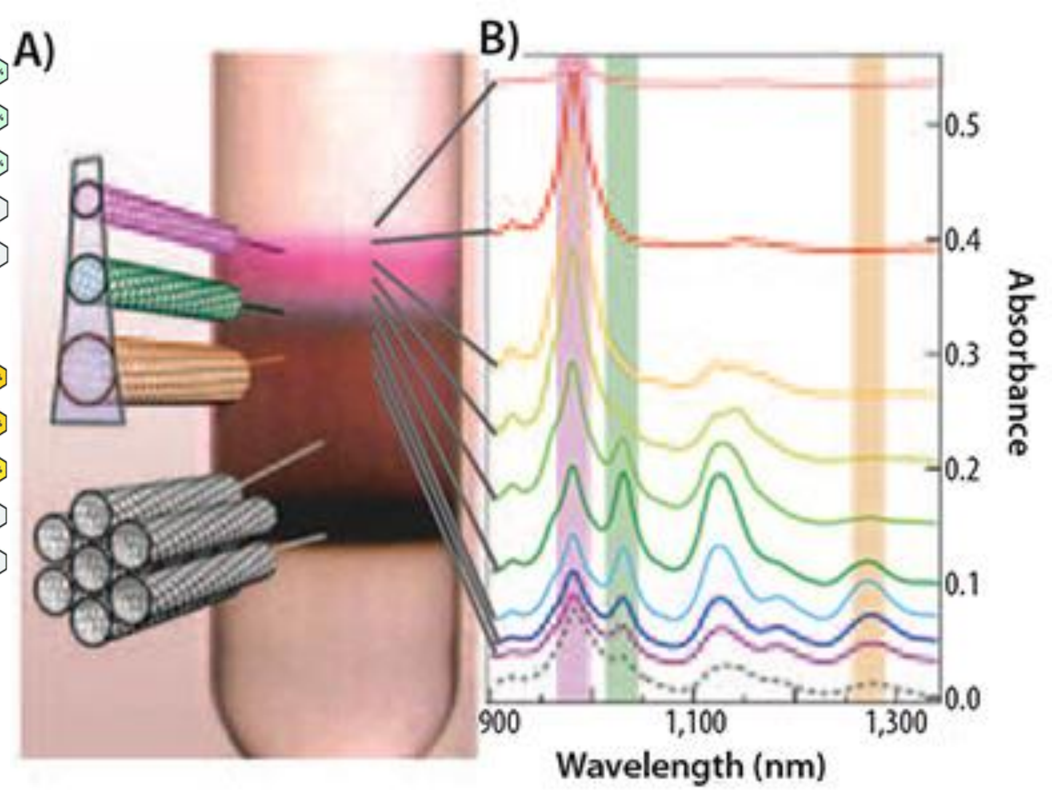


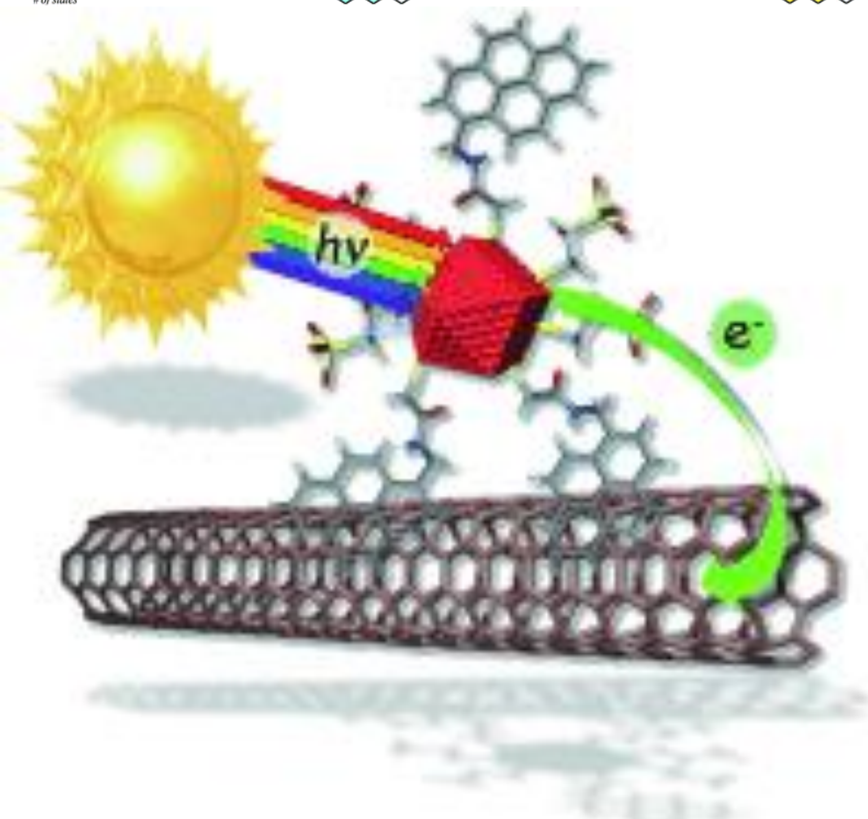


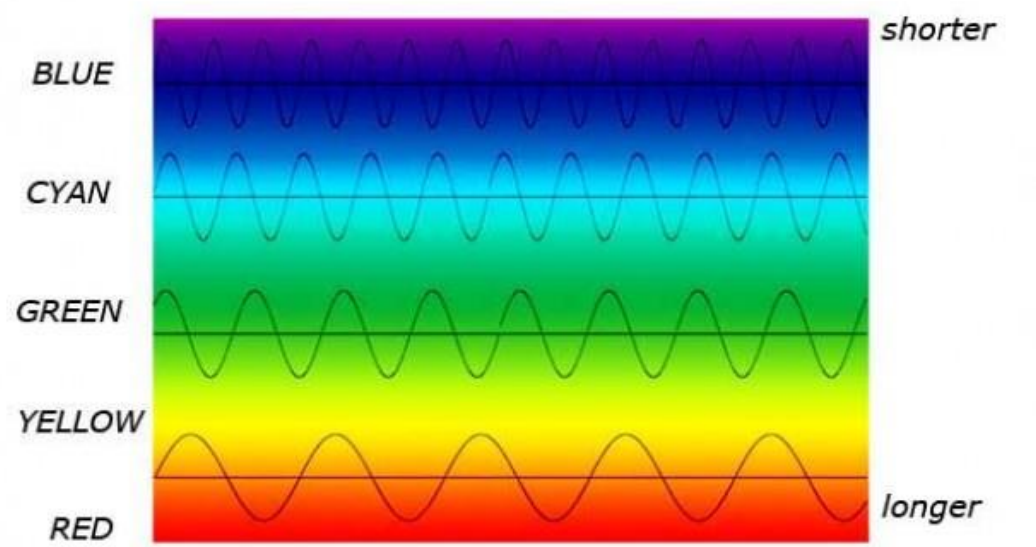


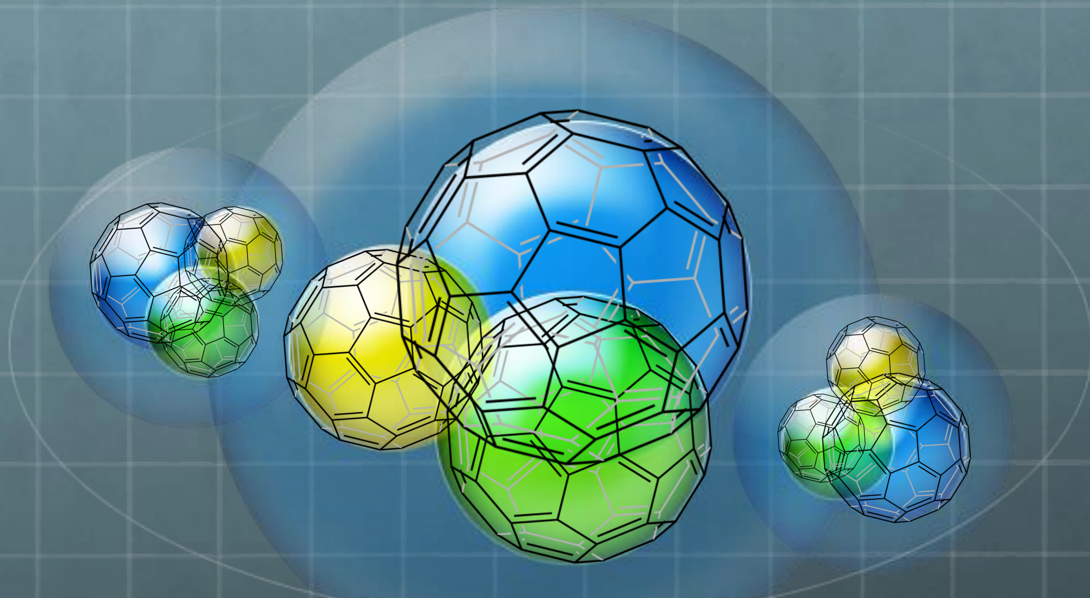
fullerene nanotube graphene


A
Energy (eV)
(6,5)
Absorbed power
Solar reference spectrum
Spectral irradiance (W.m⁻².nm⁻¹)
Absorbed power (W.m⁻².nm⁻¹)
Absorbance (a.u.)
Wavelength (nm)
B
n
m
Energy (eV)
# of states
efficiency (%)
C
n
m
Energy (eV)
# of states
efficiency (%)
D
n
m
efficiency (%)


A)
B)
Absorbance
Wavelength (nm)
900
1,100
1,300
0.0
0.1
0.2
0.3
0.4
0.5


hv
e⁻


shorter
BLUE
CYAN
GREEN
YELLOW
RED
longer



Bio-Agtive™ Emissions Solubilizer new projects

Agriculture helping the planet breathe easierTM

SBA-20 Fusion tanks Vaping sprayer

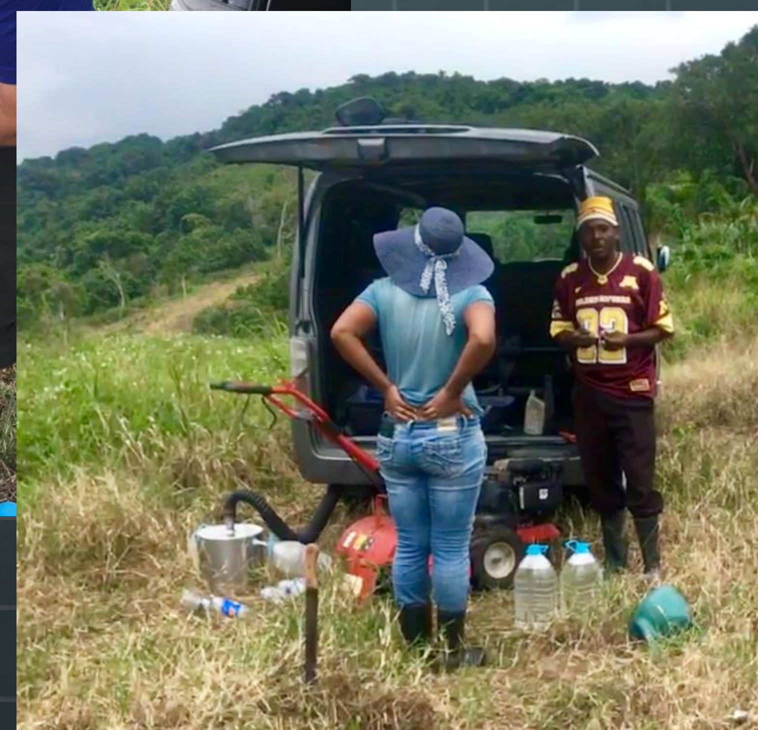
Nano-Vaping

Development of the SBA20 Fusion Tank

Bio-Agtive Solubilizer Africa Prototype

Bio-Agtive™ Turf Grass

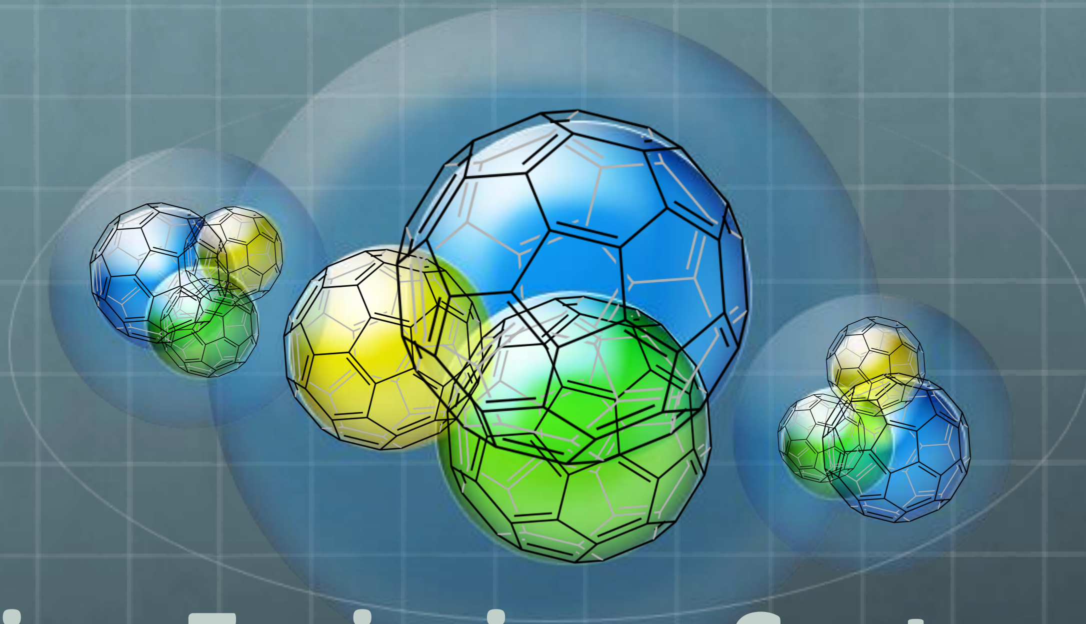
Jamaica Farmers control diseases with solubilized carbon water



Bio-Agtive Solubilized water
15 Days later recovered from pathogens

Bio-Agtive Solubilized

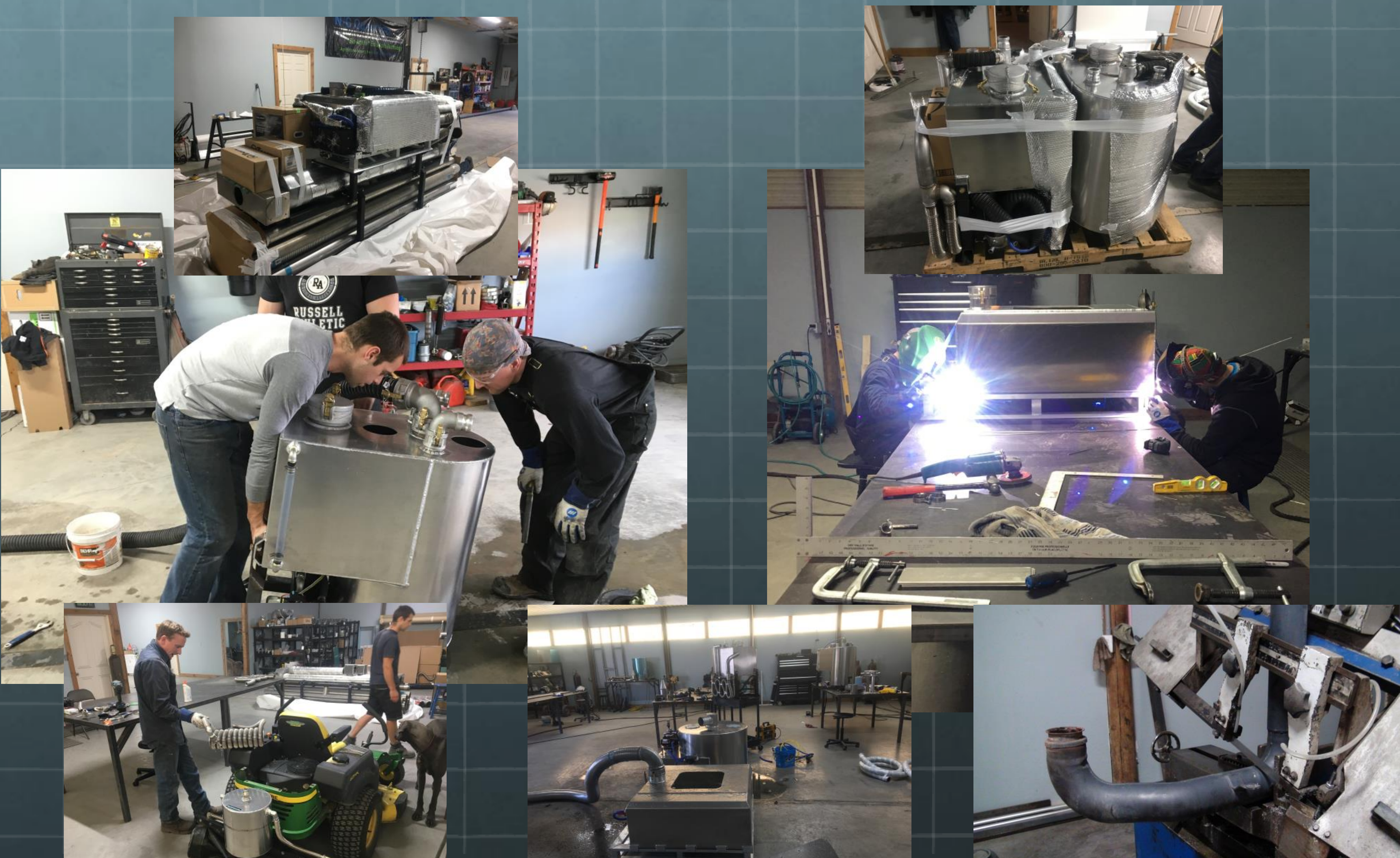
Queensland Australia



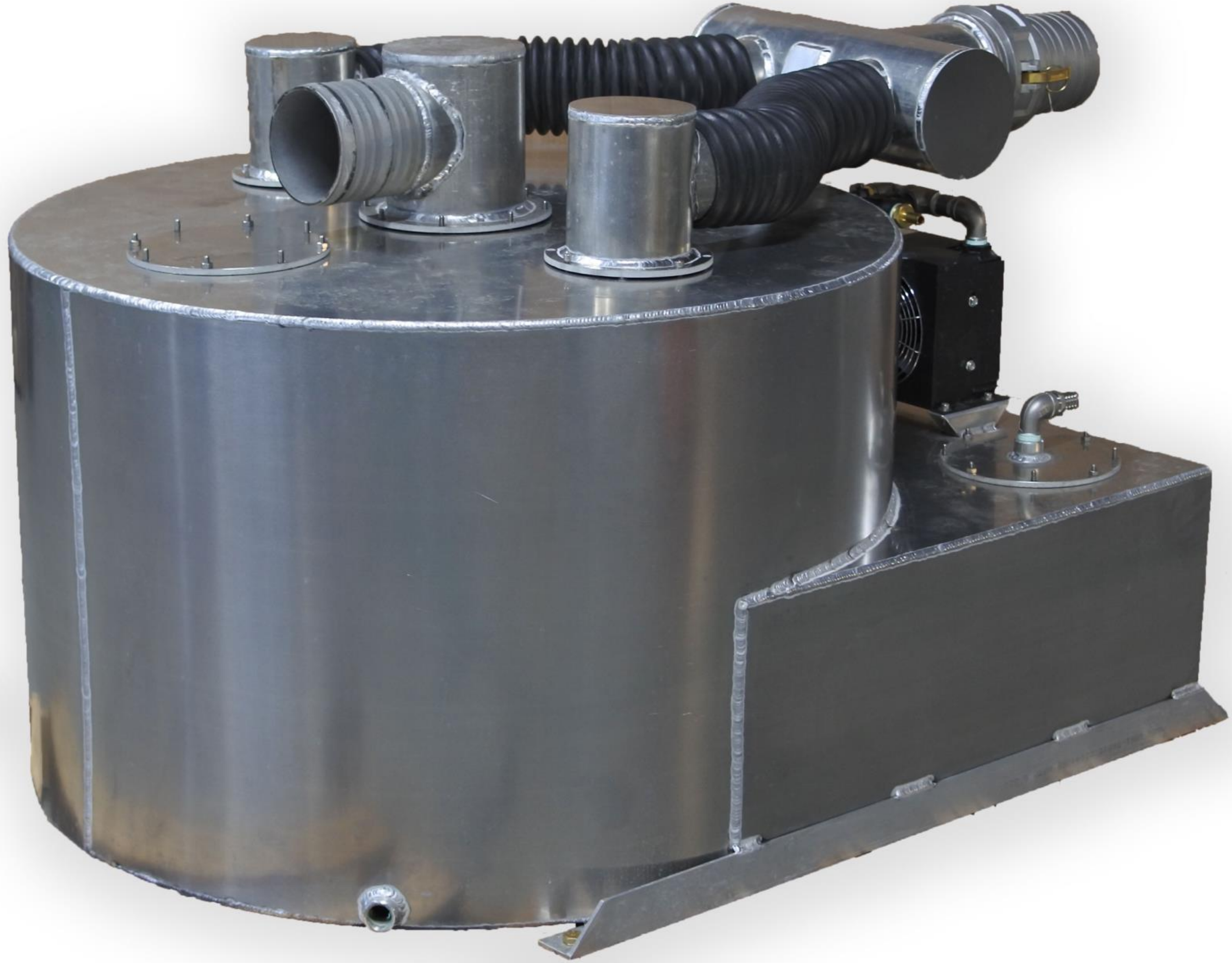
Bio-Agtive Emissions Systems2020

Agriculture helping the planet breathe easierTM

N/C Quest Inc. Shop Manufacturing Prototyping



Developing the new SBA 30-38 Fusion Tank



New tractor mount

BA6380 & SBA30

Bio-Agtive Condenser & Solubilizer

Bio-Agtive SBA 38 Solubilizer for high HP

New 600 HP BA6480X2
Bio-Agtive Condenser & Solubilizer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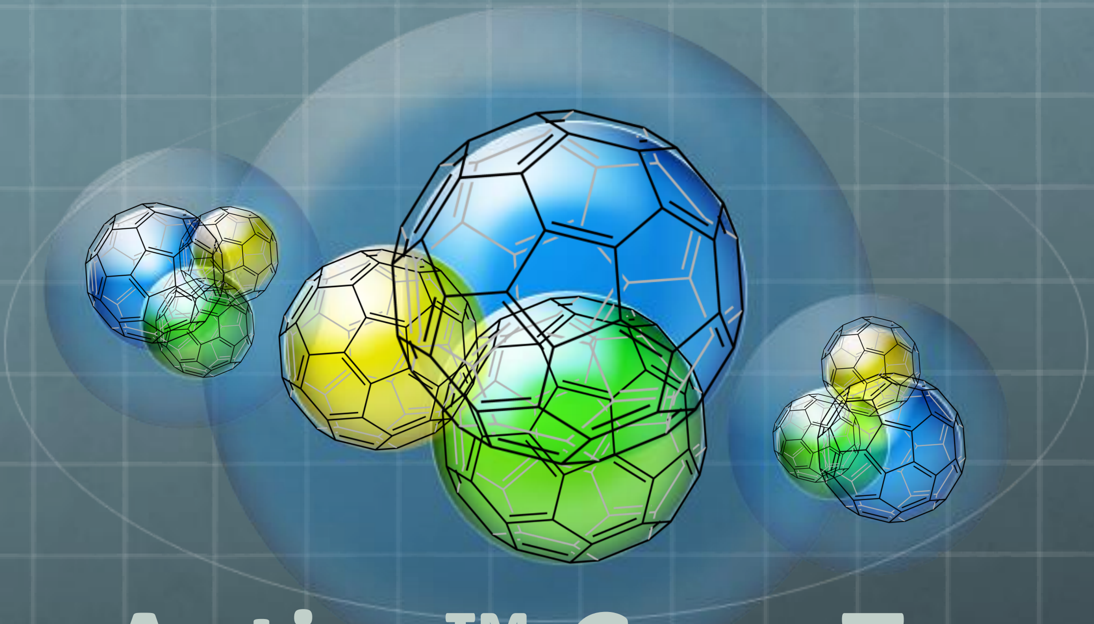
EMISSIONS
TECHNOLOGY

Bio-Agtive Sprayer & Vaping boom



Bio-Agtive™ Crop Tours

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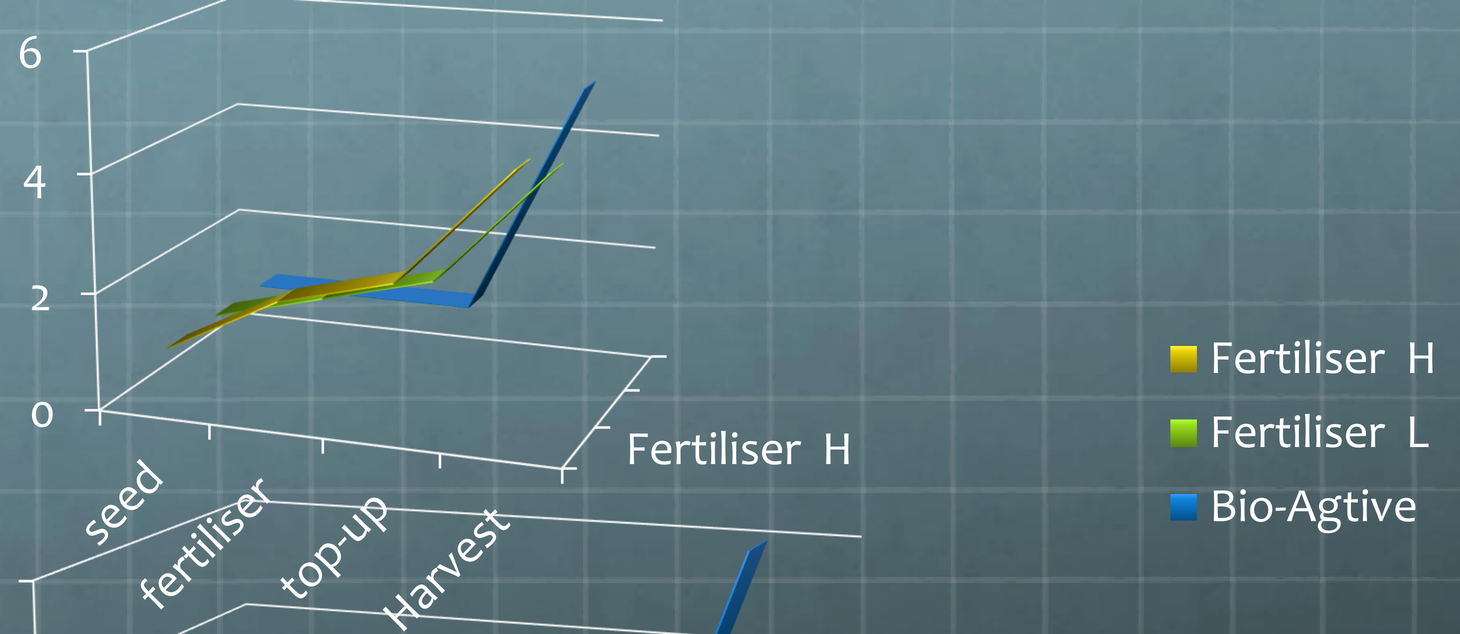
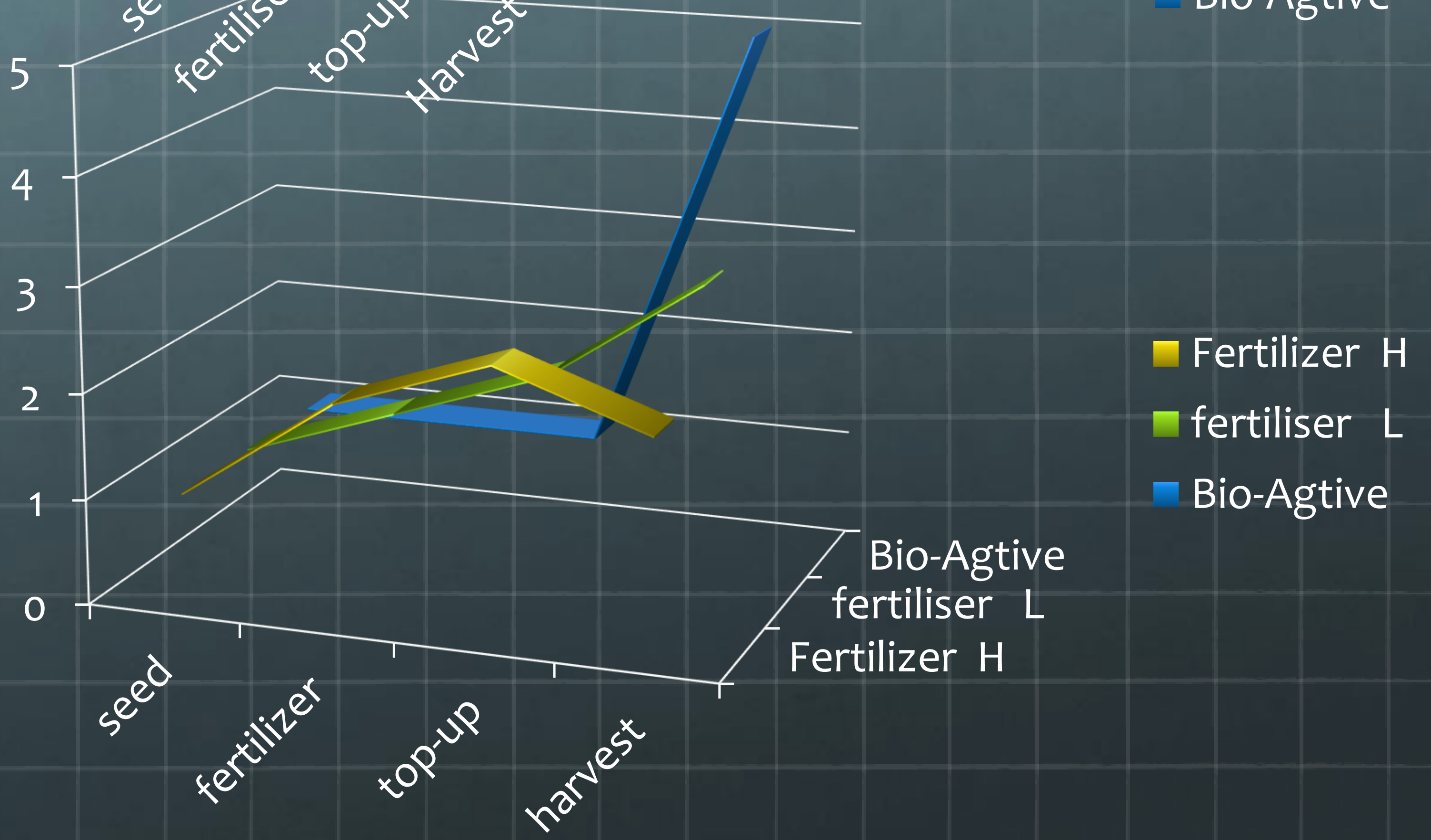
Agriculture Economics

Good Year



Poor Year



Bio-Agtive field day Leader Saskatchawan

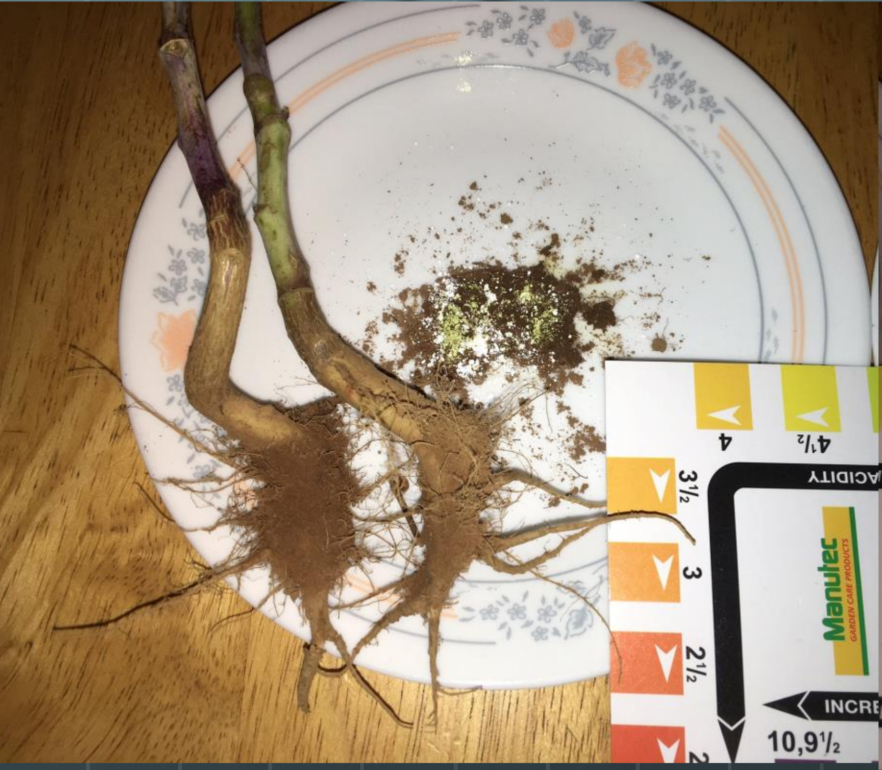

emissions

Panama

Canola

Fert acid 4.5 PH

Bio-Agtive 6.5 PH

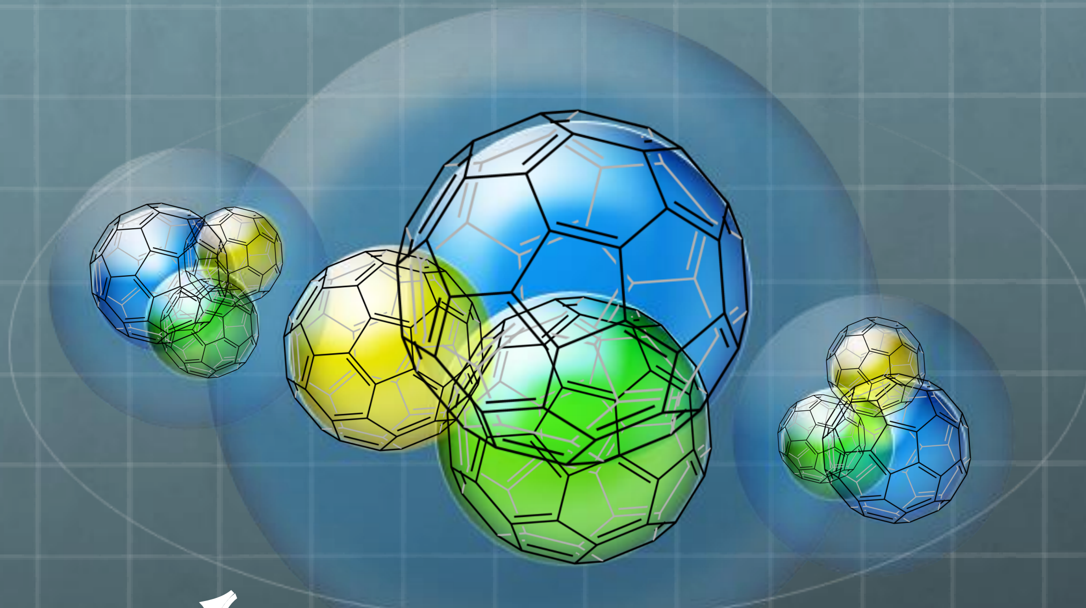


Bio-Agtive

Fertilizer

Bear County Bio-Agtive Seed Rate Trial yield 30- 50 bu county avg 20 60-90-100-120 lbs per acre seed


Seed Rate



Bio-AgTive™ Emissions Technology

Field Masters Ltd.

Tanzania

East Africa

Agriculture helping the planet breathe easierTM




Control
MAIZE + BEANS
Control
MAIZE

Bio agtive
BIO Agtive
Control
Bio Agtive
MAIZE
Bio agtive
Soil, Beans + Maize.
ControL
MAIZE

Plexus Cotton Mozambique

Gatsby Tanzania Cotton

Plexus Cotton Mozambique

Bio-Agtive roots Cotton Mozambique

70% Hand 20% Oxen 10% Mechanized




Field Masters Ltd.
Mick Dennis
Chubi Farm Tanzania
started Bio-Agtive 2012


FIELD MASTERS CTE 12.0

Bio-Agtive™ Corn

2012 corn trial control & Bio-Agtive™

Bio-Agtive™ Sorghum

Harvest 2012

Safflower cover crop 2013

Customer:	Field Masters Ltd	**Crop:**	Sorghum	**Date Received:**	30-Nov-15
Address:	Box 680Arusha	**Crop Stage:**		**Analysis Date:**	10-Dec-15
Farm Name:	Chubi Farm	**Comments:**		**Report Date:**	17-Dec-15
Contact Person:	Mick	**Condition:**	Dry	**Sample ID:**	CF049SA0029

Field: GPS 021 Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: GPS 021

History (Last 3 analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current	27-10-14	3-07-13	1-08-12	Method
pH (H2O)		**9.04**	5.80	6.80				pH	9.04	8.74	8.44	8.91	Potentiometric
*EC (Salts)	uS/cm	**485**		< 800				EC(S)	485	364	361	352	Potentiometric
Phosphorus	ppm	**1.02**	30.0	60.0				P	1.02	3.67	3.1	3.95	Spectroscopy
Potassium	ppm	**426**	518	2070				K	426	523	572	374	Spectroscopy
Calcium	ppm	**6940**	6640	9960				Ca	6940	9420	10400	8270	Spectroscopy
Magnesium	ppm	**1800**	797	1270				Mg	1800	1300	1560	1230	Spectroscopy
Sulphur	ppm	**< 0.50**	20.0	200				S	< 0.50	21.7	22.9	22.1	Spectroscopy
*Sodium	ppm	**3230**		< 764				Na	3230	3920	1820	1460	Spectroscopy
Iron	ppm	**56.0**	50.0	300				Fe	56.0	38.8	34	28.7	Spectroscopy
Manganese	ppm	**222**	30.0	300				Mn	222	158	204	149	Spectroscopy
Boron	ppm	**3.07**	0.50	2.00				B	3.07	2.91	3.51	3.18	Spectroscopy
Copper	ppm	**3.29**	1.00	10.0				Cu	3.29	3.3	3.17	2.24	Spectroscopy
Zinc	ppm	**1.26**	1.50	20.0				Zn	1.26	0.9	0.98	0.51	Spectroscopy
*C.E.C	meq/100g	**66.4**	15.0	30.0				C.E.C	66.4	78.4	76.6	60.4	Calculated
*Nitrogen	%	**0.15**	0.20	0.50				N	0.15	0.09			Colorimetric
*Organic Matter	%	**5.68**	3.00	8.00				OM	5.68	2.68	2.28	1.81	Colorimetric
*C/N ratio		**22.0**	10.0	25.0				C:N	22.0	17.3			
***PERCENTAGES AND RATIOS**													
Calcium %	%	**52.3**	50	75				Ca%	52.3	60.07	67.84	68.43	
Magnesium %	%	**22.6**	10	16				Mg%	22.6	13.82	16.96	16.99	
Potassium %	%	**1.64**	2	8				K%	1.64	1.71	1.91	1.59	
Sodium % (ESP)	%	**21.2**	0	5				Na%	21.2	21.74	10.32	10.5	
Other Bases %	%	**2.36**	3	10				OB%	2.36	2.66	2.96	2.49	
Hydrogen %	%	**0.00**	10	15				H%	0.00	0	0	0	
Total	%	**100.00**											
Ca:Mg Ratio	%	**2.32**	4	7				Ca:Mg	2.32	4.35	4	4.03	

2 Rivers Vegetable Farm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