Black Swan, LLC

"-then the Lord God formed the man out of the dust of the ground and blew into his nostrils the breath of life, and the man became a living being." **Genesis** 2:7

POWER PLANT MDAC AND FGXB REDUCES FUEL CONSUMPTION AND BIOSEQUESTERS

American Institute of Chemical Engineers 2022 National Meeting

Brian Kolodji, PE, President and Owner

Kolodji Corp and Black Swan, LLC

bkolodji@sbcglobal.net, cell: (713) 907-8742

ENERGY CARBON MANAGEMENT

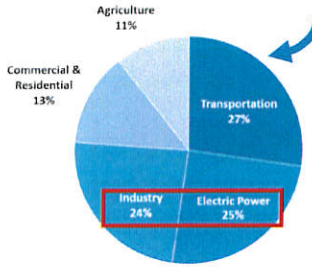
Dr. Bruce Kimball, Retired USDA (Green Leaf Group);
Dr. Brian Marsh, County Director Advisor University of California Cooperative Extension- Kern County
Paramjit Dosanjh, Manager/Owner Dosanjh Brothers Orchards
Dr. Amit Gunasakara, Formerly with California Department of Agriculture, Chief Scientist
Manual Aguayo, Kolodji Corporation, Supervisor Operations
Dr. Marc Straub, Vice President, Formerly with Generon

11/14/2022

2020 REFERENCE

EPA United States Environmental Protection Agency

Total U.S. Greenhouse Gas Emissions by Economic Sector in 2020

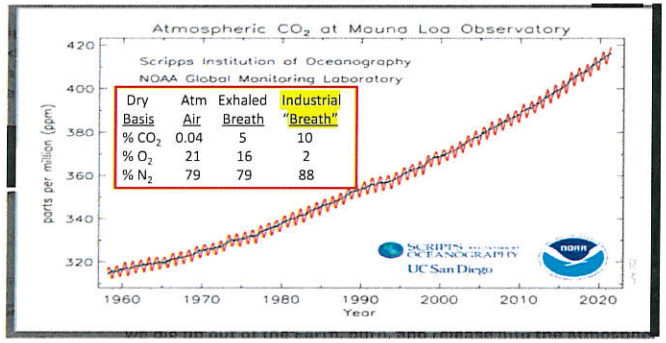


BLACK · SWAN FXGB & MDAC:

1. **Removes All five (5) GT/Y CO2 produced from All US Sectors**
2. **Removes another 5 GT/Y from air**
3. **Achieves Carbon Neutrality and beyond...**

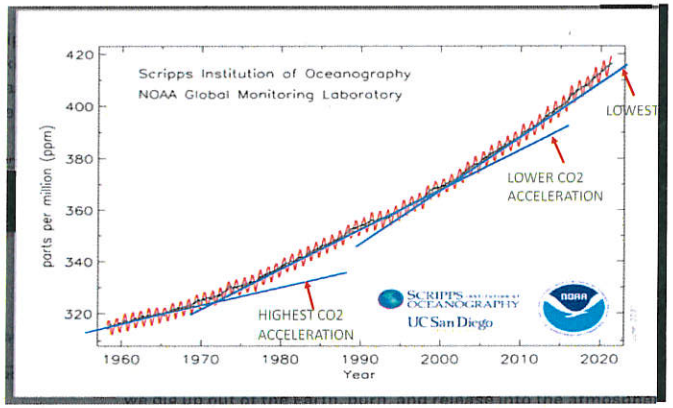
Energy Carbon Management!!!

"Keeling" Curve

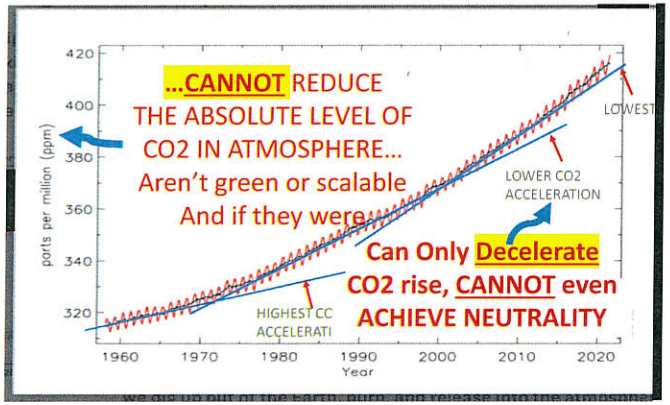


Dry Basis	Atm Air	Exhaled Breath	Industrial "Breath"
% CO_2	0.04	5	10
% O_2	21	16	2
% N_2	79	79	88

Cause? Energy Carbon Mis-management



CURRENT CONVENTIONAL CO2 CAPTURE TECHNOLOGY



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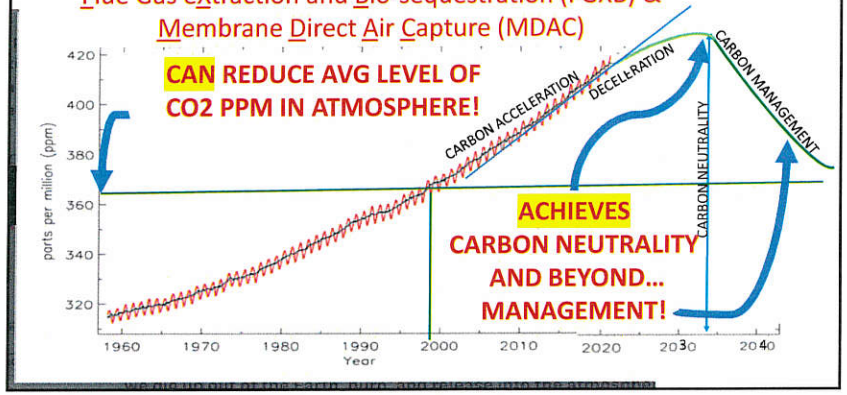
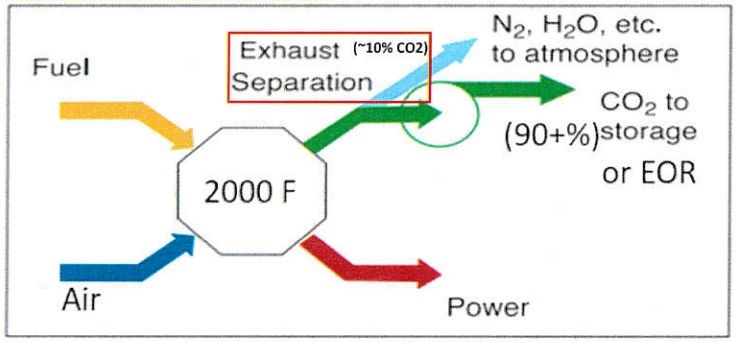
Flue Gas eXtraction and Bio-sequestration (FGXB) &
Membrane Direct Air Capture (MDAC)



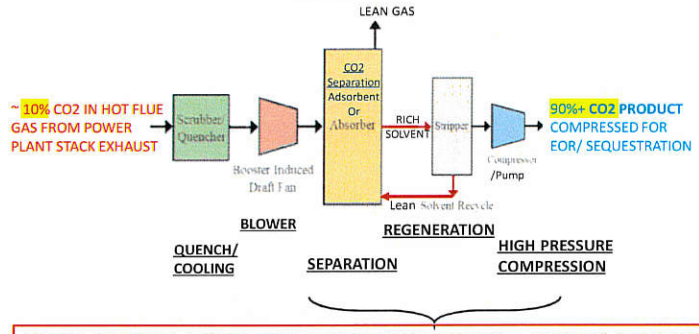
CONVENTIONAL POST-COMBUSTION CO2 CAPTURE



Separates CO2 from Exhaust Stream

CONVENTIONAL POST-COMBUSTION CO2 CAPTURE UNIT

KEY COMPONENTS, SEQUENCE, STREAMS

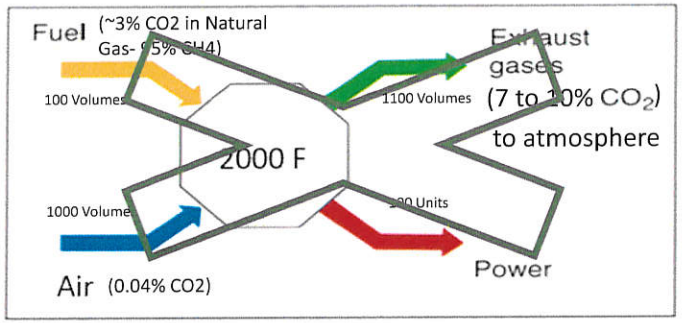


HIGH CAPITAL/ ENERGY/ RESOURCE CONSUMPTION COMPONENTS

PETRA NOVA- CONVENTIONAL POST-COMBUSTION CAPTURE

- LARGEST: 1.6 Million Ton/Year (MMT/Y)
- 99% CO2 Product from 10% in Fluegas
  - -for Enhanced Oil Recovery (EOR)
  - -(Carbon Positive, Not Green)
  - -Makes more carbon than removed!
- Not Economic at $1B ($600+/Ton)
- Cost: $4 Trillion for US 6GT/Y Removal

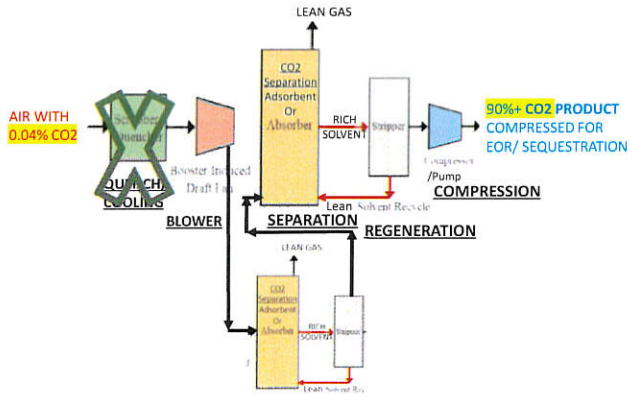
CONVENTIONAL DIRECT AIR CAPTURE (DAC)



NOT RELIANT UPON POWER GENERATION

CONVENTIONAL DAC or Direct Air Capture Unit

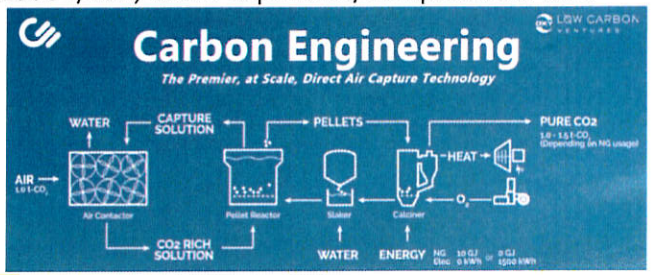
KEY COMPONENTS, SEQUENCE, STREAMS- almost double that of Post-Comb



CONVENTIONAL DIRECT AIR CAPTURE (DAC)/ EOR

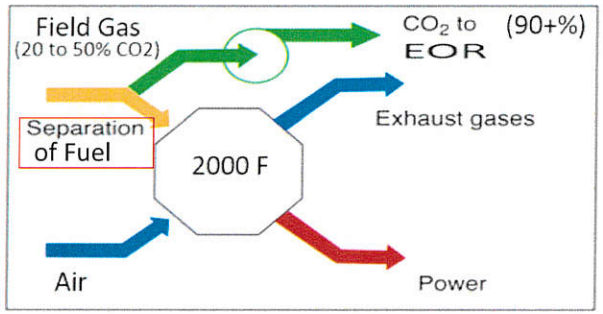
OXY LOW CLIMATE VENTURES/ CARBON ENGINEERING

$1000+/Ton, Looks expensive/complicated? It is!



Highest Driving Force Required- Dual sep/regen cycles & EOR

CONVENTIONAL PRE-COMBUSTION CO2 CAPTURE



Separates CO2 from Fuel Stream

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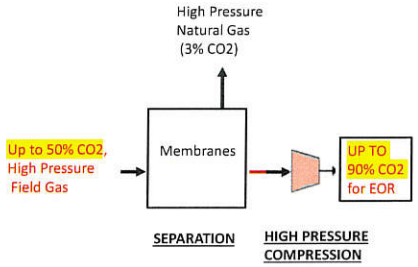
CONVENTIONAL PRE-COMBUSTION CAPTURE



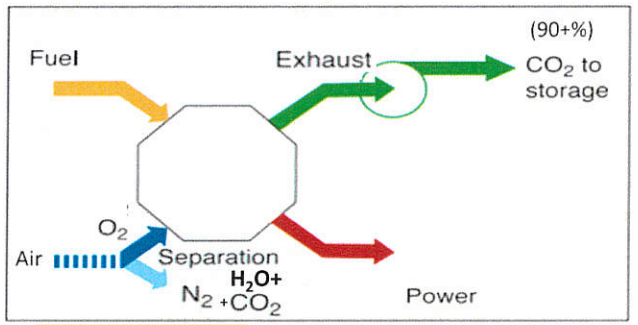
PRE-COMBUSTION Carbon Capture/ EOR with Membranes

FPSO Cidade de Angra dos Reis MV22

3.2 Million Tons CO2/ Year **LARGEST EVER** Captured

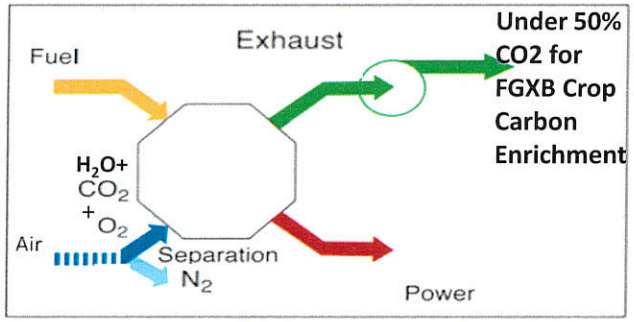
CO2 for EOR Produces 100,000 BOPD & 150MMSCFD Oil and Gas

SEPARATING NITROGEN AND CO2 FROM COMBUSTION O2 IN AIR



CONVENTIONAL OXY-FUEL COMBUSTION

BLACK · SWAN MDAC/ FGXB



¼ cost/ ~Same fuel gas savings/ Exploits tech diminishing return of conv

Direct Air Captures (DAC) CO2 with O2 and H2O!!!, reduces FGXB cost

Energy Tips — Process Heating

Oxygen-Enriched Combustion

Figure 2. Energy savings from oxygen injection

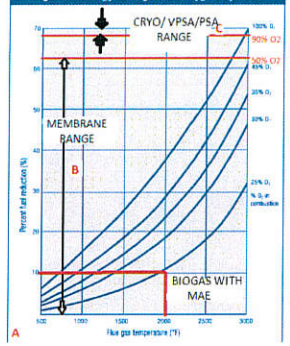


Figure 2 Reference: DOE/GO-102005-2178 September 2005 Process Heating Tip Sheet #3

O2 Source	%O2 Purity Dry Concen	%O2 Net Increase	% Fuel Savings
A Air	20.9	0 BASELINE	0
B MDAC	21-50	~1-30	30-60
C ASU Cryo/ VPSA/ PSA (Cryo/V/PSA)	90-99+%	70-80	70 Max

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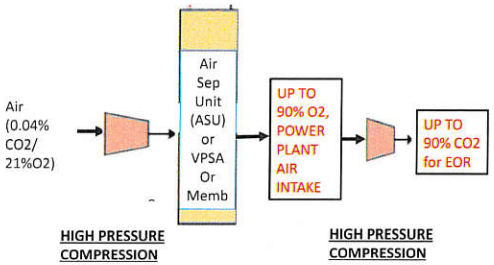
CONVENTIONAL OXY-COMBUSTION



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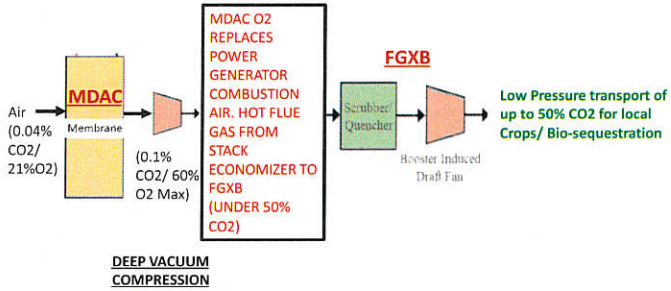
MDAC/FGXB

PRE/POST/ DAC/ OXY-COMBUSTION CO2 CAPTURE



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MDAC & FGXB

Advantage Summary

- Direct Air Capture (DAC), Pre- and Post-Combustion
- Based on large scale commercial practice for over 50 years
- Only scalable tech for 30 GT/Y CO2 Capture/ Management

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MDAC & FGXB

Low Capital, Energy, Resource Intensity- Nature Based

- No regeneration, high pressure compression/ high temperatures
- Min 30% less power plant fuel consumption/ No recycle for cooling
- "Plug and play"-No furnace/pipe material mods- simplifies install
- ¼ cost for conventional oxy-combustion/ a tenth of conv. DAC
- Fuel, water savings, more agriculture/biomass (renewable fuel)

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Flue Gas eXtraction and Bio-sequestration

FGXB

FLUE GAS RELEASE POINT

	Before FGXB	With FGXB
1.Release Elevation:	100 + Ft	< 10 Ft (grow zone)
2.Release Temp:	Hot (320F)	Cold (80F)
3.Water Content	High	Very Low
4.Density/Congestion:	Low	High
5.Velocity/ Direction:	High/Upwards	Low/Downwards

Cool, Denser than Air, Slumping Enriched Gas Lingers In Orchard

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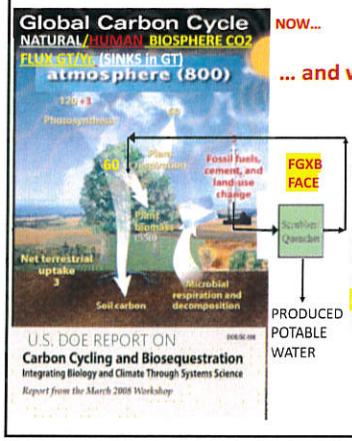

NOW...

... and with Global Carbon Neutrality Targets for 2035!!!

FGXB FACE

PRODUCED POTABLE WATER

17 MILE TROPO/STRATOSPHERE ATMOSPHERIC SINK

	Before FGXB	With FGXB
1. Atmospheric CO2 Sink	800 GT	Target: 650 GT (-19%)
2. Avg Atmos CO2 Conc.	400+PPM	Target: 350 PPM (-12%)

FLOOD Global Boundary (100') Layer Growing Zone

3. Carbon Inventory/ Flux	0.150 GT	+60 GT/Yr Available
4. CO2 Concentration, PPM	400	Target: 800 (+100%)
5. Plant Biomass CO2 Sink	550 GT	700 GT (+19%)
6. Atm to Plant Flux, GT/Y	60	90
7. Biomass Fuel to Power	0.001 GT/Y	30 GT/Y

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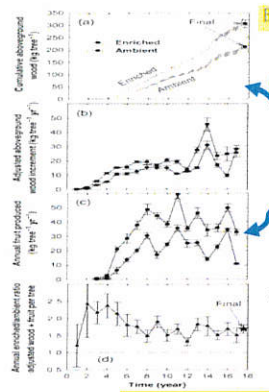
MORE RECENT GROUND BREAKING RESEARCH!

2020 BERKELEY NATURAL CYCLE/ BIOSEQUESTRATION STUDY

- GLOBAL CO2 CONCENTRATIONS...GREW...17% HIGHER FROM 360 PPM TO 420 PPM...
- 12% HIGHER PHOTOSYNTHESIS...FROM 1982 TO 2020...AN ALMOST 40 YEAR PERIOD...
- 14 GIGATONS/YR OF ADDITIONAL CARBON (WAS) REMOVED BY PLANTS (BIOSEQUESTERED)...
- ...EQUIVALENT OF THE CARBON EMITTED WORLDWIDE FROM BURNING FOSSIL FUELS IN 2020

2020 BERKELEY STUDY by KEENAN ET AL WAS PUBLISHED IN NATURE*...

17-YEAR CO_2 ENRICHMENT OF ORANGE TREES



B. A. KIMBALL *et al*

MOST DRAMATIC EVIDENCE!

USDA/USDOE PUBLISHED 2007 STUDY

CIRCA 650 PPM in Open Top Chamber Crop Carbon Enrichment

- CAPTURE: AVG 50.5% INCREASE IN BIOMASS
  - MOST BIOMASS INCREASE IN FRUIT YEILD
  - 10 MT/Y/A more than unenriched mature trees
- AVG +70% YIELD (including 4 non-producing years)
  - FOUR PEAK YEARS AT +100% YIELD (6,7,11,13)
  - THREE TROUGH YEARS AT +200% YIELD (9,14,17)
- WATER UTILIZATION EFFICIENCY (WUE) INCREASED 70%

Up to Double the Fruit with 10% Less Water!

Dozen other Crop Studies on Benefits of Crop Carbon Enrichment

60 Years of Data where Biosphere is Raised from 300 to 650 ppm CO_2

of +80 to 200% for Corn, Soybeans, Cotton, and Sweet Potatoes Yields with Boost of Agricultural Yield and Water Use Efficiency With USDOE/BNL Free Air Carbon Dioxide Enrichment (FACE) Technology

- 1967: Ford & Thorne (Corn +70% yield)*
- 1983: Rogers (Corn and Soybean Water Use Efficiency +100%)*
- 1984: Havelka (Wheat +35% yield)*
- 1985: Acock & Allen (Soybean +40% biomass)*
- 1985: Bhattacharya et al (Sweet Potatoes +83% yield)*
- 1986: Cure & Acock (Cotton +200% yield)*
- 1987/1989: Kimball et al (Cotton +100% yield)*
- 1993: Kimball et al (Rice/Soybeans)*
- 1994-7: Bindi et al: Grapes (+50 to 70% yield)
- 2002: Leavitt, Kimball, et al 70% Water Utilization Efficiency Increase for Citrus
- 2007: Kimball et al: Citrus (up to +70% yield, +55% WUE- using OTC, see previous slide)

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FGXB

MIN EXPECTED INCREASED RETURN ABOVE COST Per UC Davis

CITRUS CROP CARBON ENRICHMENT
BASIS: MIN + 60% YIELD

Dollars/Carton	%	$/100 ACRES
18.80	888%	$362,000
19.80	436%	$400,000
20.80	304%	$422,000

ALMOND CROP CARBON ENRICHMENT
BASIS: MIN + 50% YIELD

Dollars/lb	%	$/100 ACRES
3.00	318%	$335,300
3.50	200%	$445,300
4.00	145%	$510,300

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POTENTIAL Immediate BENEFITS of FGXB FACE Implementation

100% GREEN Capture With Just CA ALMOND ACREAGE (1.6MM):

16 Million Tons/ Year CO2

This is Over 5% of California's 300 MM T/Y CO2 Emissions

POTENTIAL ADDITION TO CALIFORNIA GDP:

$4.5+ BILLION/YR **PROFIT (NOT COST!!)**

BONUS: MINIMUM 10% LESS WATER USAGE
IN CALIFORNIA'S HIGHEST WATER USER (Agriculture!)

WITH CO2 SUPPLIED BY INDUSTRIALLY SOURCED FLUE GAS

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KOLODJI CORPORATION- DOSANJH ALMOND ORCHARD CARBON ENRICHMENT PILOT FGXB
QUENCH COLUMN MADE WITH DUCTING AND SPRAYERS

Reduce gas temperature

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KOLODJI CORPORATION- DOSANJH ALMOND ORCHARD CARBON ENRICHMENT PILOT FGXB
CARBON DIOXIDE INSTRUMENTATION AND DISTRIBUTION DUCTING

600+PPM Sustained for Multiple Hours!

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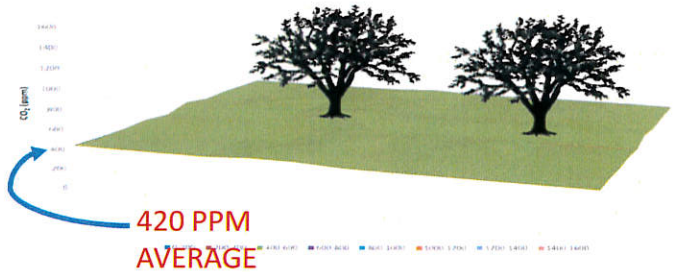
BASE LINE AMBIENT CO2 (3-CONCENTRATION AT GRADE)

Ambient day time CO2 concentration. Tree images display the location of trees in relation to 3D CO2 data for the following images of CO2 concentration over time during enrichment.



420 PPM
AVERAGE

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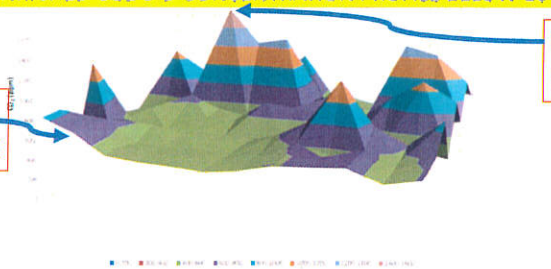
FGXB

TWO TREE ENRICHED CO2 3-D CONCENTRATION PROFILE BELOW 10 FEET PEAKS

1500 PPM PEAK

700 PPM AVERAGE



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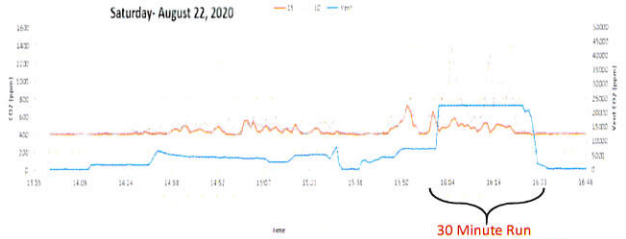
"KITTY HAWK MOMENT"



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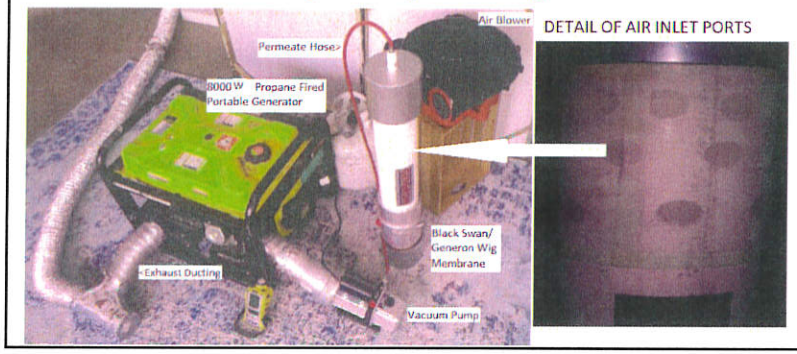
100 Ton/Year CO2, 12HP, 8 KW

Bench Scale M/DAC OxyComb Wig™ Membrane



DETAIL OF AIR INLET PORTS

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DEFINED

...ELEGANT...NATURAL...GRACEFUL...

OBVIOUS ONLY IN HINDSIGHT

COUNTER-INTUITIVE

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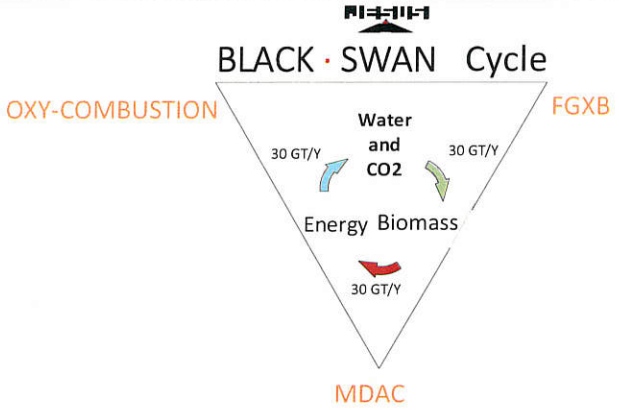
THE ONLY "GREEN" ECONOMIC CAPTURE TECHNOLOGY
***QUICKLY SCALABLE* TO 50 GT/YEAR**

- Achieve Carbon Neutrality in CA by 2025!
- Achieve US Carbon Deceleration at -0.04 GT/Yr^2 by 2030!
- Achieve Carbon Neutrality around the World by 2035.

Carbon Management that Profitably makes Fuel, Water, and Sugar with…!

BLACK · SWAN Cycle



CARBON MANAGEMENT HARNESSES "POWER OF BREATH"

Black Swan, LLC
11/14/2022

Jesus said to them, again,
"Peace be with you. As the Father has sent Me, so I send you."
And when He had said this,
He breathed on them and said to them,
"Receive the Holy Spirit."

THANK YOU FOR YOUR TIME & PATIENCE!!!!!

Brian Kolodji, PE, President and Owner
Kolodji Corp and Black Swan, LLC
bkolodji@Csbcglobal.net, ell: (713) 907-8742

The McGuire's planted their high tunnel trees in 2019 and kept them for three growing seasons with harvests in 2020 and 2021.

High Tunnel Apple Production Doesn't Pay

Chris and Juli McGuire put unused high tunnels to work growing organic apples on their Two Onion Farm. Funded in part by a USDA-SARE grant, they spent several years evaluating the practice's potential.

"Most of our results were neutral to negative," says Chris McGuire. "I'm not saying the whole idea is really bad, but you have to select specific varieties that tolerate the heat. Perhaps two of the seven varieties we tried were suited for it. The others were mushy with off flavors and sunburn."

When McGuire totaled up the costs of high tunnel construction and maintenance, heat-related fruit defects, and the need for sprays to control insect damage, the idea simply didn't pay. While diseases were absent or rare, insect damage was similar to what they saw in outdoor trees.

"Before the research grant, we had raised nursery apple trees for a year in high tunnels before transplanting them to permanent locations," says McGuire. "We were impressed by the vigorous growth and absence of disease. This motivated us to consider growing them permanently under high tunnels."

The couple has been raising organic apples for the past 10 years, as well as currants and gooseberries. When they started farming in 2003, they focused on organic mixed vegetables. The high tunnels had previously been constructed for use growing vegetables at a cost of about $10,000 and 180 hrs. of labor.

They planted their high tunnel trees in 2019 and kept them for three growing seasons with harvests in 2020 and 2021. They planted 13 trees of each of the seven varieties. Tunnels were covered with an opaque silage tarp over winter. Average yields were 7 lbs. per tree in 2020 and 25 lbs. per tree in 2021. Five of the varieties were common heirlooms that are in high demand. However, disease susceptibility keeps the McGuires from growing them outdoors. Two more modern varieties with some disease resistance and heat tolerance were also planted.

Detailed information is available in the SARE research report online.

Contact: FARM SHOW Followup, Two Onion Farm, 19638 Cottage Inn Rd., Belmont, Wis. 53510 (ph 608-726-2550; twoonionfarm@gmail.com; www.twoonionfarm.com).

He Built His Own Potato Bug Sweeper

After his 2021 potato crop was devastated by Colorado potato beetles, Jason Matthews knew he needed to do something. Operating a chemical-free farm, he figured out a mechanical solution. Over a couple of afternoons, using parts from a La-Z-Boy chair, lawn mower, signboard, belting, and a bucket, he rigged up a bug sweeper. Though not ideal, it helped, and by mid-July, he and his wife, Lisa, were selling tennis ball size Superior potatoes at the farmers market and their J&L Farms stand on Prince Edward Island.

Matthews based his bug sweeper on a walk-behind model he had seen in a potato museum. He designed his to be ground-driven and pulled behind a tractor. The lawn mower rear axle runs between the potato rows and the chair frame fits perfectly with holes that line up with a lawnmower spindle that spins a piece of belting to knock bugs into a 5-gal. bucket cut in half and bolted together.

He pulled the sweeper through his acre of 220-ft. rows of potatoes once or twice a week when the bugs started coming.

"Because it was ground-driven, it required driving extremely slow," Matthews says, and it only swept one row at a time.

Jason Matthews' bug sweeper manually sweeps bugs into a container without the use of pesticides.

"I plan to build it larger to do four or six rows and make it PTO that will allow height and speed adjustments," he says. "Also, I will run a piece of cloth for the bugs to hit, to absorb the impact."

Many of the bugs hitting the sign board bounce to the ground or even hit him, Matthews says.

Despite its flaws, the bug sweeper helped. The plants had better looking leaves and produced nice size potatoes.

"It generated a stir in the community," Matthews says. "Most farms reach for the chemical tool, and we like to rely on physics."

A video of the bug sweeper in action is on J&L Farms' Facebook page.

Contact: FARM SHOW Followup, Jason Matthews, J&L Farms, 1681 Rt. 131, Arlington, PEI, Canada C0B 1Y0 (ph 902-888-7817; jlfarms17592@yahoo.ca; Facebook: www.facebook.com/www.jlfarms.ca/).

Exhaust from a propane generator and several vehicles is collected and fans funnel it through a system of ducts. The cooling system uses water from a children's pool, a pump, a sprinkler and a condenser. Photo credit: The Bakersfield Californian; Eliza Green

Carbon Dioxide Used To Increase Orchard Yields

Can you double or even triple yields by swamping orchard crops with CO2? Brian Kolodji may have the way to do it. He floods orchards with diluted CO2 several times higher than that in ambient air, and keeps it there for extended periods.

Researchers and greenhouse growers have long shown high levels of CO2 can boost yields, sequester carbon and improve water use efficiency in crops by 10 percent. Kolodji's simple process lowers costs by a factor of 20.

In addition to reduced costs, Kolodji hopes to match or exceed results from a previous 17-year FACE study with CO2 in citrus. It demonstrated a 70 percent increase in yield on average.

"If you took out the first 6 years when the new trees were maturing, the yield increase was 100 to 200 percent," says Kolodji.

He notes that the citrus research was at a low level of enrichment, only 550 parts per million (ppm) versus CO2 levels in ambient air of 400 ppm. He has delivered as much as 1,500 ppm for 8 hrs. in multiple trees.

"We've proven it can be done and more cost-effectively than ever before," says Kolodji. "Our process brings the cost down to less than $1,000 per acre, compared to the $2 to $3 million an acre cost in the citrus study. Eventually, I expect to lower it to less than $500."

Kolodji has multiple patents on the process, but his prototype system installed in a California almond orchard is seemingly simple. Exhaust from a propane generator and several vehicles is collected and fans funnel it through a system of ducts. The cooling system uses water from a children's pool, a pump, a sprinkler and a condenser. Flexible tubes distribute the CO2 into the tree canopy.

Passing the CO2 through the water vapor cools the hot exhaust gas down to 80 degrees. The condensation process also takes water out of the flue gas. This raises the molecular weight of CO2 above that of air. When distributed around trees, the heavier CO2 displaces the air, and the multiple distribution points reduce the velocity of the gas.

"The trees act as baffles, reducing air movement, and the distribution reduces the velocity of the gas," says Kolodji. "We point it into the trees where it hovers and then slumps to the ground for extended periods."

While the system has been shown to work, application of the CO2 has not been consistent enough to prove yields. The next step is to utilize flue gas from a refinery across the street from the orchard. Currently, the refinery sends up to 200,000 tons of CO2 up its stacks each year.

"We propose to use the flue gas in the orchard," says Kolodji. "We could use it to feed CO2 to 1,000 acres."

Initial work on the project was financed in part with a $100,000 grant from the state of California. Kolodji is seeking additional funding to access the refinery's exhaust and prove increased yields with his system.

"If we could get CO2 from refineries, we could swamp our orchards," he says.

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