



KAIROSPACE
TECHNOLOGIES

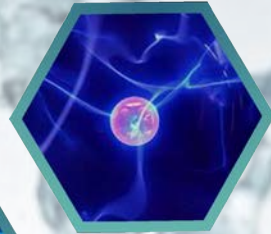
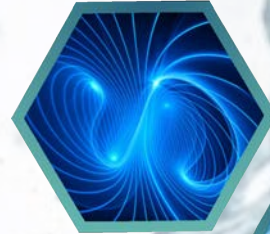
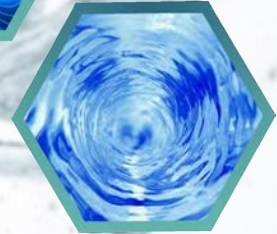
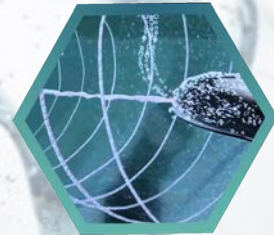
PHASE 1 EXPERIMENTAL VALIDATION REPORT



ABOUT KAIROSPACE

Our groundbreaking and innovative solutions leverage fundamental principles of physics, including plasma, electromagnetism, frequency induction, ultra fine bubbles, cavitation and fluid dynamics to enhance the physicochemical properties and structure of water without harmful chemicals.

We produce positive environmental and economic results by employing cutting edge science and research to develop novel solutions to current industry and government challenges.



AG PACK

Clean-Tech water treatment platform aimed at sustainable food production



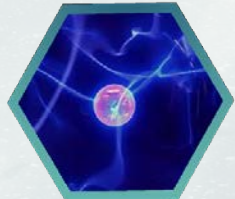
ULTRA FINE BUBBLES

- High-efficiency liquid-gas mixing (O₂, O₃, CO₂)



WATER CONDITIONING

- Improvement of carrying capacity of salts
- Reducing surface tension



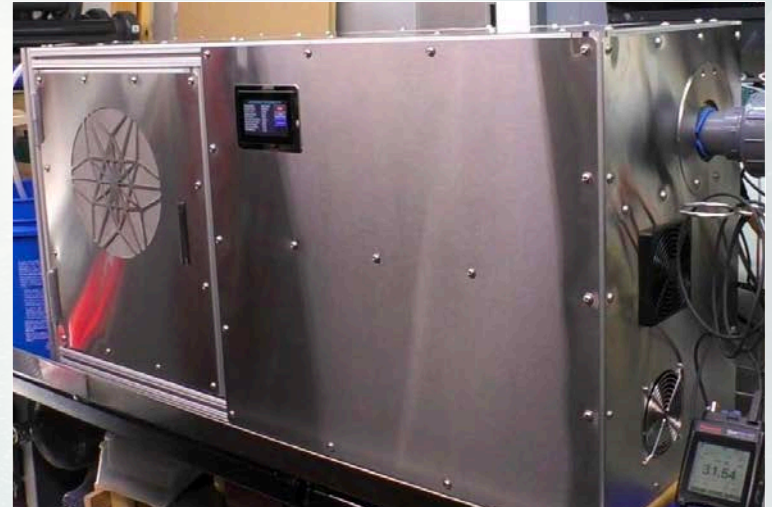
ADVANCED OXIDATION PROCESS

- Recovery of waste water

KAIROSPACE TECHNOLOGIES
INTRODUCES THE AGPACK 40 P1



[click to play demo](#)



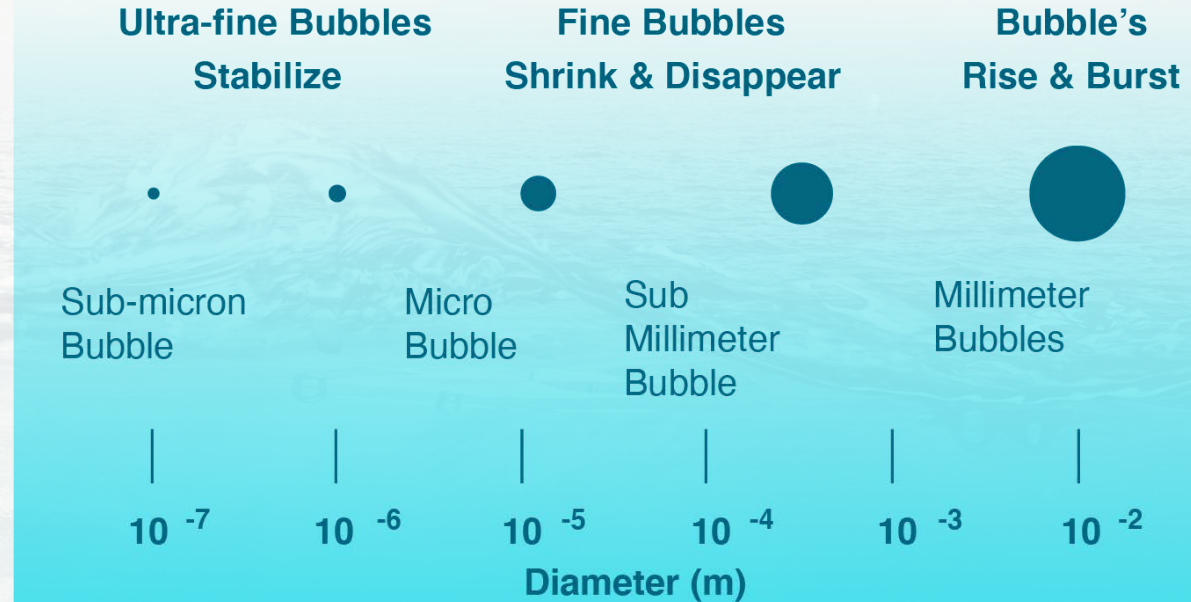
WHY ULTRA FINE BUBBLES?

Maximum Mass Transfer Efficiencies

- Increased Oxygen Transfer
- Neutral Buoyancy
- Extended Lifespan
- Improved Dissolution Rates

UFB are 500 times smaller than micro bubbles, having over 400 times more surface area, ensuring effective delivery of gases.

BUBBLE CLASSIFICATION



TECH VALIDATIONS RESULTS

Water Validation Series

Dissolved Oxygen Increase

+367%

Surface Tension Decrease

- 10 %

Nitrification Boost

+150ppm

N-NH₃ Catalyst Assisted
Advanced Oxidation

-100%

Plant Biology Validation Series

Seedling Growth Rate Boost

+8.96%

Brix Level Increase

+15.3%

Increased Shelf Life

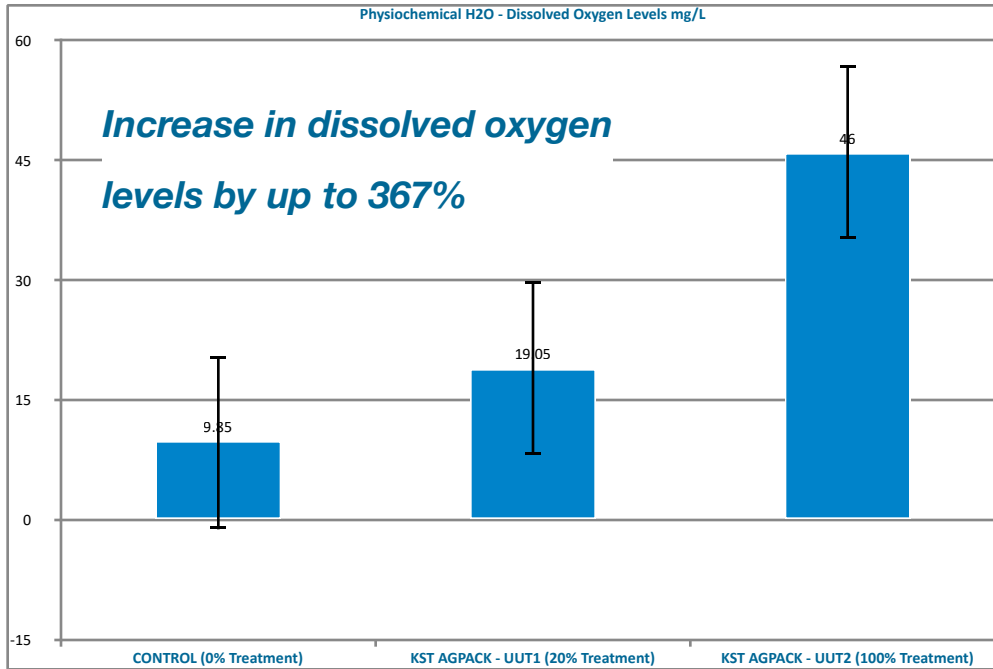
+42%

Wet Weight Increase

+18%

BENCH TESTING & EXPERIMENTAL VALIDATION

Water Series - Dissolved Oxygen



Water Series - Dissolved Oxygen

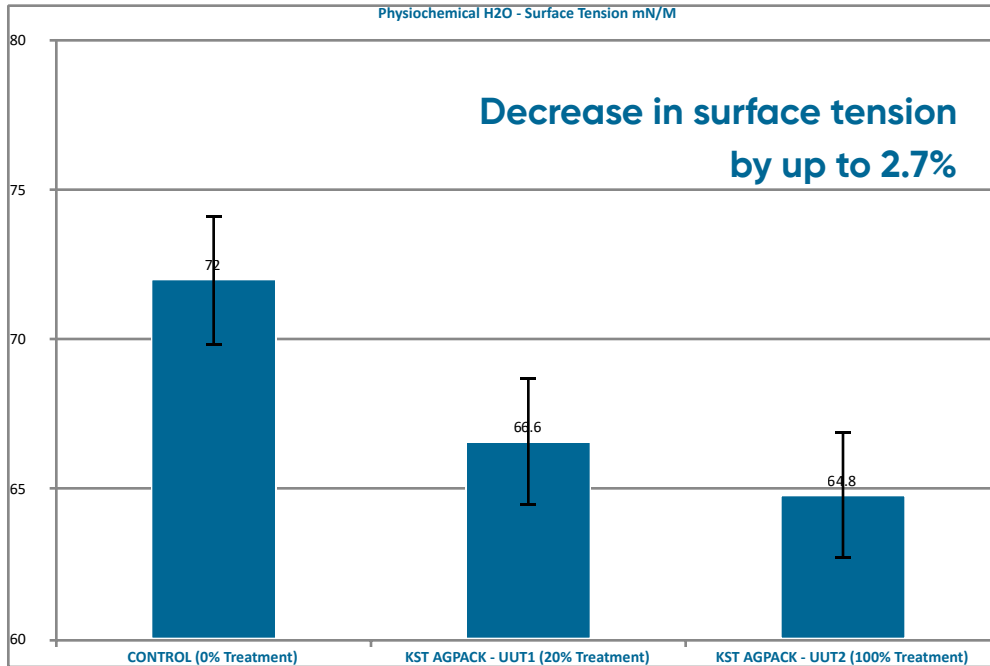
We were measuring the amount of free oxygen dissolved in water. Dissolved oxygen (DO) pertains to the amount of free oxygen that is dissolved in water. It may be expressed in mg/L, parts per million (ppm), or in percent of saturation (i.e. where saturation pertains to the maximum amount of oxygen that can be theoretically dissolved in water at a particular altitude and temperature). In biology, the oxygen plays a crucial role in various biochemical and physiological processes. One of these processes is cellular respiration. The presence of oxygen makes cellular respiration about ten times more efficient in yielding adenosine triphosphate (ATP), universal cellular energy cofactor fueling all life processes. Favorable effects of increased DO levels are linked with improved germination rates and the stimulation of growth in plant biology.

In this experiment, a full physiochemical analysis (DO, pH, oxygen reduction potential ORP, TDS, Salt, CON) was conducted on all water experiments to determine a baseline and assess overall water quality. Three experiment groups were prepared; CONTROL (0% DO treatment), UUT1 (20% DO solution treatment), UUT2 (100% DO treatment). It is considered that UUT2 is in DO at super saturated state.

The KST AGPACK application of magnetic resonance induction treatment, coupled with O₂ saturated ultra fine bubble treatment, influenced the water parameters. An increase in DO levels by up to 367% was documented. Experiment replication and statistical analysis showed that our experimental results are significant.

BENCH TESTING & EXPERIMENTAL VALIDATION

Water Series - Surface Tension



Water Series - Surface Tension

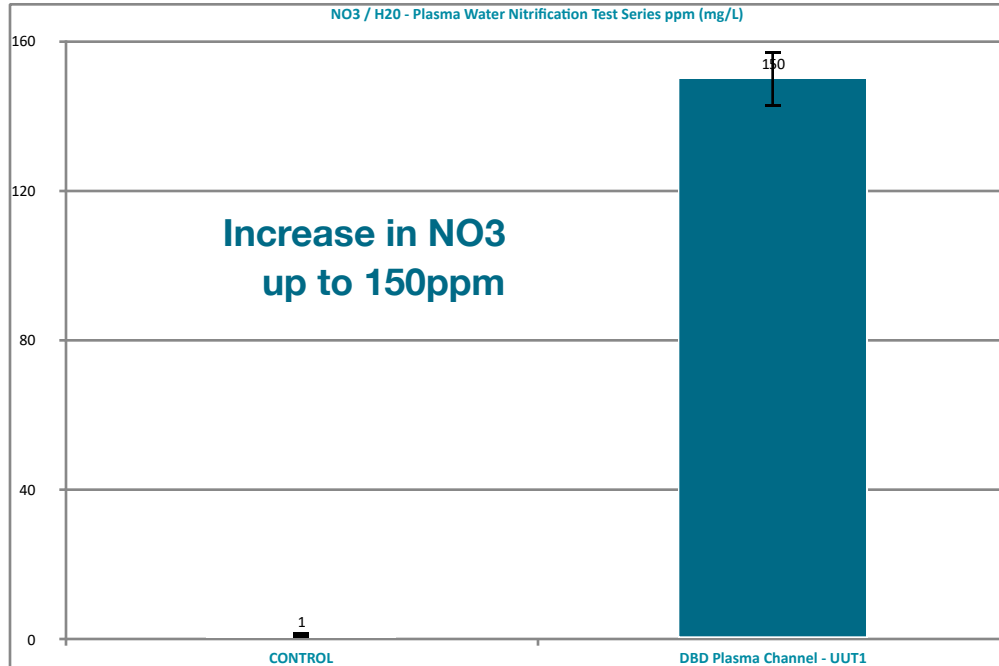
The cohesive forces between molecules in a liquid are shared with all neighboring molecules. Those on the surface have no neighboring molecules above and, thus, exhibit stronger attractive forces upon their nearest neighbors on and below the surface. Surface tension could also be defined as the property of the surface of a liquid that allows it to resist an external force, due to the cohesive nature of the water molecules. Favorable effects of magnetic water treatment technology in agriculture have shown decreases in surface tension, resulting in the removal of fouling deposits in water pipes, improved germination rates and the stimulation of growth in plant biology.

As a continuation of initial water series, three experiment groups were prepared; CONTROL (0% DO treatment), UUT1 (20% DO solution treatment), UUT2 (100% DO treatment) and measured for surface tension. Method of measurement for surface tension pressure is through capillary action measured in dyn/cm and converted to mN/m.

The KST AGPACK application of magnetic resonance induction treatment coupled with O2 saturated ultra fine bubble treatment influenced the water parameters, decreasing its surface tension by up to 10%. Statistical analysis showed that our experimental results are significant.

BENCH TESTING & EXPERIMENTAL VALIDATION

Plasma Activated Water – Nitrification Test Series



Plasma Activated Water (PAW) – NO3 Nitrification Test

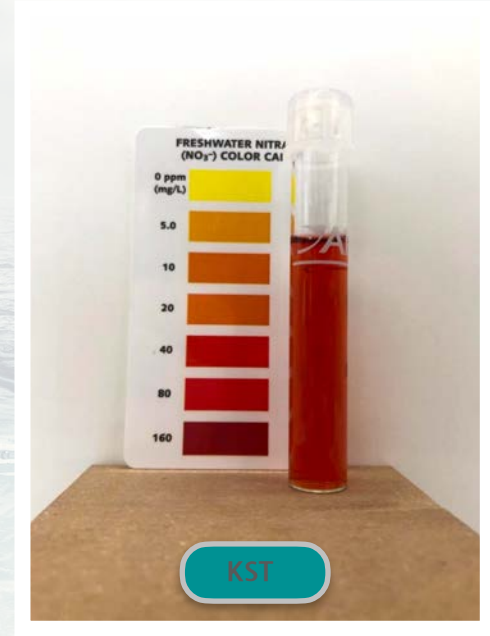
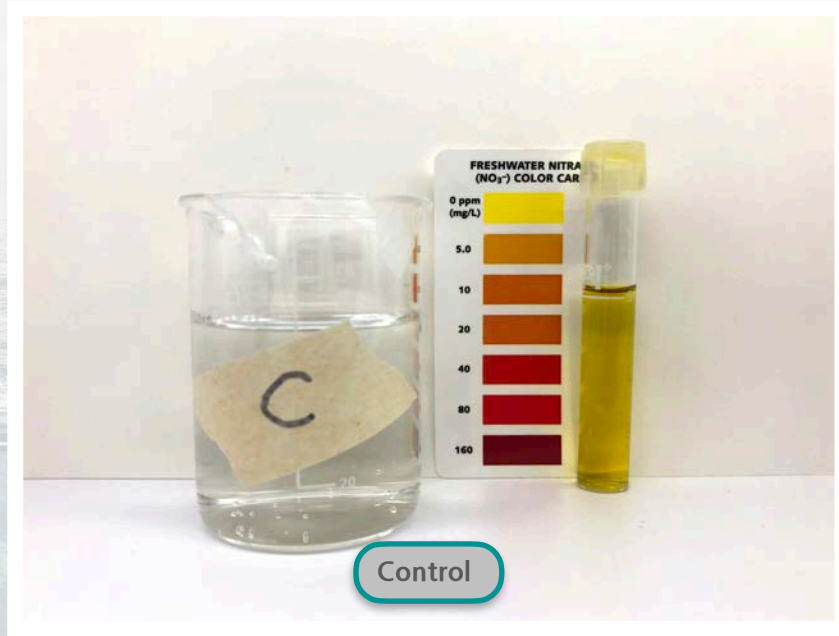
Increase in NO3 up to 150ppm

Water quality, mineralization, and chemical composition, particularly pH and nitrogen compounds each, play a crucial role in plant development and growth. Treatment of water with non-equilibrium cold plasma discharges results in the change of its properties and chemical composition, which in turn may affect plant growth process and subsequently agriculture produce quality. Plasma discharges generated in air or in water produce a number of reactive neutral and charged species, electric fields, and ultraviolet radiation. Plasma treatment of water results in significant change of its properties like pH, oxidation reduction potential (ORP), conductivity, and concentration of reactive oxygen and reactive nitrogen species (ROS and RNS).

In this PAW nitrification treatment experiment, the generation of nitrified water has been investigated. Two experiment groups were prepared; CONTROL (100% distilled water), UUT1 (100% PAW treated distilled water). The experiment groups were measured via titration and Ion Selective Electrochemistry methodology and compared for NO3 additive characteristics.

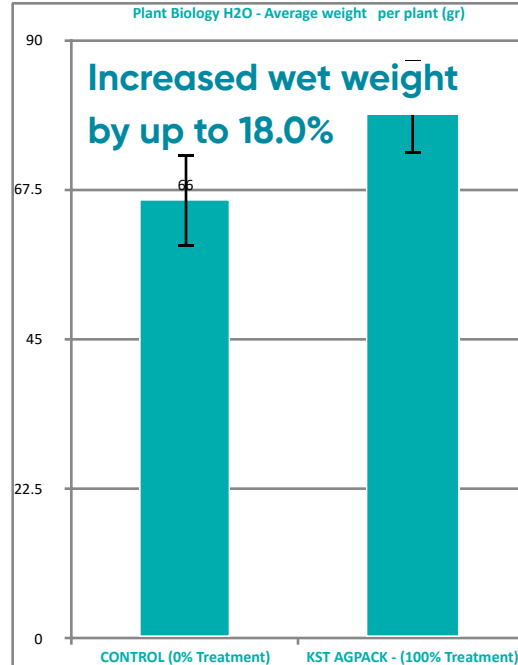
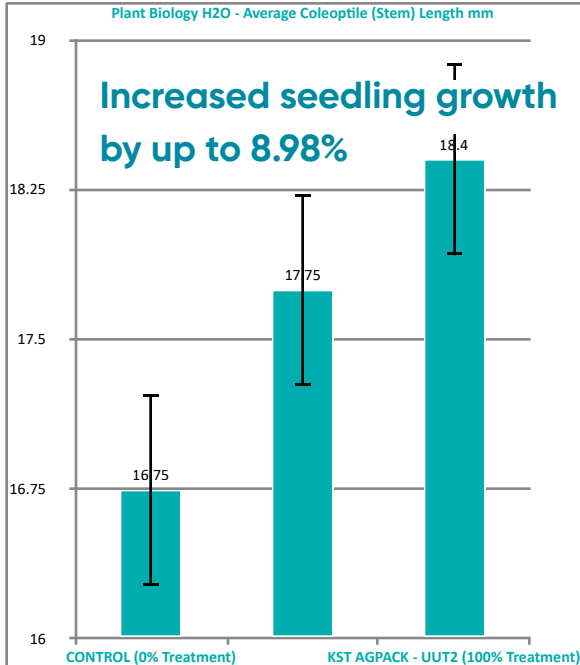
The KST AGPACK application of Plasma Activated Water influenced the test parameters, increasing NO3 levels by up to 150ppm. Further experiment replication and statistical analysis is required.

Plasma Activated Water – Nitrification Test Series



BENCH TESTING & EXPERIMENTAL VALIDATION

Plant Biology Series – Seedling and Plant Growth



Plant Biology Series –

Seedling and Plant Growth

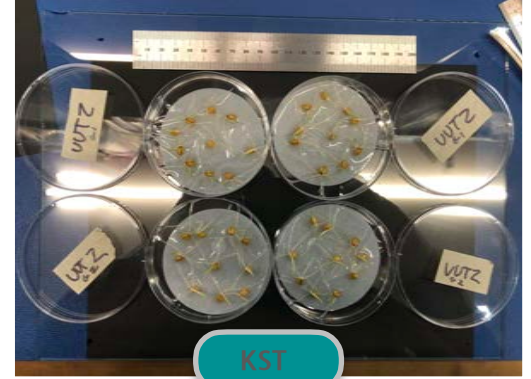
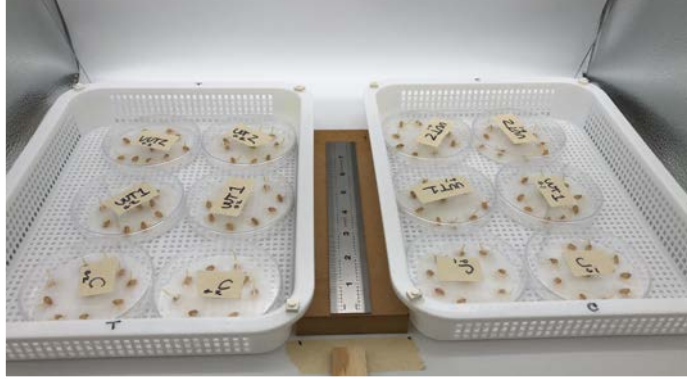
Plant growth is affected by several factors such as seed variety, amount of water, soil type, amount of light, temperature, humidity, and others. There are many factors to be considered in terms of water quality. One of the most critical factors for plant biology is the concentration of dissolved oxygen (DO). Aquatic and terrestrial plants as well as many species of microorganisms require oxygen for cellular respiration to generate the energy necessary for carrying out life processes.

In this seedling plant growth experiment, the effect of high concentrated DO on plant growth in a hydroponic environment has been investigated. Three experiment groups were prepared; CONTROL (0% DO treatment), UUT1 (20% DO solution treatment), UUT2 (100% DO treatment). It is considered that UUT2 is in a super saturated state. The seedling groups were continuously measured and grown into a mature state for further (Brix) testing.

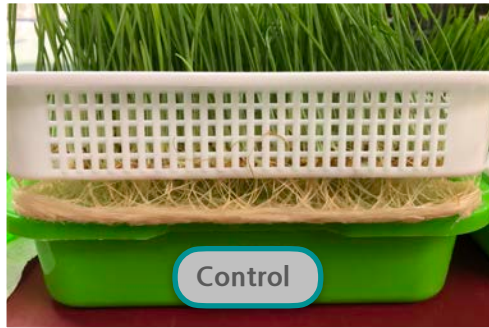
In the wet weight experiment we used lettuce as test crop. The effects of the treated water shown a remarkable increase of 18%

The KST AGPACK application of kinetic mixing and magnetic resonance induction treatment, coupled with O₂ saturated ultra fine bubble treatment, influenced the plant biology parameters, increasing plant growth by up to 8.96%. Experiment replication and statistical analysis showed that our experimental results are significant.

Plant Biology Series - Seedling and Plant Growth



Plant Biology Series - Seedling and Plant Growth

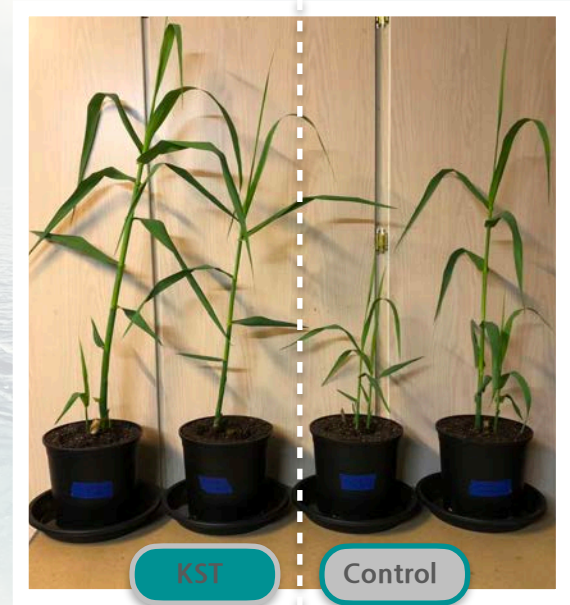
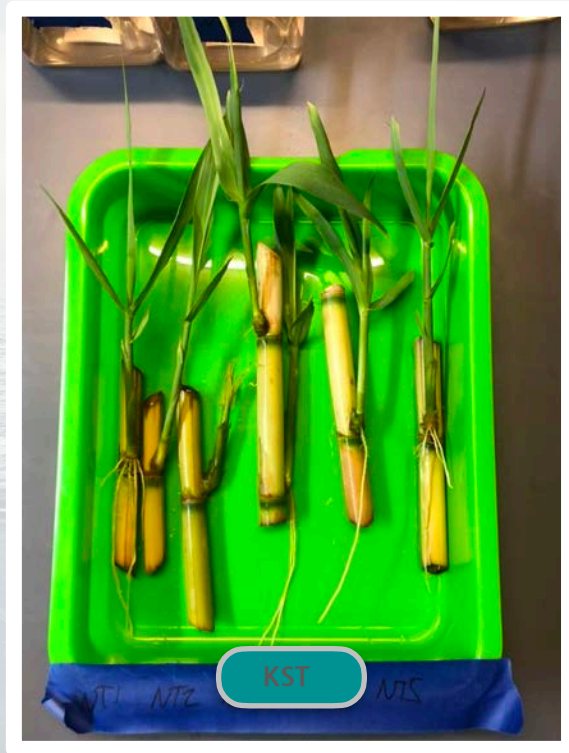


Wheatgrass. 2X root development. + 15% Brix.



Lettuce. +18% Wet Weight.
-10% Time to Harvest.

Plant Biology Series - Regenerative BioMass

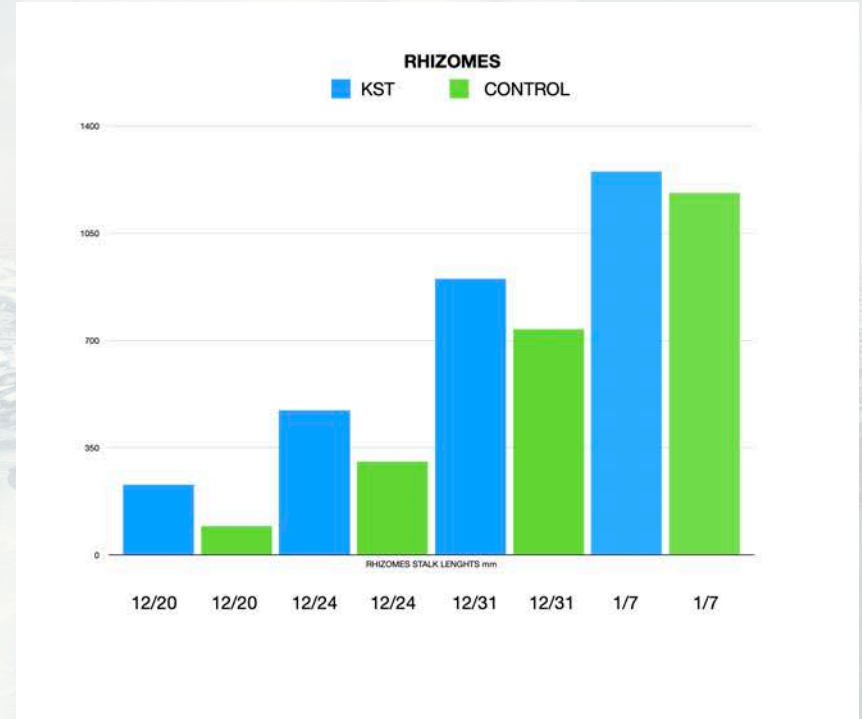
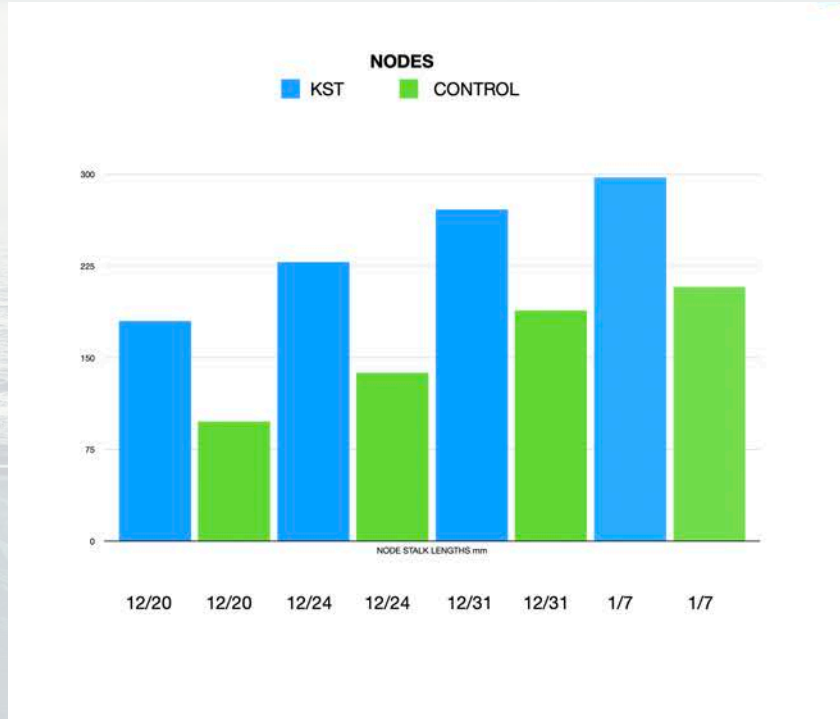


Regenerative-Biomass. 1.5X growth.

Plant Biology Series - Regenerative BioMass

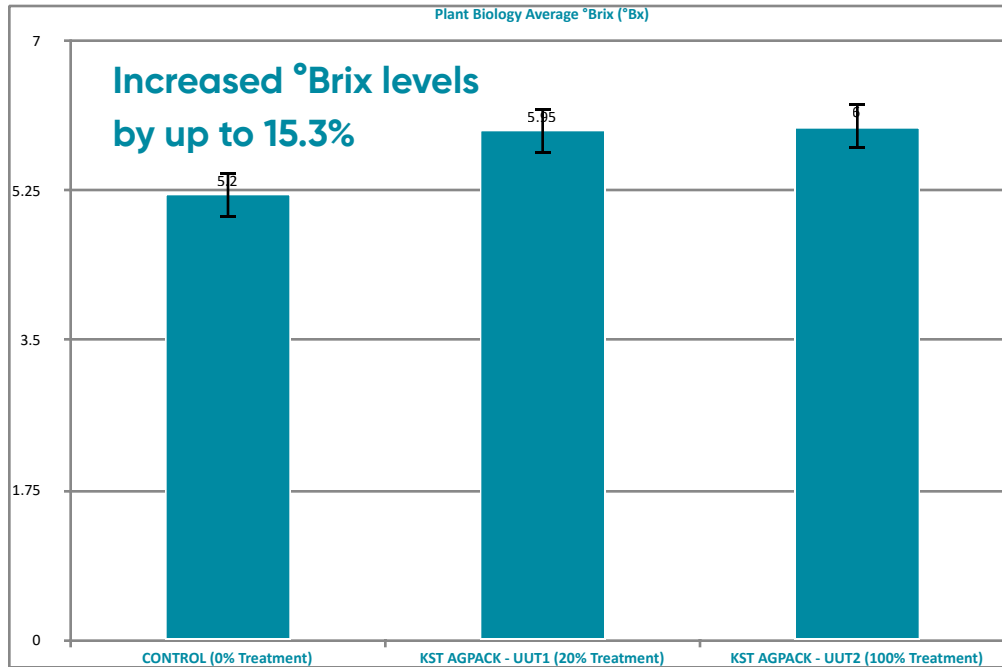


Plant Biology Series - Regenerative BioMass



BENCH TESTING & EXPERIMENTAL VALIDATION

Plant Biology Series - °Brix (°Bx)



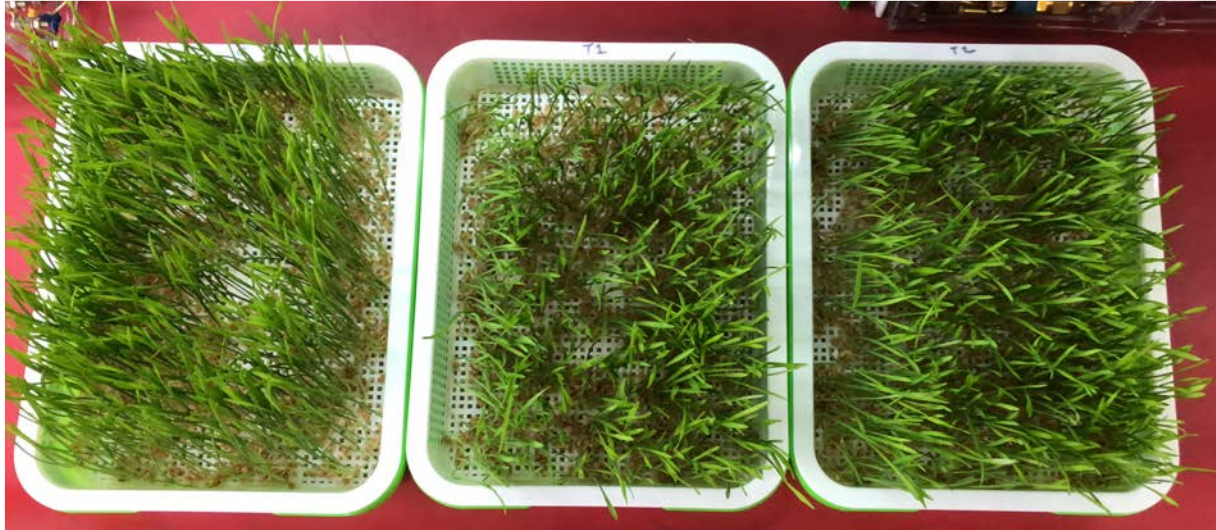
Plant Biology Series - °Brix (°Bx)

Brix is the number of dissolved solids in a liquid. Those solids that can be found in plants are sugars, amino acids, minerals, vitamins, and phytonutrients. A plant's juice is measured with a Brix refractometer. The °Brix is derived from the specific gravity equation of any liquid is referred to its density when compared to water. A °Brix value is expressed in degrees Brix. (°Bx) and defined as the amount of sucrose in grams present in every 100 grams of liquid. Brix measurement is commonly used as a marker for plant yield quality and level of nutrient density. An increase in Brix levels is indicative of a beneficial result when comparing treated and untreated experiment groups.

In this seedling growth Brix experiment, the effect of high concentrated dissolved oxygen (DO) on plant growth in a hydroponic environment has been investigated. Three experiment groups were prepared; CONTROL (0% DO treatment), UUT1 (20% DO solution treatment), UUT2 (100% DO treatment). It is considered that UUT2 is in a DO supersaturated state. The seedling groups were grown into a mature state, their plant juice was extracted and continuously measured.

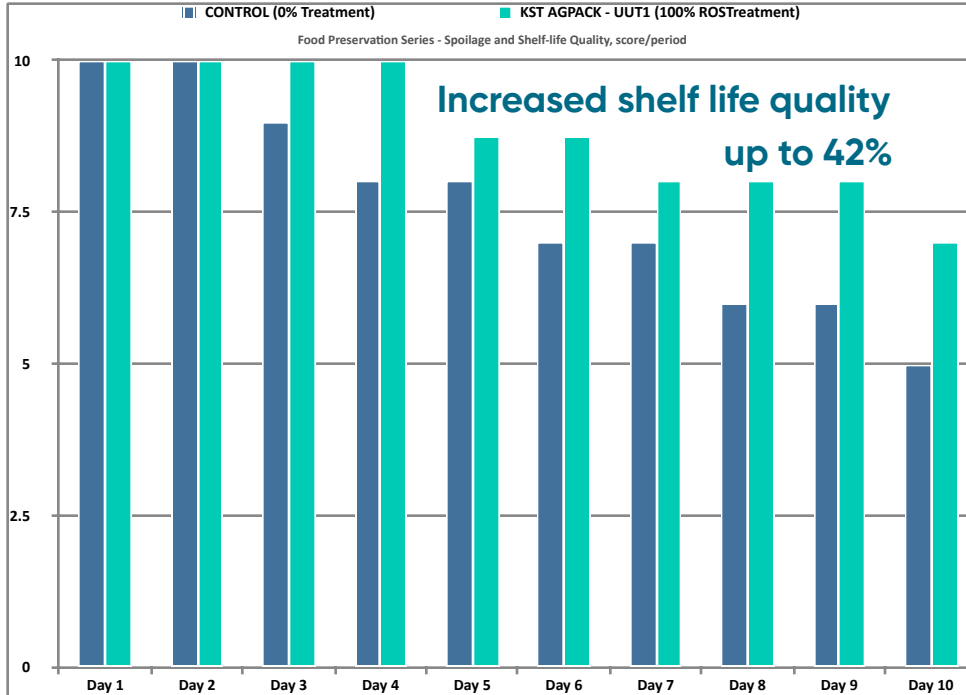
The KST AGPACK application of kinetic mixing and magnetic resonance induction treatment, coupled with O₂ saturated ultrafine bubble treatment, influenced the plant biology parameters, increasing °Brix levels by up to 15.3%. Experiment replication and statistical analysis showed that our experimental results are significant.

Plant Biology Series - °Brix (°Bx)



BENCH TESTING & EXPERIMENTAL VALIDATION

Food Preservation Series - Spoilage and Shelf-life



Food Preservation Series - Spoilage and Shelf-life

Food waste has huge economic, environmental and health consequences. The current approaches to shelf-life extension focus on removing bacteria, pathogens and microorganisms that contribute to food spoilage. One of the most common approaches is the post-harvest wash. At the industrial level, the wash is combined with the application of chemicals to improve the efficacy of water. Compounds such as quaternary ammonium, salts, chlorine, and acids are used to protect produce from microbial spoilage and increase shelf life. However, chemical solutions create more resistant bacteria and generate serious environmental and health concerns. There has been an emergence of new food preservation technologies that avoid using chemicals, such as ionizing and ultraviolet radiation, pulsed light, ultrasound, cold plasma, high hydrostatic pressure, nano-bubbles and dense phase carbon dioxide. Such technologies seem to be useful for microbial decontamination and shelf-life extension.

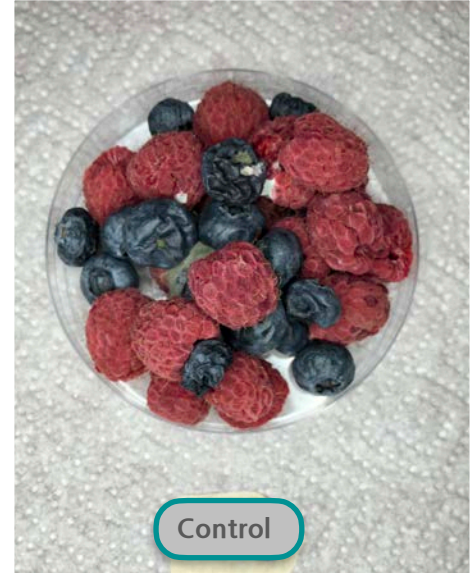
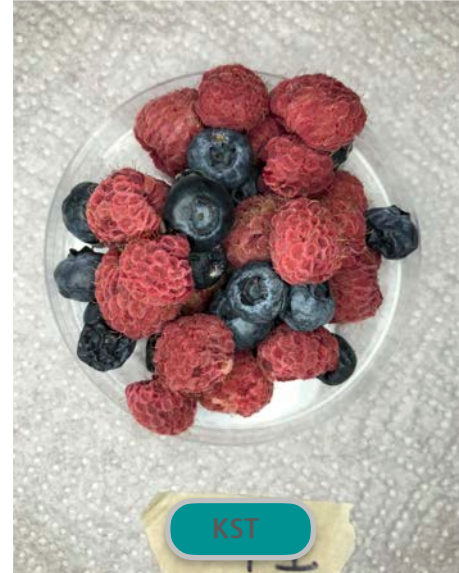
In this food spoilage and shelf experiment, the effect of high concentrated dissolved oxygen (DO) and reactive oxygen species (ROS) water treatment has been investigated. Two experiment groups were prepared, washed and soaked; CONTROL (0% ROS treatment), UUT1 (100% ROS solution treatment). It is considered that UUT1 is in a ROS super saturated state. The experiment groups were scored daily on quality degradation characteristics, such as mold and/or yellowing over 7-10 day time periods. Percentage values were then calculated.

The KST AGPACK application of kinetic mixing and magnetic resonance induction treatment, coupled with O₂/ROS saturated ultra fine bubble treatment, influenced the food spoilage parameters, increasing shelf life by up to 42%. Experiment replication and statistical analysis showed that our experimental results are significant.

Food Preservation Series – Spoilage and Shelf-life



Yellowing degradation characteristics



Mold degradation characteristics

NSF

Government Grant Proposal - Phase 1 Invite



NSF PROJECT PITCH

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..." NSF is vital because we support basic research and people to create knowledge that transforms the future. This type of support:

- Is a primary driver of the U.S. economy.
- Enhances the nation's security.
- Advances knowledge to sustain global leadership.

With an annual budget of \$8.5 billion (FY 2021), we are the funding source for approximately 25 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing.

Strictly Confidential

Introduction: Company and Project Description

Company Description: Kairospace Technologies LLC ("Kairospace") focuses on pressing water related environmental issues that are currently lacking practical clean solutions. Kairospace provides technology and innovation in industries using water processes, with focus on agriculture and mining.

Project Description: Reducing economic and environmental costs by decreasing food waste: testing the level of microbial decontamination and shelf-life extension by using water treated by [REDACTED] plasma and nano-bubbles for post-harvest wash of fresh produce.

Potential NSF Categories:

BT7. Food Processing and Safety Technology
CT4. Food Processing, Chemicals and Agriculture
CT5. Green Chemicals and Chemical Alternatives
CT6. Separations and Water Treatment
ET3. Food, Agriculture, and Energy
ET4. Habitat Conservation, Adaptation and Restoration
ET6. Water Treatment, Resilience, and Sanitation
N3. Nanotechnology Solutions to Global Grand Challenges

The Technology Innovation

Food waste has huge economic, environmental and health consequences. The current approaches to shelf-life extension focus on removing bacteria, pathogens and microorganisms that contribute to food spoilage. One of the most common approaches is the post-harvest wash. At the industrial level, the wash is combined with the application of chemicals to improve the efficacy of water. Compounds such as quaternary ammonium, salts, chlorine, and acids are used to protect produce from microbial spoilage and increase shelf life. However, chemical solutions create more resistant bacteria and generate serious environmental and health concerns. There has been an emergence of new food preservation technologies that avoid using chemicals, such as ionizing and ultraviolet radiation, pulsed light, ultrasound, cold plasma, high hydrostatic pressure, nano-bubbles and dense phase carbon dioxide. Such technologies seem to be useful for microbial decontamination and shelf-life extension; however, they require adoption by the industry and often considerable changes in the processes used to decontaminate produce.



America's
SEED FUND
SBIR.STTR

Project Pitch: 0002 [REDACTED]
SBIR/STTR Topic Area: SBIR: Environmental Technologies (ET)
Invite Date: 10/4/2020
Expiration Date: 10/4/2021

Dear Jeremy,

Upon reviewing your submitted Project Pitch, I am pleased to **invite you to submit a full Phase I proposal** to the National Science Foundation's (NSF) Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) program. This invitation to submit a full proposal (based off of the project proposed in the associated Project Pitch) is **valid for one year** and can only be used once for one full proposal submission (i.e. cannot be used for multiple full proposal submissions).

GREEN MINING AOP



Reduction in N-NH₃ up to 100%

Remediation of Mining Effluents

- Prototype testing at Centre Technologique de Residues Industriels
- Catalyst Assisted AOP
- Phase 1 technology 3rd party validation completed
- Phase 2 testing Q2/Q3 2022

CTRI
Centre technologique des résidus industriels
Innovater, c'est notre métier!

TEAM



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Science

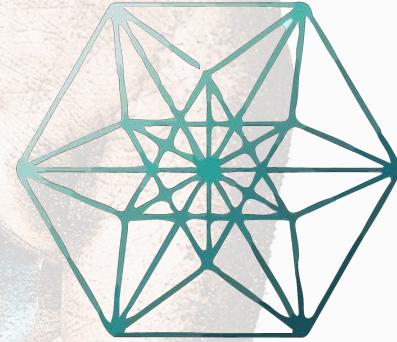


Peter
Yolles
Business



KAIROSPACE
TECHNOLOGIES

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KAIROSPACE
MINING CANADA

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