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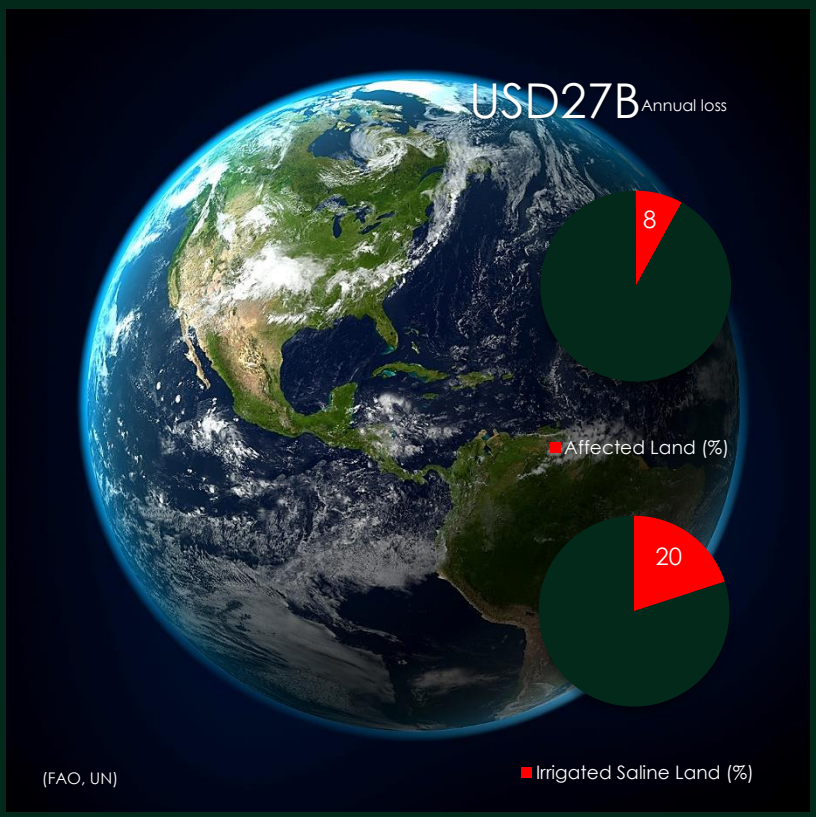
REVERSING THE TIDE

In-Plant Cellular Regeneration as a Tool to Combat Soil Salinization, Uplifting Food Security

Non-GMO, Non-Chemical, Non-Pesticides

A Cellular Regeneration Biotech with HQ in Singapore

Official Website: www.ibiostim.com



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LESS "SALT"

Editor Dr. Jeff Lim

Fieldwork by ChongMing

UNDERSTANDING SEAWATER INTRUSION & HIGH TDS WATER

Seawater intrusion poses a significant threat to coastal agriculture, with the FAO reporting that soil salinization affects approximately 833 million hectares globally, including areas impacted by seawater intrusion. The UN highlights that rising sea levels and increased storm surges exacerbate this issue, threatening freshwater resources and agricultural lands. This problem is particularly acute in regions like the MENA, where water scarcity and high Total Dissolved Solids (TDS) levels further complicate agricultural productivity. The economic impact is substantial, with losses due to soil salinization reaching up to $27 billion annually in some regions. These statistics underscore the

urgency of addressing seawater intrusion to protect food security and agricultural livelihoods.

In ISSUE 9, we explore the severe impact of seawater intrusion on agriculture, particularly in coastal regions, and introduces a groundbreaking solution: iBioStim™'s cellular regenerative biotechnology using actual case study of a tropical fruit orchard. By reversing the damage caused by high salinity, iBioStim™ offers new hope for restoring productivity to affected farms and orchards, ensuring food security in the face of climate change.

Understanding Seawater Intrusion

- **Definition and Causes:** Seawater intrusion occurs when saltwater encroaches into freshwater aquifers, which are crucial sources of water for drinking and irrigation. This phenomenon is primarily driven by two factors: rising sea levels and storm surges. As global temperatures increase due to climate change, polar ice melts and seawater expands, causing sea levels to rise. This rise in sea levels pushes saltwater further inland, contaminating freshwater sources. Additionally, storm surges, which are temporary rises in sea level caused by intense storms, can force seawater into coastal aquifers, exacerbating the problem.

- **High TDS Water in MENA**: The Middle East and North Africa (MENA) region faces unique challenges related to water quality, particularly high levels of Total Dissolved Solids (TDS) in water. TDS refers to the concentration of dissolved substances, such as minerals, salts, and organic matter, in water. High TDS levels can result from natural processes, such as the dissolution of minerals in the soil, or from human activities, such as irrigation and industrial activities. In the MENA region, the combination of scarce freshwater resources and high TDS levels makes water management particularly challenging. The presence of high TDS in water used for irrigation can exacerbate soil salinization, further reducing agricultural productivity and increasing the vulnerability of coastal farms to seawater intrusion.

FOOD SECURITY & FOOD SUFFICIENCY

Fieldwork by ChongMing

The Impact of Seawater Intrusion on Agriculture

- **Soil Salinization:** Seawater intrusion leads to soil salinization when saltwater infiltrates freshwater aquifers and irrigation systems, depositing high levels of salt into the soil. This process significantly alters the soil's chemical composition, making it less fertile and more hostile to plant growth. High salinity levels disrupt the water uptake mechanisms of plants due to osmotic pressure, causing dehydration and nutrient deficiencies. As a result, crop yields plummet, and many plants may fail to grow altogether. This is particularly devastating for coastal farms that rely on these freshwater sources for irrigation, as the increased salinity can render large swathes of agricultural land unproductive.

- **Economic and Environmental Consequences**: The broader economic and environmental impacts of seawater intrusion are profound. Economically, the loss of arable land due to soil salinization can lead to significant financial losses for farmers and the agricultural sector as a whole. Reduced crop yields mean lower income for farmers and higher food prices, which can exacerbate food insecurity. Environmentally, the intrusion of seawater and subsequent soil salinization can lead to a loss of biodiversity. Many plant species cannot tolerate high salinity levels, leading to a decline in plant diversity. This, in turn, affects the entire ecosystem, including the animals and insects that depend

on these plants for food and habitat.

Additionally, the degradation of soil health can lead to increased erosion and further loss of fertile land, creating a vicious cycle of environmental degradation and economic hardship.

Global Food Production

Seawater intrusion poses a significant threat to global food production by compromising the quality and availability of arable land. As saltwater infiltrates freshwater sources and soils, it leads to soil salinization, which severely hampers crop growth and reduces agricultural yields. This reduction in productivity can have a cascading effect on food supply chains, leading to higher food prices and increased food insecurity, especially in regions already vulnerable to climate change and resource scarcity. Addressing seawater intrusion is urgent for maintaining global food security, as the growing population and changing climate continue to put pressure on agricultural systems. Ensuring that coastal farms remain productive is crucial for meeting the food demands of the future.

Case Study

The said coastal tropical fruit orchard in South East Asia is a family owned commercial farm who has been experiencing seawater intrusion for the past 3 years, where most of the fruit trees are completely bear. Saline stress represents a form of abiotic stress, preventing regular nutrient uptake thereby disrupting natural plant metabolism. The shedding of leaves is a clear sign that the fruit tree is suffering from severe malnutrition and is unable to perform photosynthesis. The traditional method involves immediate soil structure remediation, which is labor-intensive and impractical for a plantation with a density of 80 trees per acre on a plot under 50 acres.

We applied the principle of plant metabolism discussed in ISSUE 1, by supplying affected fruit trees with a potent recipe comprised bio-enzymes, L-amino acids, macro and micro-nutrients in their bio-available form at a dilution factor of 100x using 5 to 10L of water on a weekly regime by drenching.

In two weeks of application, 100% of the affected fruit trees exhibited instant flush, showing clear evidence for dominant primary metabolism.

Growth happens only when the cellular energy (CE) budget is met, compensating for the negative effects of secondary plant metabolism through gene expression, which consumes a lot of cellular energy. This explains why trees are on the brink of dying without intervention. Rapid Cellular Regeneration is not new at iBioStim™. The same principle is applied to rejuvenate herbicides destroyed C3 plants, to restoring cellular budget in frost hit plants in ISSUE 4, in which we revived a dying chilli farm with the same recipe in a matter of days, against a backdrop of climate change when temperature fluctuated in the range of 14 to 17 °C, a condition that would cause the plants to immediately succumb.

Likewise, the same adapted recipe is also applied as a tool for cultivation of berries to withstand 4 months of severe precipitation and heat stress of 30 °C in the SPECIAL ISSUE for Blueberry. It is also the same recipe that is capable of raising complex carbohydrates content in a wide variety of plants, such as described in ISSUE 2 and ISSUE 5, that was applied as a tool to influence feeding insects behaviour from just 7 days in the absence of pesticides and Plant Growth Regulators (PGRs).

Therefore, it is clear beyond a reasonable doubt the application of iBioStim™ recipe containing specific proportions of bio-enzymes, L-amino acids and nutrients in their natural bio-available form represents a robust formula that addresses major pain points in the whole of agriculture today, writing a new chapter in modern agriculture through application science.

The successful intervention at this orchard is economically significant. For a mature and fruit bearing tree, of between 200-300 per tree, a nominal revenue of USD 14K and upward can be expected, with China as the largest importer for this specialty fruit. For this reason, the adoption of iBioStim™ regime represents the only go-to investment for harvest security through tree health.

The Economic Role of iBioStim™ in MENA

Addressing TDS Stress in Agriculture: The Middle East and North Africa (MENA) region faces significant challenges in agriculture due to high levels of Total Dissolved Solids (TDS) in water. High TDS levels, which include salts and minerals, can lead to soil salinization, reducing soil fertility and crop yields. The cellular regenerative biotechnology discussed in ISSUE 9 offers a crucial solution by enhancing the saline resistance of crops. This technology helps plants to better tolerate and thrive in high-salinity conditions, effectively mitigating the adverse effects of TDS stress. By improving the resilience of crops to saline water, iBioStim™ enables farmers in the MENA region to maintain and even increase agricultural productivity despite the challenging water quality.

Supporting Carbon Neutrality Goals: In addition to addressing agricultural challenges, iBioStim's technology aligns with the MENA region's commitments to achieving carbon neutrality. Many MENA countries have set ambitious targets to reduce carbon emissions, such as the UAE and Oman aiming for net-zero emissions by 2050, and Saudi Arabia by 2060. The adoption of saline-resistant crops can contribute to these goals in several ways:

Reduced Need for Freshwater Resources: By enabling the use of saline water for irrigation, iBioStim reduces the reliance on freshwater resources, which are often scarce and energy-intensive to obtain. This helps lower the carbon footprint associated with water extraction and distribution.

Enhanced Carbon Sequestration: Healthier, more resilient crops can sequester more carbon dioxide through photosynthesis. This contributes to the overall reduction of atmospheric CO2 levels, supporting carbon neutrality efforts.

Monetization of Carbon Credits: Farmers adopting iBioStim™'s technology can potentially generate income through the monetization of carbon credits. By implementing sustainable agricultural practices that enhance carbon sequestration and reduce emissions, they can earn carbon credits that can be sold in carbon markets. This provides a financial incentive for farmers to adopt environmentally friendly technologies and contributes to the region's economic sustainability.

By addressing both the immediate agricultural challenges posed by high TDS levels and supporting long-term carbon neutrality goals, iBioStim™'s saline-resistant technology represents a vital tool for the MENA region. It not only helps secure food production but also aligns with broader environmental and economic objectives, making it a comprehensive solution for sustainable development.

Citrus Planting in the MENA Region

Climate Change Mitigation: Planting citrus trees in the MENA region plays a significant role in mitigating climate change by reducing the carbon footprint. Citrus trees, like other plants, absorb carbon dioxide (CO2) from the atmosphere during photosynthesis and store it as carbon in their biomass and soil. This process, known as carbon sequestration, helps to lower the overall concentration of CO2 in the atmosphere, a major driver of global warming. Additionally, citrus orchards can improve soil health and prevent erosion, further enhancing their capacity to sequester carbon. By increasing the number of citrus trees, the MENA region can effectively reduce its carbon footprint and contribute to global efforts to combat climate change.

Economic Benefits: Citrus planting also offers significant economic benefits through the potential monetization of carbon credits. Carbon credits are tradable certificates representing the reduction of one metric ton of CO2 emissions. Farmers who adopt sustainable practices, such as planting citrus trees, can earn carbon credits by demonstrating their contribution to carbon sequestration. These credits can then be sold in carbon markets, providing a new revenue stream for farmers. This financial incentive encourages the adoption of environmentally friendly practices, making citrus planting not only a tool for climate mitigation but also a viable economic opportunity for farmers in the MENA region.

Measuring the Economic Impact of Saline Resistant Biotech

In the SPECIAL ISSUE Measuring Economic Impact in the Middle East, we determined the value of in-plant ESL as additional income up to 20% of current country GDP (agriculture, forestry and fishing combined) for a Kingdom in MENA region. This is also discussed without the context of high TDS water for irrigation. For the vegetable sector alone, we are looking at USD422M. On a whole, this translates into 115.5% to 154% Food Sufficiency Goal of the Kingdom.

For a Kingdom with a carbon footprint of 80 million metric tonnes and a commitment for 21% reduction by year 2030, with remaining 63.2 million metric tonnes of carbon footprint by 2050, Saline Resistant Biotech essentially operates like a Renewable Carbon Capture and Storage Biotech by storing more carbon in the soil, through in-plant Saline Resistance, for plant health.

By focusing on uplifting the economy of the agriculture sector through vegetable cultivation alone, we are already contributing to a significant equivalent reduction in carbon footprint goal, in the order of up to USD422M in the absence of tradable certificates for carbon credits. By scaling up the operation of agriculture sector, beyond meeting domestic needs into export of fresh produce serving the MENA region, we are easily looking at one order of magnitude (and more) of additional income attributable to in-plant ESL and Saline Resistant Biotech on total economic integration, serving as a vital GDP multiplier tool beyond the framework for Food Security and Food Suffiency.

CONCLUSION

In-plant cellular regeneration biotech at iBioStim™ is a tool to uplift income bracket in agriculture, as well as a tool to uplift profitability in the retail sector through its exclusive in-plant ESL capabilities, as well as operating as a Saline Resistant Biotech and Renewable Carbon Capture and Storage enabler, supporting major oil producing countries to meet carbon neutrality goals in a systematic manner that is both measurable and impactful at the population and economic level.