WEIZMANN INSTITUTE OF SCIENCE

CASE STUDY

ClimateCrop

Company
ClimateCrop

Established
2021

Lead WIS scientist
Prof. Avihai Danon Z"L

Founders
Yehuda Borenstein, Co-founder & CEO
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Sector
AgroTech

The Challenge

As the planet's resources are strained to meet an ever-increasing global demand for essential crops. The flaws in our modern agricultural system become more apparent. What was once a sustainable, farmer-driven endeavor has evolved into an industrial business in most developed countries that maximizes yields without necessarily considering the environmental or health repercussions. Monocultures and relentless pursuit of productivity have left cultivated plants ill-equipped to adapt to changing environments. Climate change affects food availability, quality, and diversity, impacting food and nutrition crises worldwide. To overcome those challenges, researchers are continually seeking novel pathways to bolster plant resilience and productivity.

The Research

Prof. Avihai Danon sadly passed away in 2021 and was a professor at the Department of Plant and Environmental Science at the Weizmann Institute. His pioneering research centered on elucidating the intricate mechanisms underlying redox and oxidative signals in cellular photosynthesis processes.

Under Prof. Danon's guidance, his research group discovered a novel family of proteins, among which one was identified to regulate the daily biosynthesis of plant starch. This was an important discovery, as increasing starch biosynthesis by engineering its metabolism synthesis pathway has the potential to revolutionize crop resilience and yield.

During photosynthesis, plants produce sugars essential for sustaining their metabolic processes, providing energy for growth, and supporting various physiological functions. A portion of the synthesized sugars is subsequently stored in the leaves as starch, serving as a reserve for limited energy production.

This occurs when plants encounter constraints, such as the inability to perform photosynthesis at night or during periods of stress, as they prioritize self-preservation and resource conservation. To mitigate these challenges, the stored starch is converted back into sugar to continuously fulfill the energy demands of the plant's physiological processes.

The cycle of storing starch and breaking it down into sugars when photosynthesis is inactive repeats daily. At the beginning of each day, plants have no stored starch; as the day progresses, they accumulate starch, and during periods of darkness or stress, they utilize the stored starch for energy production.

At Weizmann, researchers identified the group of proteins responsible for controlling this daily starch mechanism. By deactivating the protein that negatively regulates and inhibits starch production, it becomes possible to augment the starch content in plants.

This increase in starch production of a plant has numerous benefits, including producing higher yields of the same quality due to the availability of additional energy for growth and development, reduced strain on resources, as more crops can be made without the need for additional land, water, nutrients, and power; and greater resilience, due to the extra energy available for protecting plants during stresses.

The Startup

ClimateCrop originated in 2021 when Yehuda Borenstein, alongside two of Prof. Danon's postdoctoral researchers, licensed the groundbreaking technology. With a focused vision, ClimateCrop was established to bring this innovation to commercialization across multiple crops swiftly. The timing couldn't be more suitable, as the demand for such innovation has been evident and validated across various crops, including Potatoes, Tomatoes, Canola, and Sorghum.

The company attracted prominent investors and earned the distinction of being the first Israeli company to join the prestigious Biotech accelerator IndieBio (SOSV Fund). Subsequently, the company was selected by the Breakthrough Energy Fellowship program to serve as innovation fellows, owing to its technology's significant potential for decarbonization and its capacity to adapt crops to warmer climates.

From Lab to market

The company’s initial hurdle was identifying a method for plant modification that enables a fast route to market without being classified as GMO. It pinpointed two methods:

1. Chemical Mutagenesis has been used for decades and is widely recognized as non-GMO worldwide.

2. CRISPR, a novel method acknowledged as non-GMO in several territories, though still considered GMO in others.

With these two alternatives, ClimateCrop serves as a versatile toolbox for modifying plants in a manner that, in most cases, would not be classified as GMO.

Its next obstacle revolved around choosing the most suitable crops to focus on. With the capability to modify all higher plants—providing a staggering 391,000 options—meticulous crop selection was paramount. After extensive deliberation, the company decided to prioritize crops where collaborative partnerships with end customers were feasible, ensuring a clear pathway to the market.

With precise tools and a clear go-to-market strategy, ClimateCrop is today modifying the following crops: Bananas, Soybeans, Yellow Peas, Faba Beans, Rissotu, Durum Wheat, and chickpeas, which are key crops in many diets.

ClimateCrop's Environmental Impact

ClimateCrop's ambition is twofold: first, it aims to enhance plants' adaptability to extreme weather conditions and the shifting climate while simultaneously increasing crop yields to support population growth. The company envisions a broad platform that benefits a variety of crops rather than focusing on a single plant species. Second, ClimateCrop strives to develop a system that empowers farmers without controlling their seeds or practices. By incentivizing farmers to adopt their technology through improved yields and carbon credit opportunities, they company aims to impact climate change mitigation positively.

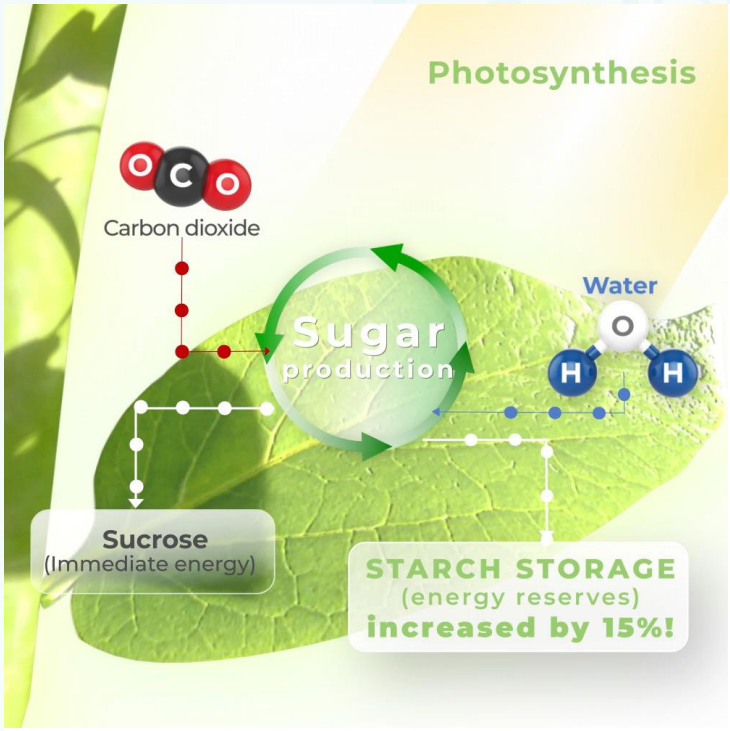
Benefits of ClimateCrop plants include:

- **Greater climate resilience**: Elevated levels of starch storage mean that more energy can be remobilized and is available to mitigate stress conditions. The plants are more robust against heat waves and drought, with faster recovery from the stress.
- **Reduced strain on resources**: Efficient plants produce more without draining additional resources. ClimateCrop can increase yields with the same resource inputs – water, land, nutrients, and energy.
- **Larger yield, same quality**: By storing more energy as transitory starch during photosynthesis, plants can use that extra energy to support better performance. This improves yield and plant health while retaining nutrient quality.
- **Farm-ready**: ClimateCrop's technology requires no further investment in new agricultural practices, mechanization, machinery, or tools. Farmers can continue to plant, grow, and harvest as they see best.

Looking Ahead

ClimateCrop's technology can potentially upgrade 391,000 different species of vascular plants, providing broad application and opportunity across plant-based industries and agriculture. According to Borenstein, "The scalability of ClimateCrop is remarkable because, essentially, we're altering genetics".

ClimateCrop views itself as a genetic assets company, and it will lease the genetic assets to farmers and growers to increase yield and resilience without any additional investment in capital equipment or changing the method or inputs for the crops.



Starch storage process.