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LIFE ON LAND

Research

AgriTalk Smart Agriculture System - Using IoT Technology to Provide the Optimal Farming Environment

"AgriTalk" is a smart agriculture system developed by NYCU with core technologies from the biotechnology team led by Professor, Wen-Liang Chen of the Department of Bioscience and Technology and the IoT team led by Professor, Yi-Bing Lin from the Department of Computer Science. With strong support from Quanta Computer and Chunghwa Telecom, the "AgriTalk technology" has been commercialized for sustainable operation. Through the cultivation from "the Ministry of Science and Technology's Industrial Value Creation Program," the smart agriculture technology startup AgriTalk has been established. The "AgriTalk" smart agriculture system combines IoT farm monitoring systems, AI for agriculture, and biologics research and development. In particular, AI for agriculture includes three systems for predicting soil microbiomes and fertility, as well as disease and pests. The "AgriTalk" platform allows effective management of farmlands and quality control of crops. Using an AI system to provide farm management suggestions for early intervention as well as the research and development of corresponding biologics, the platform provides early warnings as well as friendly solutions, creating a comprehensive pesticide-free technology farming system.

NUE: Nitrogen Use Efficiency - Identifying the First Nitrate Transporter Gene in Plants

Yi-Fang, Tsay, adjunct professor of NYCU's Department of Life Sciences and Institute of Genome Sciences, indicated that nitrogen is the most important factor affecting crop production. Nitrogen fertilizer production consumes 1-2% of global energy usage. However, only 30-50% of the nitrogen fertilizer applied are utilized by plants. The remainder can pollute water sources and lead to the production of greenhouse gases. Yi-Fang Tsay's research team discovered that plants can detect nitrate concentrations to regulate their own development, growth, and gene expression. CHL1 is a dual-affinity nitrate transporter responsible for transporting nitrate from outside the cell to inside the cell. A high external concentration of nitrate triggers the "low-affinity" system, in which the CHL1 transporter absorbs and stores large volumes of nitrate for later use. A low concentration of nitrate, caused by factors like rainfall, triggers the "high-affinity" system, where CHL1 absorbs every bit of residual nitrate. Therefore, improving the nitrogen use efficiency of crops is the top priority for developing sustainable agriculture. In addition to applying the NRT1 gene to improve the nitrogen use efficiency of crops, different strains from various ecological environments are also used to find related genes that can affect nitrogen use efficiency.

Social Impact

DIYGreen Circular Farm

To help resolve three major environmental problems in Taiwan, namely the heat island effect, excessive recycled bottles and the low processing rate of kitchen waste, Professor, Jehng-Jung Kao from the NYCU Institute of Environmental Engineering developed "DIYGreen" technology, designing a new DIY green rooftop garden built with a base of recycled bottles that will allow people to easily plant fruits and vegetables. To promote "DIYGreen," the research team further designed the DIYGreen kit, which has a short construction time, is easy to maintain, and can be expanded flexibly to suit different needs, allowing people to plant their own fruits and vegetables from the comfort of their balcony or rooftop. The kit conserves water and works on any flat surface, such as a balcony. The design, which combines environmental protection, food safety, and ecosystems, has garnered interest from schools at all levels, communities, and tech companies. According to Professor Jehng-Jung Kao, the team is currently collaborating with 30 schools. Teachers who are interested in the kit are welcome to make inquiries, he said, as the team has raised enough funds this year to launch a teacher's program that will support 200 teachers from across Taiwan to incorporate the "DIYGreen kit" in their classes. Additionally, Professor Kao also led NYCU students to create green rooftop gardens in service learning courses, allowing students to fully experience the joy of growing vegetables.

Re-Emergence of the Formosan Flying Fox! Research confirms the existence of a population of Formosan flying foxes, once thought to be extinct on the main island, in Hualien.

A joint research team led by Assistant Professor, Wen-Ya Ko from NYCU's Department of Life Sciences and Institute of Genome Sciences and Dr. Shiang-Fan, Chen from National Taipei University participated in the "National Ecology Green Network Establishment Project". They also worked with the Council of Agriculture's Endemic Species Research Institute and the Bat Association of Taiwan to establish the "Formosan Flying Fox Conservation Strategy Development and Promotion Team". After over a year of research, the team identified three known habitats of the Formosan flying fox. In addition to the populations on the offshore Guishan Island and Green Island, there is also a colony in Hualien County. The total population of Formosan flying foxes falls somewhere between 78 and 205. Based on the habits of the Orii's flying fox on Ryukyu Island, the research team concluded that the population of Formosan flying foxes in Hualien likely live in the mountains and forests around Hualien City during the day and, based on the fruit available from flowering trees, come to rest on roadside trees in the city when they feed at night. Flying foxes play an important role in the ecosystem as they contribute to the dissemination and pollination of plant seeds. Seeds excreted from the digestive tracts of flying foxes have a higher germination rate and shorter germination time than undigested seeds. Therefore, a decrease in the flying fox population will inevitably affect forest expansion, maintenance, and renewal.

Student Cultivation

A Different Kind of Service-Learning - Ecological Conservation at Datun Nature Park

Assistant Professor Fen-Hwa Wong and Assistant Professor, Sheng-Hui Lan from NYCU's Department of Life Sciences and Institute of Genome Sciences offer a service-learning course for students of the Department of Life Sciences and general sophomore students. However, this course takes a different approach from the typical beach cleanups, picking up cigarette butts, or community service. Instead, the course features a series of insect and plant-related seminars and field trips, allowing students to take a break from their heavy course loads and spend time in nature. Led by Assistant Professor, Fen-Hwa Wong and Assistant Professor Sheng-Hui Lan, students experience ecological conservation first-hand at the Datun Nature Park at Yangmingshan. In recent years, Brazilian spiderwort has been found growing near the Datun Trail of Yangmingshan National Park. Originally introduced to Taiwan from South America as a garden plant, the Brazilian spiderwort has become an invasive species that the National Park Administration is asking for volunteers to help remove. Invasive species invade the habitat of indigenous species, and may even cause their extinction. If not removed completely, even a single section of stem or root can grow quickly, so it is important to remove them as thoroughly as possible. The service learning course not only protects the indigenous species at Yangmingshan National Park from an invasive species but also offers students the ability to put the knowledge they learned into practice.

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Publications in SCOPUS

Stewardship

NYCU Eco Designer

The academic student club "Eco Designer" was founded to bring the Maker spirit and environmental awareness to the campus and provide a platform for students of different departments to collaborate, exchange ideas, and expand their network. The club organizes various events every semester, including: 1) Implementing product design and concept promotion projects, 2) discussing environmental protection issues, 3) lectures and seminars by guest speakers, and 4) mountain and beach cleanups. For example, the club organized a talk about "the food waste issue" in May 2020, which stated how the food waste Taiwan generates in a year is enough to fill 74 Taipei 101 buildings. Of these 3.4 million tons of food waste, about 40% comes from up-stream production, storage, and processing. In other words, down-stream retail and consumers account for over 60% of food waste. From this, it is clear that modern retail and convenient, instant-gratification services are indirectly responsible for such an outcome. But how can individuals contribute to bring change in society? By promoting the club and fostering solidarity between members, the club hopes to encourage and allow more students to take part in environmental protection activities, raise awareness about environmental protection, and take action.