Organized Session 8

**CIGR-WG 9 (Plant Factory and Intelligent Greenhouse)**

Perspective of AI, ICT and mathematical model based practical agricultural production in plant factory and greenhouse: On the earth, in space, and the science bridging them

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Concept of Organized Session

The environmental control in advanced greenhouses is mostly computerized and automated, which is totally different from the manual control in traditional ones. To achieve optimum growing conditions in these advanced greenhouses, a sensor-based plant health monitoring technique called the “Speaking Plant Approach (SPA)” has been gaining attention. This method that assesses the plant’s physiological status was proposed more than 30 years ago. The SPA is a key concept for promoting practical agricultural production by integrating artificial intelligence (AI), information and communications technology (ICT), and mathematical models in plant factories and greenhouses, thus bridging the science behind agriculture on the earth and in space.

In recent years, space exploration has been gaining continuous momentum. Long-term activities in space will require the development of technologies to convert organic waste into resources that can be recycled for food production. Technological innovations will be necessary to improve nutrient supply and cultivation efficiency under space and labor constraints. Such technological developments for resource-limited situations such as space agriculture is expected to be significant and groundbreaking in solving various social issues on the ground.

Furthermore, it is also important to elucidate the environmental responses under complex environment cycles such as non-24-hour conditions and heterogeneity in plant factories and space agriculture. By mathematically elucidating the spatiotemporal dynamics of the circadian clock using the oscillator network model, the specificity of the circadian clock at growing tissues and its relationship with growth were clarified. With this new science, a platform technology that analyzes and controls the complex behavior of the circadian clock is drawing attention in plant factories and space agriculture.

Keywords: Biological clock, Environmental control, Plant diagnosis, Space farming