

## **Developing Key Components of Plant Factory**

A plant factory is an environmental control closed system for plant growth, in which constant production of plants is achieved all year around. The facility utilizes microcontroller units and computers for management of light, temperature, moisture/water, carbon dioxide concentrations, and nutrient supply through either automatic or manual activation. At present, plants grown in plant factory are mostly vegetables with few exceptions of flowers, ornamentals and fruit. By using high-tech plant factories, plants are produced in an industrial manner avoiding unpredictable weather elements. A plant factory can produce stable quantity and consistent quality of crop products year-round. With careful sanitary controls, there is no need to apply pesticides.

The research project entitled “Developing Key Elements of Plant Factory for Crops Production” is another highlight of this integral project. There are three research directions planned for this thematic program. Firstly, several high-performance three-dimensional modular shelving systems are designed to grow crops which are moved automatically from one shelf (growth stage) to another shelf, as well as from one layer/track to the next layer/track, on the basis of pre-set developmental criteria. At the end of the rolling conveyor, mature plants are harvested. Various numbers of shelf modules can be connected to each other, according to the spatial limits or demands, to set up the system of needs. Water or non-soil materials will replace soil as growth medium to improve efficient supply of nutrient recipe/solution, which will be recycled and reused through a series of processing procedures.

Secondly, environmental settings vary by plant developmental stages will be established so that plants are always grown in the optimal growing conditions in the plant factory. Practical know-how to accomplish a growth/production cycle will put together for a number of crops. Appropriate cultivation technologies for a wide range of crops will be programmed to fit to plant factory production. Accordingly, their corresponding environmental settings are built to create ‘climate-ready’ conditions for plant growth. To be more environmentally friendly, efforts will be taken to equip these new facilities for tomorrow’s agriculture with renewable energy sources.

Lastly, in the beginning phase of the program, vegetables that harvest vegetative tissues as final products are the top choices. Later on, research team will strive to produce reproductive organs (e.g. flowers) or functional chemicals (e.g. herbs). In addition to fixed type of plant factory by its long standing location, mobile type of systems that grow one single crop or mixed

crops will also be explored. For example, in a two-compartment model that grows lettuce and mushroom simultaneously in the same container, mushrooms are grown as the companion plants of lettuce. High concentrations of carbon dioxide released in mushroom culturing compartment can be pumped into the next room for growing lettuce as source of ‘carbon fertilizer’. Such mobile type of plant factory can be moved from one place to another for purposes of exhibition, education, outreach, enjoyment, scientific study, etc.

In Taiwan, this new way of facility farming is developing on the slow path. Due to high initial investments on hardware and software, and high energy costs, the majority of plant factories in operation are on a small scale. Nevertheless, with high economic value of certain crops and reduced carbon footprint associated with food transport, business opportunities for this new farming system are unlimited. In conjunction with techniques and knowledge databases developed from others, this thematic program will try to find resolutions for reducing manpower and energy inputs associated with plant factory operations.



High-performance three-dimensional modular shelving system using artificial light source for a re-circulating water culture method



Two mobile types of plant factory, a two-compartment model growing lettuce and mushroom simultaneously in the same container (left) and a simply equipped model growing one single crop as a store showcase (right)

## Taiwan-France Bilateral Symposium on Miniature Pigs

The miniature pig is very similar to humans with respect to its anatomy, physiology and metabolism. In this sense, the mini-pig offers an excellent animal model for biomedical research to better understand various human disorders and illnesses. Toward this end, Taiwan Livestock Research Institute (TLRI) and the Institut National de la Recherche Agronomique (INRA), France organized the “Bilateral Symposium on Miniature Pigs for Biomedical Research” at TLRI in Tainan City on October 22 and 23, 2013 to exchange the recent improvements and new developments in miniature pigs as a platform for advancing biomedical research. The symposium presentations included: conservation, genetics and improvement of mini pigs; reproduction and nutrition; facilities and management of mini pigs; animal welfare and behavior in pigs; porcine embryonic stem cell technology; experimental surgery and brain imaging; mini-pig models to study abdominal aortic aneurysm, metabolic-related diseases and wound therapy; etc. Beside four distinguished scientists from INRA, the symposium attracted 50 participants. The panel discussion after paper presentations focused on how some other advancement for existing achievements could be added, and the development of collaborative initiatives to further biochemical and translational research with miniature pigs.



Participants of Taiwan-France Bilateral Symposium on miniature pigs