Controlled-environment agriculture

With the challenges of limited land available for food production, growing scarcity of irrigation water supplies, unpredictable weather, and changing climate patterns, more attention has recently been paid to controlled-environment agriculture (CEA), a production system able to manipulate the crop environment to the desired conditions using precise technologies and equipment to improve the efficiency of operations even in areas with poor and/or degraded soil conditions.

In view of the interest in CEA and its potential for application in areas devastated by natural disasters, the APO organized a workshop on Controlled-environment Agriculture, 19–23 March 2012, with financial support from the Japanese Ministry of Foreign Affairs. The workshop started with a two-day seminar in Sendai, the capital of Miyagi prefecture where the March 2011 earthquake and tsunami heavily damaged areas along the coast. The seminar focused on the future development of enclosed plant factories using artificial lights. Seven prominent experts, Professor Toyoki Kozai and Associate Professor Toru Maruo (Chiba University), Professor Haruhiko Murase (Osaka Prefectural University), Tsuneo Abe (consultant to a plant factory in Sumita, Iwate prefecture), Tamotsu Ito (Mitsubishi Research Institute), Masatoshi Miyaki (Panasonic Co., Ltd.), and Ishinomaki Mayor Hiroshi Kameyama, made presentations from their own perspectives. Eighteen participants from APO member countries with backgrounds mainly in horticulture and agronomy attended, with 73 local individuals in the audience.

APO participants learned that many plant factory facilities are in commercial operations in Japan including the completely enclosed type where vegetables are grown under artificial light and those utilizing temperature- and moisture-controlled hydroponics technology. It was demonstrated that plant factories can achieve higher yields per hectare due to multilayered growing shelves and relatively shorter crop production periods compared with open-field production. It was also suggested that enclosed types of plant factories could achieve higher hygienic levels. Future development patterns were also demonstrated including small-scale devices for home use or retail displays and large-scale commercial facilities for herbs and seedlings. While some plant factories are profitable, cost reduction remains a major challenge. Another challenge is the lack of specific plant varieties for growing in plant factories. The experts then revealed their expectations for further technological improvements to address these issues.

Leafy vegetables growing in an artificially controlled environment in Sumita Vegetable Factory in Iwate, Japan.

After the two-day seminar, APO participants visited plant factories operated by Kyushuya Co., Ltd. and Chiba University.