INNOVATION IN GREENHOUSE ENGINEERING

Gene Giacomelli[1], Nicholas Castilla[2], Eldert van Henten[3], David R. Mears[4], Sadanori Sase[5]

[1]Gene A. Giacomelli, Controlled Environment Agriculture Center, University of Arizona, Arizona, USA *giacomel@ag.arizona.edu*

[2]Nicholas Castilla, CIFA-IFAPA. Granada. Spain *ncastill@arrakis.es*

[3]Eldert van Henten, Farm Technology Group, Wageningen University, Wageningen, The Netherlands *eldert.vanhenten@wur.nl*

[4]David R. Mears, Bioresource Engineering, Rutgers University, New Jersey, USA *mears@aesop.rutgers.edu*

[5]Sadanori Sase, Controlled Environment Agriculture Team, National Institute for Rural Engineering, Ibaraki, Japan *sase@affrc.go.jp*

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Abstract

Innovations in greenhouse engineering are developments which help evolve the state-of-the-art in CEA (Controlled Environment Agriculture). They occur in response to the operational demands on the system, and to strategic changes in expectations of the production system. Influential operational factors include availability of labor, cost for energy, logistics of transport, etc. These are local, day-to-day concerns that have a direct influence on production system operations. Influential strategic factors result from broader, regional issues such as environmental impact, product safety and consistency, and consumer demand. These are more industry-wide concerns that have the effect of changing the production system in the long term. Global issues are becoming more influential on greenhouse production sustainability, and include less tangible issues such as social acceptance, political stability, quality of life benefits, and environmental stewardship. These offer much more complex challenges and are generally beyond the realm of engineering. However global issues do affect greenhouse engineering innovation. The most effective innovations in greenhouse engineering design, operations and management, will incorporate input from partnerships with the academic, private and public sectors of society. Furthermore, successful applications include, at least to some degree a multi-disciplinary approach of the sciences, engineering and economics, while for ultimate success and sustainability, societal and political support must also be attained. For this overview of innovation

in greenhouse engineering we have attempted to organize a list of influential factors, or "driving forces" affecting the development, application, evolution and acceptance of greenhouse systems within the local facility and the global society. The factors will be defined, example technologies will be described, and developments of application will be put into perspective. The factors are similar around the world for all greenhouse systems, as they include the plant biology of the crop, the physical components of the structure and production system hardware, the management and logistics of labor and materials, and the mechanism of marketing the crop. Each greenhouse system, wherever located, must resolve similar problems for its specific application. The magnitude of the factors and their relative local importance are different for the specific sites. The design response will be introduced and related to the factors, as examples of innovation. Our goal is to review greenhouse innovations, which may range from the simplistic to highly complex. We will offer some examples of innovation of today that was a response to the influential factors of past. It will not be all-inclusive, but it is with great expectations that we offer our insights, and help to support the purpose of this symposium.