

## NCR-101 REPORT FOR 2001



Gene Giacomelli, (520) 621-1412, giacomel@ag.arizona.edu  
Joel L. Cuello, (520) 621-7757, jcuello@ag.arizona.edu

---

### New Facilities

A new Controlled Environment Agriculture Program has been established at The University of Arizona, with Gene Giacomelli as Director. A new greenhouse for the program is located at the university's Campus Agricultural Center, and serves as a teaching, research and demonstration facility. The greenhouse includes a hydroponic crop production system that is used for tomato, cucumber and sweet pepper production. It serves as the educational, "hands-on", laboratory for students interested in the study of controlled environment plant production systems. The 484 m<sup>2</sup> saw-tooth roof greenhouse structure consists of 2, 7.3 m by 33 m bays, and includes hot air heating, drip irrigation, fan & natural ventilation, evaporative cooling, and fertigation systems, as well as, a microprocessor controller that automatically monitors and maintains the proper environmental conditions. The construction of a new office/laboratory/lecture classroom building for the CEA program is under construction.

### Monitoring Sensors and Measurement Instruments

A new Lamp Measurement Chamber (LMC) in the shape of a dodecahedron, a 12-sided polyhedron, was developed to measure both the energy balance and the three-dimensional radiation distribution of water-cooled lamps. The LMC was developed for use in an NRA grant on Hybrid Solar and Electric Lighting Systems. Contact Joel L. Cuello.

### Workshops/Colloquia/Symposia

- Cuello, J.L. Colloquium on "Bioregenerative Advanced Life Support for Space Applications," Yunnan Agricultural University, Kunming City, Yunnan Province, People's Republic of China. 05/29/01.
- Cuello, J.L. 2001 Solar Forum, American Society of Mechanical Engineers (ASME). "Hybrid Lighting: Designing an Energy-Saving Strategy for Bioregenerative Space Life Support." Washington, D.C. 03/01.
- Cuello, J.L. 4th International Symposium on Artificial Lighting. "Latest Developments on Lighting Technologies for Bioregenerative Space Life Support." Quebec City, Canada. 11/00.
- Giacomelli, G. International Symposium on Design and Environmental Control of Tropical and Subtropical Greenhouses, Taichung, Taiwan, R.O.C. April 15-18. Member of organizing committee.
- Giacomelli, G. 15th Workshop on Agricultural Structures and ACESYS (Automation, Culture, Environment & Systems) IV Conference - Environmentally Friendly High-Tech Controlled Environment Agriculture. Tsukuba International Congress Center, Tsukuba, Japan. December 4 - 5, 2000. JISTEC. Member of organizing committee.

## Cooperative Interdisciplinary Projects

Giacomelli, G. Space Act Agreement was initiated between the National Aeronautics and Space Administration Lyndon B. Johnson Space Center and the Arizona Board of Regents, The University of Arizona for evaluation of water-jacketed lamps. Dr. Dan Barta and Dr. Gene A. Giacomelli

Cuello, J.L. 2001. Development of Algae Photobioreactors with Hybrid Lighting for CO<sub>2</sub> Sequestration. Collaboration among The University of Arizona, Ohio University, Rensselaer Polytechnic Institute and Oak Ridge National Laboratory.

## Recent Publications

Cuello, J.L., Y. Yang, S. Kuwahara, E. Ono, K. Jordan, T. Nakamura and H. Watanabe. 2001. Plant Hardware Equipped with Hybrid Lighting: Combining Solar Irradiance with Xenon Metal Halide Lamps and Light-Emitting Diodes for Life Support in Space. *Proceedings of the 31<sup>st</sup> International Conference on Environmental Systems. SAE: Engineering Society for Advanced Mobility in Land, Sea, Air and Space.*

Cuello, J.L., Y. Yang, E. Ono, K. Jordan and T. Nakamura. 2000. Hybrid Solar and Xenon-Metal Halide Lighting for Lunar and Martian Bioregenerative Life Support. *Proceedings of the 30th International Conference on Environmental Systems. SAE: Engineering Society for Advanced Mobility in Land, Sea, Air and Space.* CD-ROM Paper No. 00ICES419. 10 pp. Refereed.

Cuello, J.L., D. Jack, E. Ono and T. Nakamura. 2000. Supplemental Terrestrial Solar Lighting for an Experimental Subterranean Biomass Production Chamber. *Proceedings of the 30th International Conference on Environmental Systems. SAE: Engineering Society for Advanced Mobility in Land, Sea, Air and Space.* CD-ROM Paper No. 00ICES420. 9 pp.

Giacomelli, G.A. 2001. Nutrient Delivery Systems for Crop Production in the Controlled Environment. ACTA Horticulturae [in press] International Symposium on Design and Environmental Control of Tropical and Subtropical Greenhouses, Taichung, Taiwan, R.O.C. April 15-18.

Giacomelli, G.A. 2000. Engineering aspect of innovative growing systems. Proceedings of the 15th Workshop on Agricultural Structures and ACESYS (Automation, Culture, Environment & Systems) IV Conference - Environmentally Friendly High-Tech Controlled Environment Agriculture, Tsukuba International Congress Center, Tsukuba, Japan. December 4 - 5.

Giacomelli, G.A and J. Gottdenker. 2000. Effects of Supplemental Lighting on the Yield and Morphology of Sweet Charlie Strawberry (*Fragaria Anannassa* Duch. Sweet Charlie cvs.) in the Greenhouse. Proceedings of the International Symposium on Protected Cultivation in Mild Winter Climates: Current Trends for Sustainable Technologies, Cartagena, Spain. March 7-11.

Giacomelli, G.A. 2000. Environmental Control for Improved Plant Quality within Controlled Environment Plant Production Systems. Proceedings of the International Symposium on Transplant Production in Closed System for Solving the Global Issues on Environmental Conservation, Food, Resources, and Energy, Chiba, Japan. Feb 28-March 2.

Konomi K., G. A. Giacomelli and J. Cavazzoni. 2000. A System for Measuring Canopy Gas Exchange at the NJ-NSCORT. Proceedings of the 4<sup>th</sup> International Conference on Life Support and Biosphere Science, August 6-9, Baltimore, Md

Ono, E., K. Jordan and J.L. Cuello. 2001. Dynamic Monitoring of Nutrient Species in Hydroponic solutions for Advanced Life Support. *Proceedings of the 31<sup>st</sup> International Conference on Environmental Systems*. SAE:Engineering Society for Advanced *Mobility in Land, Sea, Air and Space*.

Ono, E. and J.L. Cuello. 2000. Photosynthetically Active Radiation (PAR) on Mars for Advanced Life Support. *Proceedings of the 30th International Conference on Environmental Systems*. SAE: *Engineering Society for Advanced Mobility in Land, Sea, Air and Space*. CD-ROM Paper No. 00ICES421. 6 pp.

Shimomachi, T., K. Jordan and J.L. Cuello. 2001. Energy Balance and Three-Dimensional Radiation Distribution of Water-Cooled HPS Lamps for Bioregenerative Space Life Support. ASAE Paper. St. Joseph, MI: ASAE.

#### Internet Sites

A new Internet website developed for the programs and activities of the Controlled Environment Agricultural Center at the University of Arizona was recently launched. <http://ag.arizona.edu/CEAC>  
This complements the previous website for greenhouse hydroponic crop production. <http://ag.arizona.edu/hydroponictomatoes>