

Symposium Papers and Authors

Presiding: Theodore W. Tibbitts

Introduction

Theodore W. Tibbitts

NASA's Controlled Ecological Life Support Systems (CELSS) Program

James H. Bredt

CELSS for Advance Manned Mission

R.L. Olson, M.W. Oleson, and T.J. Slavin

Challenges to Plant Growing in Space

Robert W. Langhans and D.R. Dreesen

Plant Productivity in Controlled Environments

Frank B. Salisbury and Bruce Bugbee

Introduction

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It is a pleasure to be introducing this symposium to provide an appreciation of the real interest that NASA has in using plant systems for life support in space. The symposium is directed toward providing details on what is planned, and what is actually underway, in this effort. It is a program that has been titled CELSS, Controlled Ecological Life Support System, and involves a tremendous breadth of horticultural areas—areas that can require the expertise of nearly everyone in horticulture, as suggested in Fig. 1. The project must start with plant propagation, probably tissue culture propagation, and involve all aspects of environmental optimization of growth, breeding of adapted cultivars, nutrient, possibly nutrient film, feeding techniques (NFT) and automated nutrient recycling, contaminant control in the atmosphere, pathogen control in the nutrient solution, precise growth modeling for regulation of the system, maximization of harvest index to reduce inedible portions, efficient food processing, balanced diets, and complete recycling of all wastes. The expertise of all types of horticulturists is needed if this project of NASA is to be successful.

This program provides interesting and unique research opportunities for horticulturists. It will provide a new frontier for horticulture. It will extend and expand the frontiers of controlled environmental agriculture, a technology that has been developing tremendously in the past decade. This effort really becomes the ultimate in controlled environment farming. This program must take the *art* out of horticulture and make it a *pure science*.

The payoffs for agriculture on this planet are bound to be great. Payoffs that are associated with all factors listed in Fig. 1. There is information that will be of significant use in operations today and

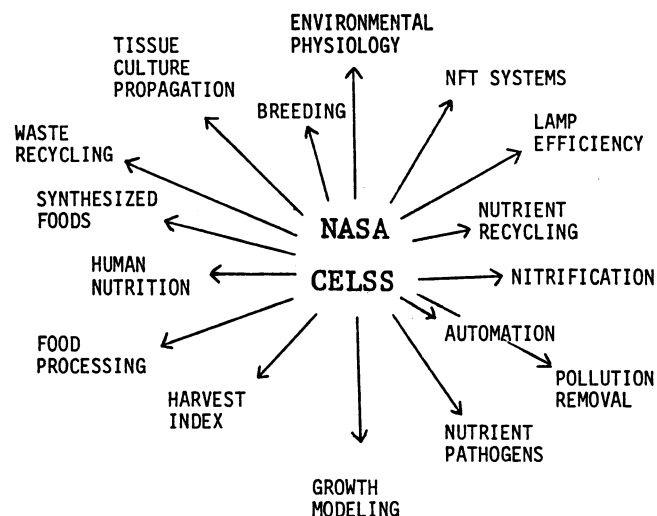


Fig. 1. Plant science components of NASA's Controlled Ecological Life Support System (CELSS) program.

even more so in future years as precise control and regulation of plant growing become more and more critical. This program has some very interesting challenges ahead. I hope and trust many of you will accept these challenges and become involved in horticulture for NASA.

NASA's Controlled Ecological Life Support Systems (CELSS) Program

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Abstract. NASA is interested in extraterrestrial crop production because it is expected that some future missions may require life support systems that can regenerate food as well as air and water. Such systems must produce a nearly complete human diet within very stringent limits on size and energy consumption. Although many problems remain to be solved by further research, CELSS based on crop production by higher plants appear to be feasible. The feasibility of this approach will be tested in the next several years by a project to build and operate a preprototype system that can recycle oxygen, carbon, water, and nitrogen. If this project succeeds, it will be followed by Space Station experiments to develop cultural methods for weightless plants and ground-based tests of more sophisticated prototypes with human occupants. Readiness to build operational space systems may be achieved as early as the turn of the century.