SPACE LIFE SCIENCES SYMPOSIUM (A1)
Environmental Control, Life Support and EVA Systems (6)

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PLANT SHOOT ENVIRONMENT MONITORING AND CONTROL IN THE SVET SPACE GREENHOUSE

Abstract

SVET Space Greenhouse (SG) was the first automated plant growth facility with the largest vegetation area up to now operating in microgravity conditions in the period 1990-2000. A total of 680 days of experiments were conducted in SVET SG onboard MIR Space Station, answering fundamental questions concerning the field of gravitational developmental and reproductive biology. SVET SG was designed and constructed to work out technical solutions and biotechnologies for plant growing in the future larger SG, as part of a Biological Life Support System for human planetary exploration (first to Mars). By that time, SVET sensor systems were concentrated mainly in the root-zone's parameters measurement and automated control of the substrate moistening. During the last three years our efforts were directed to the monitoring of the air parameters and control of the lighting conditions in the shoot zone. Attempts to solve this task were made during the Russian-Bulgarian-American joint collaborative experiments in SVET-GEMS system in 1997, when plant shoot zone had been closed for 12 days in order to provide monitoring of the shoot environment. A new sensor system for leaf zone environment parameters measurement was developed for next generation SVET-3 SG. Light intensity, air relative humidity and temperature, air flow velocity and air pressure are observed. Data acquisition process was realized by a microcomputer system with appropriate software. In order to provide most favorable conditions for plant vegetation, the system will be developed to collect plant physiological status data and to control the environmental parameters in dynamics through the actuating mechanisms of the greenhouse. A new Light Unit on powerful LEDs was developed replacing one on fluorescent lamps used in the past. The combined radiation of red, green and blue LEDs, controlled by a DMX programming device allows to simulate different spectral levels and light intensity to control the light conditions in the chamber and experimentally determine the most suitable ones for plant growth and optimal plant development.