Scientific Objective and Infrastructure of Space Exploration (1)
Scientific Objective and Infrastructure of Space Exploration (2)

Author: Ms. Nan Zhang
Space Institute of Southern China(Shenzhen), China

Prof. Qingni Yu
National Key Laboratory of Human Factors Engineering, China Astronaut Research and Training Center, Beijing 100094, P. R. China., China
Dr. Yongkang Tang
National Key Laboratory of Human Factors Engineering, China Astronaut Research and Training Center, Beijing 100094, P. R. China., China
Dr. Jialian Li
Space Institute of Southern China(Shenzhen), China

WHEAT CULTIVATION AND NUTRIENT CONTROL FOR THE 180-DAY CELSS INTEGRATED EXPERIMENT

Abstract

Wheat has been selected as a significant candidate staple crop during long-duration space habitation. During the 180-day integrated experiment of controlled ecological life support system(CELSS), wheat is one of the key biological components which is closed related to atmosphere regeneration, water circulation and food supply. As an important part of the 180-day program, this research was to screen the well-adapted wheat cultivar and investigate the optimum cultivation condition of wheat. In this experiment, wheat covered an area of 112.98 m2 (111.3 m2 with hydroponics and 1.68 m2 with substrate culture) when the system reached the statement of relative balance and had been planted in 17 batches with a time interval to realize stable regeneration of oxygen, water and food during the 180-day duration in the closed cabin. Light was provided with red-blue-white LED light source in a ratio of 1:1:1 and the photoperiod was either 16-h light/8-h dark or 24-h constant light. The fertilizer for wheat was supplied by nutrient solution. To ensure the wheat grew healthily, optimum quantity of nutrient elements and adequate absorption were crucial. During the program, an innovative controlling pattern was established to monitor the nutrient solution dynamically by monitoring its pH, Electrical Conductance (EC) and Dissolved Oxygen (DO) in real time and detecting the content of elements periodically, and supply the deficiency accordingly. The result indicated that nutrient solution could be recycling continuously without being renewed if its nutrient dynamics could be monitored at regular intervals and nutrient elements could be supplied timely. In this experiment, six wheat cultivars from different areas of China were planted and the result revealed that different wheat cultivars displayed obvious difference and adaptability. The cultivars Ningchun4 and Yongliang15 were well-adapted while the cultivar Longmai26 adapted this environmental condition poorly, which could be reflected in yield.