

Vegetable Production as a part of a Closed Life Support System in a Russian Martian Space Flight Scenario

Yu. Berkovich, S. Smolyanina, N. Krivobok, A. Erokhin and A. Agureev

State Scientific Center, Institute of Biomedical Problems, RAS, Moscow, Russia
(grigoriev@imbp.ru / Fax: (495) 1952253)

Projects 1172 and 2120, supported by the International Science & Technology Center in Moscow, involved in the Russian Mars Mission scenario that will be a simulation of the Mars mission using the "spacecraft. This vehicle will have a crew of 4 to 6, with a volume of 240 m³ and with a diameter of 4 vegetable production facility with a power consumption of 10 kW is being considered as a component life support system. The proposed Mars mission concept will be comprised of 4-modules, which will have a conveyer-type Plant Growth Facility (PGF) in each of the modules. Each PGF has a cylindrical growth chamber surface and an LED lighting system that has been designed to provide a higher specific productivity to utilize onboard resources. Each module will have a growth chamber that will be 1.8 m in length, with a volume of 0.75 m³ and a crop illuminated area of 2.8 m². Several crops have been selected and will be used per module. Leafy type crops (*Brassica*, lettuce, spinach, chard, etc.) have been selected for module 1, primarily because of the high specific productivity per consumed resources; a carrot crop (advised by dietitians) will be grown in module 2, pepper in module 3 and tomato in module 4. From the experimental productivity data concerning "Vitacycle" and "Phytocycle SD" studies, water and power consumption to be utilized by each cylindrical conveyer plant facilities will be based on those calculations. The different structures should produce 0.17 to 0.25 kg/(crew member-day) of fresh edible biomass, which will provide 50% of recommended daily requirement of a vegetable supplement. The partial food generating capability will increase the closure so that less of these supplies will be needed since this system will provide 15% of essential minerals and about 10% of fibers. In addition the food system could be entirely closed in vitamins C and A with help of the PGF. The present state of plant growth technology provides a high readiness and applicability in the fabrication of a flight-rated unit.