

Concept of Space Agriculture for Manned Activities on Mars

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Astrobiology is one of core objectives in exploration of Mars. Sending scientists to Mars might essential to survey life form, either extant or extinct, by their naked eyes on site. Space agriculture is the engineering to support such manned exploration on a distant planet Mars. We define our target of this engineering as follows. In order to support 100 people for 20 years, the agricultural system is composed with biological components. Pressurized greenhouse dome keeps farming yard with 20 kPa in total pressure and 10 kPa oxygen that is required to cultivate plants, and reduce the risk of fire at having inert nitrogen gas for balancing gas. Water, oxygen and food are regenerated by recycled materials. Martian atmosphere and regolith are utilized as a supplemental source of resource. There are three core items in our innovative space agriculture. They are; 1) hyper-thermophilic aerobic composting bacterial ecology to convert metabolic wastes and inedible biomass to fertilizer for farming, 2) cultivation of trees for producing excess oxygen with byproduct of lumber for living section of Martian outpost, and 3) insect eating. This proposal is well matured based on our cultural and historical background. Safety of hyper-thermal aerobic composting bacteria is verified for home kitchen garbage machine and other application. Candidate insect species for supplying animal proteins are discussed together with tree species for those insects. Insects could play an important role at raising quality of foods materials from inedible biomass or metabolic wastes. Insects, such as pupae of silkworm can be processed directly to human diet, or be fed animals. We expect that space agriculture could be a testbed for solving the global problems we are facing now, and contribute to develop sustainable civilization on the earth.