

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

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HYDROPONIC CULTIVATION OF SOYBEAN FOR BIOGENERATIVE LIFE SUPPORT  
SYSTEMS (BLSS)

**Abstract**

Plant-based life-support systems may play a key role in long term manned Space missions producing fresh food on board spacecrafts or on extraplanetary outposts. At the same time, Plants will be an optimal tool for CO<sub>2</sub> reduction / O<sub>2</sub> production and could be used to purify waste water through mineral nutrition and transpiration. In this respect, soybean [*Glycine max* (L.) Merr.] is studied as a candidate species for hydroponic cultivation in the context of a BLSS, because of the high nutritional value of seeds, rich in proteins and lipids, and the possibility to provide several edible products (fresh sprouts, soymilk and soy pulp). Beside, the presence of soy-proteins in the diet helps to hamper phenomena, such as osteoporosis and muscle atrophy, which are frequent in animal organisms exposed to weightlessness. For long time our research group has been involved in experiments aiming to evaluate the possibility to cultivate plants for Space applications. Specifically, our research activities regard the effects of space factors such as microgravity and ionising radiation on plant growth and the setup of a BLSS based on the use of higher plants. The group contributed to the National Space project CAB – Biogenerative Environmental Control working on the development of the HPC - Higher Plant Compartment and on all the aspects related to the Plant growth including cultivar selection. In parallel, within the European Space Agency - MELiSSA (Micro-Ecological Life Support System Alternative) research project, a series of experiments were carried out in growth chamber under controlled environment to evaluate the adaptation of soybean to hydroponics in order to optimise the choice of the cultivar and to set up the best cultivation protocol for BLSSs. Results of our first researches showed that hydroponic cultivation improves the nutritional quality of seeds and their derivatives compared to open field. They also revealed that the proximate composition of food products depends on the plant genotype, suggesting that specific cultivar could be selected to obtain desired features. However, since plant performance in hydroponics strictly depends on the maintenance of optimal environmental conditions, attention has also been paid to cultivation parameters. Furthermore, plant response to useful microbes in the rhizosphere has been investigated, comparing plants inoculated with a mix of mycorrhizal and trichoderma species and beneficial bacteria to a non-inoculated control. Plants' response is evaluated in terms of morphological traits, physiological traits, nutritional quality of seeds and their products , and technical parameters