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AGRONOMICAL AND NUTRITIONAL CHARACTERIZATION OF SOYBEAN FOR BLSSS: LESSONS LEARNED FROM THE MELISSA PROJECT – FOOD CHARACTERIZATION PHASE I

Abstract

Bioregenerative Life Support Systems (BLSSs) are fundamental for the realization of long-duration exploratory-class manned missions in so far as they help fulfilling astronauts' needs. Higher plants in BLSSs may act a major role by regenerating resources, supplying fresh food and providing psychological support. The program ESA - MELiSSA (European Space Agency - Micro-Ecological Life Support System Alternative) aims to conceive an artificial bioregenerative ecosystem based on both microorganisms and higher plants. Soybean [Glycine max (L.) Merr.] is one of the four crops selected within this program as a candidate for cultivation in forthcoming BLSSs. Soybean has been chosen for cultivation in BLSSs because its seeds have high nutritional value, being rich in proteins and lipids, and contain proteins possibly hampering diseases triggered by the exposure to Space factors. In this study, we describe the process of theoretical cultivar selection and the experimental soybean cultivation in soilless system aiming to indicate a roadmap to achieve an objective selection of the best candidate cultivar for cultivation in BLSSs. More specifically, we illustrate a three-step procedure: S1) The theoretical application of an algorithm aiming to identify a selection of cultivars (candidates) capable to satisfy nutritional requirements and to fit with technical/technological constraints. This theoretical cultivar selection was based on data available in literature and information available on the seed market. S2) Agronomical and nutritional characterization of the candidate cultivars after their cultivation in hydroponic system. More specifically, considered agronomic traits included plant size, seed yield, resource use efficiency and ratio between produced edible/non edible biomass. Nutritional attributes included protein and fat content as well as characterization of dietary fiber and isoflavones. S3) Re-running of the mathematical procedure (S1) based on data obtained through the cultivation trials (S2) performed on the candidates. The reported experience shows the high potentiality of our approach in cultivar selection since parameters of the algorithm were modulated not only depending on the scope of the cultivar choice, but also after new knowledge was gained. A reliable re-modulation of the algorithm would be possible to select specific cultivars to obtain the desired nutritional features of the soybean raw material depending on specific final destination in the sight of the development of new technologies for simple food processing on-board.