**USING LUNAR REGOLITH FOR ORGANICS: PLANT GROWTH TESTS USING SOIL ANALOGUES**

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**Introduction:** Plant development depends on environmental factors such light, humidity and temperature, seed quality, contaminations and soil type. We study the use of lunar regolith simulants from Eifel volcanic region on the growth of plants.

**Methods:** In order to analyze growth rate in plants on regolith soil, 10 seeds of cress *Lepidium sativum* (Superseeds, NL) per pot were planted in 4 copies of subsequent soil types: 20 g of autoclaved (2h in 120°C) Eifel regolith simulant soil (RA), 20 g of autoclaved Eifel regolith simulant soil with 2 ml of nutrients (KNOP medium [17]), (RAN), 20 g not autoclaved Eifel regolith simulant soil (R), 10g of peat (S), 10 g of autoclaved peat (SA). Lowered mass of peat (Potgrond universel, BVB Gardening, NL), was used to obtain the same volume of soil in experimental pots. 35 transparent pots were used in the experiment. 20 pots containing seeds, 4 pots per one soil type, and 15 blank pots only with various types of used soils to control contamination processes, 3 pots per one soil type (Figure 1).


*Figure 1: Experimental setup for plant growth analysis on regolith simulant Eifel soil. Left side with rows of cress: RA - autoclaved regolith, RAN - autoclaved regolith with nutrients, R - regolith, SA - autoclaved peat, S - peat. On the right side soil samples without plants to analyze contamination effects during watering and cultivation period. Regolith soil differs in color comparing to the dark peat*

Two week long experiment was performed in a microharvester (MicroHarvester V3, Germany), in 32°C with 12:12 L:D light/dark conditions (12 hours lights on, 12 hours darkness). Every second day plants were watered with 5 ml of distilled water. Growth rate analysis was performed based on data collected in four subsequent days of the fastest morphological plant transformation (5th, 6th, 7th and 8th day of the experiment), by using imaging method. Images were processed and measured in ImageJ Software. Obtained data was analyzed in Excel.

**Results: Morphological changes and diverse plant growth on the regolith simulant soils**. In laboratory conditions we could control all parameters, so observed differences were only the effect of soil type and added nutrients. In the 4th day of the experiment plants already emerged from seeds in subsequent values: 60% of plants in RA, 85% in RAN, 95% in R, 90% in SA, and 67% in S. This results suggest that emerging cress from seeds was not affected by the quality of soil, however influence of nutrients could be seen. On the next 4 following days the lengths of stems were measured and visualized in Figure 2.

*Figure 2 : Imaging method used in the plant growth analysis. For each testing sample lengths of plant stems were measured and standardized to the imaged scale. Significant morphological changes were observed between compared soil types. This images visualize 12 days old cress.*

In general, we observed that plant development was different in different types of soil. In particular, plants grown on the regolith simulant have had thinner leaves and were shorter than the plants grown on peak or regolith with nutrients. Interestingly, autoclaved peak (SA) was better for the plant development than not autoclaved one (S). This suggests, that microorganisms living in not autoclaved soil suppress plant development by evoking stress responses. The growth process reached maximal value in the 6th day of the experiment on regolith soil. The highest averaged growth rate 0.96 cm/day was observed for plants growing on the nutrient-enhanced regolith simulant (RAN).

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