

To boldly grow where no plant has grown before

When humans will settle on Mars or the moon they will have to eat there. Food may be flown in but a cheaper and more reliable alternative could be to cultivate plants at the site itself, preferably in native soils. We investigated if it is possible to grow plants in Mars and moon soil simulants (delivered by NASA) and to set up a sustainable agricultural ecosystem. In a first experiment fourteen different plant species, four crops, four nitrogen fixers and eight wild plants were sown and their development was monitored. The plants were able to germinate and grow on both Martian and moon soil simulant for a period of 50 days without any addition of nutrients. Growth and flowering on Mars regolith simulant was much better than on moon regolith simulant and even slightly better than on our control nutrient poor river soil.

In a second more simple experiment we improved the Mars and moon soil simulant by mixing organic matter through it. Subsequently ten crops were grown in trays. The growth on both soil simulants improved tremendously and garden cress, rocket, radish, peas, rye and tomatoes could be harvested. Growth on Martian soil simulant was not significantly different from the control, soil compost, where the biomass production on the moon soil simulant was significantly lower and about half the amount of the control. Subsequently, we set up a big experiment to investigate if full scale production on the soils was possible. Harvest of all crops was abundant though less than on control Earth potting soil. The crops were tested on heavy metal content, like zinc, cadmium and lead, since they are present in the soils. Metal content of the crops was low and much lower than the maximum set by the US Food and Drug administration.

Our research now focusses on the application of worms and bacteria on mainly Mars soil simulant. They are needed for a closed agricultural system, where (human) faeces and organic matter is brought back into the soil and thus the agro-system. First results are also for this positive, worms survive in the soil and agrobacterium, a nitrogen binding microbe, is able to work in symbiosis with pea plants to enrich the soil with nitrate.