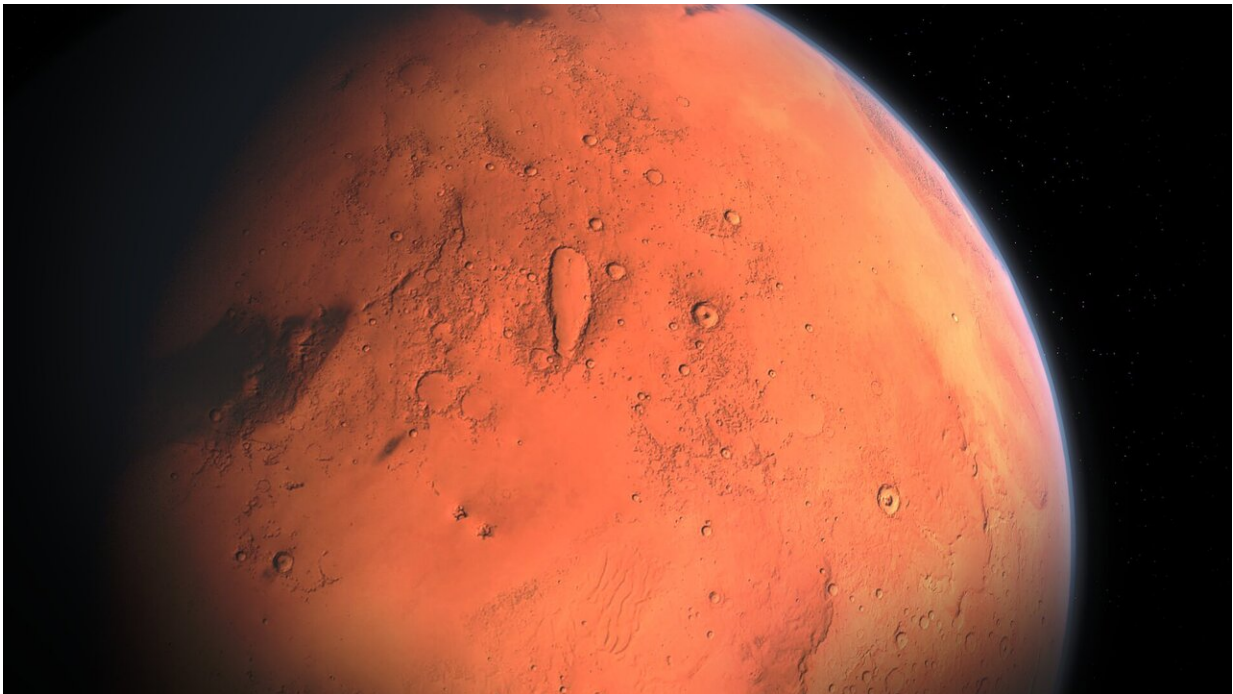


Growing crops on Mars? Probably not under the naked sun

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If humans want to live on Mars for a longer period it will be necessary to grow their own crops over there. And what is more logical than growing the crops in a greenhouse on the surface, profiting from the sunlight, as seen in many scientific designs and Sci-fi movies? However, will this be possible giving the high amount of cosmic radiation at the Martian surface level? Wageningen University & Research and the Reactor

Institute Delft (RID, TU Delft) have been investigating for some time now the effect of cosmic radiation on Martian surface on plant growth. This revealed that, just like humans, plants also need to be protected from the cosmic radiation.

BSc, student Nyncke Tack investigated the effect of [gamma radiation](#) as was recorded by the Mars rover Curiosity on garden cress and rye. "Because the [radiation](#) on Mars is much higher than on Earth (230 $\mu\text{Gy/d}$, about 17 times higher than on Earth) the experiment was carried out under strict safety precautions. We conducted the experiment in a special 'led castle' and in a fume hood," says Tack. There were multiple effects of the radiation visible, including brown leaves and dwarfed growth. Besides that, also the harvest was disappointing and lower than the non-radiated control. This was no surprise for principal investigator and space farmer Wieger Wamelink, "I always expected that the radiation would have a [negative effect](#) on plant growth as well, but it was never very well investigated so we needed to confirm if this expectation was correct."

The radiation was emitted by five cobalt 60 sources, especially 'made' by the RID. The sources were placed above the [plants](#) to create a plane radiation field comparable to Mars. The growing plants were radiated constantly for 28 days and harvested afterwards. Creating a plane radiation field is tricky and that is why 5 sources were used to prevent one plant to receive a higher dose than another plant, which would otherwise influence the outcome of the experiment. We only used gamma radiation where on Mars [cosmic radiation](#) consists of alpha, beta gamma and UV radiation, so there are still differences, but the dose was about the same as what Mars receives.

"Now that it is clear that we can expect negative effects on [plant growth](#) due to the radiation on Mars, we have to protect them. An option is to grow the plants below ground in a dome where most of the radiation

cannot penetrate so that humans are protected as well," Wamelink affirms. "It is a bigger challenge than growing plants in a greenhouse on the surface, but it also makes life easier since we can grow plants under fully controlled circumstances, applying LED light. That is why we started the first experiments now in a cold war bunker in Arnhem near Wageningen, below ground but in a fully controlled surrounding." This research in the bunker functions within the project of the Green Bunker of Local Circles in Arnhem.

Provided by Wageningen University

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