Hi Everyone. My name is Ciara Davis. I am a postgraduate researcher in Limerick Institute of Technology in the Controlled Environment Laboratory for Life Sciences or CELLS for short. I completed my undergraduate degree in 2019 from the University of Limerick in Pharmaceutical and Industrial Chemistry before beginning my research in 2020. I am currently investigating Biofortification of plant species for human health under my supervisors Dr. peter Downey and Dr. Siobhan Moane.

Here at CELLS, we are looking at various ways to grow plants, one of which is hydroponics. Hydroponics is a method of growth that does not involve soil. Instead, nutrients are dissolved in water and fed to the plant roots in various ways. Drip irrigation drops the nutrient solution to the base of the plant at a constant rate which is absorbed into the substrate, an inert material, where it is accessible to the roots. NFT (nutrient film technique) allows a constant, low level of water to flow over the roots. DFT (deep film technique) is similar with a higher nutrient solution level. Aeroponics uses pump systems to turn the nutrient solution into a mist which is then sprayed onto all roots. Finally, Ebb and Flow uses a timed system where the area around the plant is flooded at certain time intervals and allowed to rescind, leaving behind nutrients for the plants to absorb.

In the CELLS lab we have walk in growth chambers in which we can control temperature, light and monitor the nutrient solutions of the systems. Having the ability to control these factors allows us to imitate conditions from the tropics to the tundra, removing seasonal growth of plants. The lack of soil and microbes also means all the nutrients are readily available for the plants, reducing competition. These factors combined leads to a better yield and year long growth.

Humans are always pushing the boundaries of what we can achieve and now the second space race is well and truly underway. NASA, Space X, Virgin Galactic, and others are all trying to make their way to Mars and make the human race interplanetary. Elon Musk is aiming to get a crew to Mars before the end of the decade! The question the stands, How are we going to feed Martian colonies?

Let me present 3 options to you;

One option is to mix Martian soil with human fertiliser and waster created by the colony for growth.

Option two is to send resupply missions to Mars from Earth carrhying enough food to keep the colonies going

Option 3 is to grow plants in controlled environment chambers using hydroponics

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ok so I hope ye all had a good discussion non these topics. Now lets go through them together.

Our first option was growing plants with a mixture of Martian soil and human feces/ waster like Matt Damon in the Martian. Presently, we do not have any knowledge of what, if any, microbes live in the soil on Mars and could be detrimental to Earth plants. Also, using human feces and waste would be recycling the same nutrients over and over, diminishing the level of nutrients each time. Without proper filtration facilities, pathogens and other diseases may also spread.

When we initially send our colonies to Mars, there will be resupply missions of cargo to set the colony up. Over time, however, this is not a sustainable way to keep a colony alive. Rockets are extremely expensive and while steps have been taken to make them reusable, there is still a lot of testing to be done. Delays in resupply missions or any crashes to space debris could have catastrophi effects on Martian colonies.

Learning to grow their own supply of food is going to be crucial to developing and sustaining life on Mars. Using the hydroponics method, we mitigate any pathogens and soil microbes. Currently on the International Space Station, the ISS, plant growth trials have begun. Currently, astronauts are testing the effects of microgravity on the plants and comparing these plants to those grown in similar conditions here on Earth. While there are still plenty of tests and experiments to be run before scaling up, there have been some positive results. Plants are very resilient and with the right nutrition and light, may be the answer to a fully self sufficient colony on Mars.