Learning with The Martian

Note to the teacher: This activity can be presented as teacher directed learning, small groups, or independently. You can use this in a way that best suits you and your classroom culture!

Log Entry: Sol 14

I searched through the food supplies and found all sorts of things that I can plant. Peas, for instance. Plenty of beans, too. I also found several potatoes. If any of them can still germinate after their ordeal, that'll be great. With a nearly infinite supply of vitamins, all I need are calories of any kind to survive.

The total floor space of the Hab is about 92 square meters. I plan to dedicate all of it to this endeavor. I don't mind walking on dirt. It'll be a lot of work, but I'm going to need to cover the entire floor to a depth of 10 centimeters. That means I'll have to transport 9.2 cubic meters of Martian soil into the Hab. I can get maybe one-tenth of a cubic meter in through the airlock at a time, and it'll be backbreaking work to collect it. But in the end, if everything goes to plan, I'll have 92 square meters of crop-able soil. Hell yeah I'm a botanist! Fear my botany powers!

Log Entry: Sol 16

One complication I hadn't thought of: water. Turns out being on the surface of Mars for a few million years eliminates all the water in the soil. My master's degree in botany makes me pretty sure plants need wet dirt to grow in. Not to mention the bacteria that has to live in the dirt first. Fortunately, I have water. But not as much as I want. To be viable, soil needs 40 liters of water per cubic meter. My overall plan calls for 9.2 cubic meters of soil.

1) How many liters of water will Mark Watney need to feed the soil?

The Hab has an excellent water reclaimer. Best technology available on Earth. So NASA figured, "Why send a lot of water up there? Just send enough for an emergency." Humans need three liters of water per day to be comfortable. They gave us 50 liters each, making 300 liters total in the Hab. I'm willing to dedicate all but an emergency 50 liters to the cause.

2) How many square meters can Mark Watney feed with the water he is willing to dedicate?

It'll have to do. That's the long-term plan. For today, my goal was five square meters. I wadded up blankets and uniforms from my departed crewmates to serve as one edge of a planter box with the curved walls of the Hab being the rest of the perimeter. It was as close to five square meters as I could manage. I filled it with [Martian] sand to a depth of 10 centimeters. Then I sacrificed 20 liters of precious water to the dirt gods.

Log Entry: Sol 22

Wow. Things really came along.

I got all the sand in and ready to go. Two-thirds of the base is now dirt. And today I executed my first dirt-doubling. It's been a week, and the former Martian soil is rich and lovely. Two more doublings and I'll have covered the whole field.

3) Can Martian soil grow plants? If yes, explain how (use detailed evidence so support your answer). If not, what does the soil need that it does not have and how do you think Mark Watney made the soil “rich and lovely”?

All that work was great for my morale. It gave me something to do. But after things settled down a bit, and I had dinner while listening to Johanssen’s Beatles music collection, I got depressed again.

Doing the math, this won’t keep me from starving.

My best bet for making calories is potatoes. They grow prolifically and have a reasonable caloric content (770 calories per kilogram). I’m pretty sure the ones I have will germinate. Problem is I can’t grow enough of them. In 62 square meters, I could grow maybe 150 kilograms of potatoes in 400 days (the time I have before running out of food).

4) How many total calories will be produced? How many calories per day will be produced?

With my height and weight, if I’m willing to starve a little, I need 1500 calories per day. Not even close. So I can’t just live off the land forever. But I can extend my life. The potatoes will last me 76 days. Potatoes grow continually, so in those 76 days, I can grow another 22,000 calories of potatoes.

5) How many more days will the additional calories last? How many total days does growing the potatoes provide

Answers from Mark Watney:
1) So I’ll eventually need 368 liters of water to feed it.
2) That means I can feed 62.5 square meters at a depth of 10 centimeters. About two-thirds of the Hab’s floor.
3) Then things got disgusting. I dumped my big container o’ [feces] onto the soil and nearly puked from the smell. I mixed this soil and shit together with a shovel, and spread it out evenly again. Then I sprinkled the Earth soil on top. Get to work, bacteria. I’m counting on you. That smell’s going to stick around for a while, too. It’s not like I can open a window. Still, you get used to it (p. 16)
4) That’s a grand total of 115,500 calories, a sustainable average of 288 calories per day.
5) …which will tide me over for another 15 days. After that, it’s kind of pointless to continue the trend. All told it buys me about 90 days.

So now I’ll start starving to death on Sol 490 instead of Sol 400. It’s progress, but any hope of survival rests on me surviving until Sol 1412, when Ares 4 will land.

There’s about a thousand days of food I don’t have. And I don’t have a plan for how to get it.

Weir, Andy (2014-02-11). The Martian: A Novel (pp. 14-17). Crown/Archetype. Kindle Edition.