Soil compaction experiment

How do engineers and farmers attempt to solve the problem of soil compaction?

Task

Design a solution to compare the soil compaction of different axle assemblies (wheels/tracks) on soil compaction.

Why is soil compaction significant to a farmer?

- *How can we show soil compaction?*
- *What are the variables that can afect soil compaction?*

How can engineers answer the call to prevent soil compaction and still meet the needs of the farmer?

- *How can we engineer a solution to the problem?*
- *How do we use models to represent real world scenarios?*
- *What are the limitations of using models?*

Background

If you look at the equipment farmers use (tractors, combines, planters, etc), one word comes to mind: BIG! Those big machines are heavy and exert a lot of force on the ground. Soil is a farmer's most necessary resource. It is unfortunate that these machines compact the soil with their weight each time they travel across the field.

Tractors have many moving parts with an incredible amount of engineering in the engine, transmission, hitch and the wheels/tracks. In this design exercise we are assuming that all things are constant except for the wheels/tracks. The size and orientation of the wheels/tracks are specific to the needs of the farmer, the soil type and the conditions of the fields in which they operate.

Materials

Topsoil
Bins for soil
Makeblock mbot with different options for wheels/tracks
Screwdriver

Procedure

1. Add moist topsoil to long narrow plastic bins to a depth of about 3 inches, one per wheel assembly to test. (Bagged topsoil is preferred since it will show compaction with fewer passes.)
2. Complete the program for the robot using the previous Scratch programming lesson.
3. Run the Makeblock mBot over the soil a specific number of times (i.e. 25-50).
4. Check the compaction by dropping a screwdriver from 1-2" above the soil level. Create a scale to determine how to measure compaction. (Another option for measuring compaction is the lesson on Soil bulk density.)

Reflection

1. What other design solutions might help address the needs of farmers?

2. What are some other ways that farmers might reduce soil compaction?

3. How can equipment manufacturers reduce the effect of the weight of a machine on the compaction of the soil?

4. Which tread does a better job of reducing soil compaction?

5. How might soil types affect the choice of wheels/track?

6. How might the conditions in the field influence the choice by the farmer?

7. How might the task that is being performed influence the wheel choice?

8. Does the choice of tillage or no-till practice influence the choice of the farmer?