Understanding Soils

The infield dirt at Camden Yards in Baltimore, Maryland must hold up for eighty-one home games. Runners and fielders who sprint and brake on the infield dirt rely on it for good footing. Fielders must be able to predict how batted balls will bounce and roll on it. Maintaining infield dirt that is subjected to constant use requires hard work, skill, and a strong understanding of science and technology.

Nicole Sherry – Click image to watch video
Nicole Sherry, Baltimore Orioles head groundskeeper, uses technology to maintain the health of the turf and soil at Camden Yards.

Typical soils, such as those from a local park or your backyard, are not ideal for infield dirt. They contain organic matter, such as decomposing plant and animal and soil organisms and the substances they produce, that makes them crumble.

Instead, infield dirt, which is approximately 10-15 cm deep, contains between 60-80% sand, 10-30% clay, and 10-20% silt, depending on the climate of the city in which the ballpark is located. Clay (particle size: smaller than 0.002 mm) provides strength and holds moisture. Sand (particle size: 0.05-2 mm) and silt (particle size: 0.002-0.05 mm) allow for drainage and provide softness to balance clay’s firmness.

When groundskeepers, such as Nicole Sherry of the Baltimore Orioles add the right amount of water, this recipe delivers traction to prevent players from slipping or stumbling; to enhance playability; to allow batted balls to bounce predictably; and to maintain resilience so as to provide give when a player hits the dirt.

STEM and Understanding Soils

Recent advancements in materials science resulted in the development of soil conditioner that can be tilled into the infield dirt or sprinkled on top. Soil conditioner can be made of microscopic silica or clay that is heated to extremely high temperatures (600-800°C) to remove water. Soil conditioner prevents clay from sticking to players’ cleats and allows players to maintain control when they fall or slide. It also shades the infield dirt and helps drainage, especially after rain.
One of head groundskeeper Nicole Sherry’s most taxing duties is providing just the right amount of water to the infield dirt several times a day, both before and after each home game.

Infield dirt that is too dry or too wet affects how batted balls bounce and roll, and can lead to injuries when players sprint, brake, slide, and fall. An effective watering strategy must be tailored to the city’s climate and to weather on game day. Furthermore, the players themselves place demands on Sherry so that infield conditions match their style of play.

At the start of every baseball season, Nicole Sherry and other head groundskeepers test their infield dirt, making sure its composition continues to match playing conditions. Throughout the season, grounds crew, under Sherry’s direction, do much to maintain infield dirt. They use wooden rakes to loosen the upper part of the infield dirt, softening it and preparing it for watering. They also rake and level the infield dirt, remove debris such as sunflower seeds, and add soil conditioner as needed. If a rain delay occurs, the grounds crew covers the infield dirt with tarps to block out excess moisture. However, if puddles form, they must be removed before the game may resume. Finally, they also monitor the infield dirt’s behavior as moisture conditions change due to rain and drought and are constantly in communication with players, coaches, and managers.

Advising the Umpire
Nicole Sherry advising the umpire on weather conditions and how it might affect the turf for game time. How does technology play a role in Sherry’s job?

Groundskeepers may also take advantage of the following technology that agricultural managers use to determine soil moisture.

1. Tensiometers report water availability in the soil by measuring water tension. When a tensiometer is inserted into the soil, water moves between it and the surrounding soil until it reaches equilibrium.

2. Electrical resistance blocks (gypsum blocks) use a pair of electrodes embedded in a block of porous material, such as gypsum, to measure water tension. In this technology, water moves in and out of the block as it reaches equilibrium. As water moves, the electric resistance between the electrodes changes. These resistance readings are converted to water tension using a calibration curve.
3. Time Domain Reflectometry (TDR) is a newer technology that estimates soil water content by sending electrical signals through steel rods embedded in the soil. Since wet soil returns the signal more slowly than dry soil does, this technology provides fast, accurate readings of soil water content.

The data below show the percentage of ground balls hit by Adam Jones of the Baltimore Orioles in the 2018 season that resulted in him either reaching a base or being out:

**RESULTS OF GROUND BALLS HIT BY ADAM JONES IN 2018 (as of September 9)**

<table>
<thead>
<tr>
<th></th>
<th>Games at Orioles Park</th>
<th>Away Games</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resulting in Jones Getting on Base</td>
<td>17.3%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Resulting in Jones Getting Out</td>
<td>31.4%</td>
<td>31.4%</td>
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**Infield Dirt**

What do the data indicate about the condition of the infield dirt at Orioles Park compared to the condition of the infield dirt at other ballparks? Support your claim with evidence.

**Data Collection Strategy**

Propose a data collection strategy that would answer the question: Is the infield dirt at Orioles Park better maintained than the infield dirt at other ballparks? Explain how the data collected would answer the question.