Satellite Data and Agronomic Decisions

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Outline

1. Value of Satellite Imagery
2. Satellite Imagery
3. Applications In Agriculture (In-Season Management)
4. Case Study, example
5. Summary
Value of Satellite Imagery

Back On The Map: Satellite Imagery Emerges As A Valuable Tool

“Remote sensing utilizing drones is very labor intensive at the moment, and that’s not likely to change in the near future.”

In addition, satellite imagery was often hampered by cloud cover. Now it’s been found that satellites are taking images. Over recently, as a stand-alone tool, it hadn’t carved itself a stable and consistent place in the crop production regimen.

Over the past decade, the number of satellites has increased significantly, improving the quality and frequency of the images available to agriculture. Planet Labs, which purchased BlackBridge and its RapidEye satellite constellation, is supplying Wilbur-Ellis and Crop Production Services with imagery to support their precision programs.

Planet also delivers satellite imagery to agronomy/technology consulting firm Farmers Edge. Ron Osborne, Vice President of Innovation, says that while they’re doing some work with UAV imagery — specifically with Canadian drones-as-a-service

Satellite Imagery “101”

**Temporal Resolution** indicates the frequency (time interval) for obtaining imagery from the same point.

**Spatial Resolution** refers to the level of detail visible in an image: the smaller the area by each pixel, the greater the details that can be captured.

**Spectral Resolution** denotes to the number and width of the spectral bands in a sensor. The narrower these bands, the higher the spectral resolution.

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**MODIS**
*Temporali resolution: 1-2 days*
*Spatial resolution: 250m, 500m, 1000 m*
*Spectral resolution: 36 bands*
*Cost: Free*

**LANDSAT**
*Temporali resolution: 16 days*
*Spatial resolution: 15m, 30m*
*Spectral resolution: 7 bands (STM) 8 bands (ETM+)*
*11 bands (OLI TIRS)*
*Cost: Free*

**SENTINEL**
*Temporali resolution: 5 days*
*Spatial resolution: 10m, 20m, 60m*
*Spectral resolution: 13 bands*
*Cost: Free*

**RAPID EYE**
*Temporali resolution: Daily*
*Spatial resolution: 5m*
*Spectral resolution: 5 bands*
*Cost: $*
Satellite Imagery “101”

<table>
<thead>
<tr>
<th>Satellite</th>
<th>pixel size (m)</th>
<th>area (acre)</th>
<th>revisit time</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODIS</td>
<td>250</td>
<td>15.4</td>
<td>daily</td>
</tr>
<tr>
<td>Proba-V</td>
<td>100</td>
<td>2.4</td>
<td>daily</td>
</tr>
<tr>
<td>Landsat</td>
<td>30</td>
<td>0.22</td>
<td>16-days</td>
</tr>
<tr>
<td>Sentinel</td>
<td>10</td>
<td>0.03</td>
<td>5 to 10-days</td>
</tr>
<tr>
<td>RapidEye</td>
<td>5</td>
<td>0.001</td>
<td>5.5 days</td>
</tr>
</tbody>
</table>

Satellite Imagery “101”
Applications of Satellite Imagery

1. **Seasonal** (within a season) and **temporal** (across seasons) monitoring of crop vegetation (evaluating stress factors such as drought, heat, nutrient deficiency, etc.).

2. **Crop scouting**, sampling and field trips according to the field dimensions and the potential targets.

3. **Forecasting yields** at varying scales: county, regional, & state.

4. **Site-Specific Management (SSM)** using prescription maps to variable seeding rate/fertilization, depending on differences in environments.

5. **Environmental impact assessment**, fires, floods, to tracking potential changes in land use, and the status of the fields.

Seasonal crop vegetation status, same crop same year
Same year, different crops

Wheat

Double-crop Soybeans

Temporal changes, Looking to the Past

Satellite data Analysis:

NDVI:

2013-2015

Figure: Left: NDVI L8 June 2013; Right: NDVI L8 June 2015.
2012-2014-2016

Figure: Left: NDVI L7 July 2012; Center: NDVI L8 July; Right: NDVI L8 June 2015.
Temporal changes, Looking into NEW LAND (example CRP land)

Crop identification

Year-based phenology and spectral response by crop type

SALINE COUNTY

Soybean and corn area quantification via satellite imagery

- Corn
- DC/ W
- Soybean
- Sorghum
"Real-time" Crop Progress Reports

Proba-V images NDVI early season

Forecasting yield model

Relative absolute mean error = 8%
MODEL APPLIED TO OTHER STATES

Yield forecast, mid-season satellite imagery in corn and harvest yield monitor information

Observed Yield
Crop Scouting

Tracking spider mite infestation by comparing two time points (2-week interval)

Deon van der Merwe, College of Vet Med
Use of Satellite Imagery for On-Farm Research: Interpretation

[Images of satellite imagery and data analysis for different environments and strip trials]
Use of Satellite Imagery for On-Farm Research: Interpretation

- **mid-JUNE**
- **early-JULY**
- **Late-JULY**
- **early-AUGUST**

**Use of Satellite Imagery for On-Farm Research: Interpretation**

- **FLAT response**
  - LOWER Econ. Opt. Seeding Rate (EOSR)
- **CURVILINEAR response**
  - HIGHER EOSR, increasing with yields
On-Farm Research + Precision Ag Tools + Site-specific management = more $$$

NEW PUBLICATION

Thank you!
Questions?

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