2019 NUE WORKSHOP
SCAN.AI – VALUE VALIDATED WITH USERS
AND NEXT CHALLENGES

Presented by Nicos Keable-Vezina

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AGENDA

1. SCAN.AI scientific base, results and validation;
2. Successes and identified limitations;
TEAM EXPERTISE

- Nicolas Tremblay, agr., Ph.D.
  - Research Scientist at AAFC
  - 30 years of research on nitrogen
  - Former President of the International Society for Precision Agriculture (ISPA)

- Yacine Bouroubi, Ph.D.
  - Professor at University of Sherbrooke
  - Special R&D collaborator and former Chief Scientist at Effigis
  - Postdoctoral fellow at AAFC
Context

EONR vs N LOSS
EXAMPLE OF OFFICIAL APPROACH FOR THE CORN BELT

Context

Very limited parameters

- State;
- Previous crop (corn or soybean);
- Corn price;
- Nitrogen price.
EXAMPLE OF APPROACH OF THE FERTILIZER INDUSTRY

Context

Yield goal-based prediction of N rate
- widely used;
- easy to implement;
- generates low accuracy diagnosis.

Consequence

A number of land-grant universities in the US have shifted their N rate recommendation system to **omit yield goal** as an input.

Scharf N book 2015
EXAMPLE OF APPROACH OF LOCAL AGRONOMISTS

Context

https://dl.sciencesocieties.org/publications/aj/articles/110/1/1

Figure 7. Relationship between the late spring soil nitrate test (LSNT) and the economic optimum N rate (EONR) across trials in multiple years with corn following soybean and continuous corn. Each point represents a trial presented in Figure 3 (J. Sawyer, 2015).
Context

SCAN.AI

- Updated science – Evidence-based
  - Meta-analysis;
  - Fuzzy inference system (AI = future).

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Our Approach

SCAN.AI CALIBRATION AND VALIDATION

Calibration

Independent validation (data 2014-2017 - preliminary)
NORTH AMERICAN DATABASE
Scientific Basis

CANADIAN DATA SOURCE
Selected Metrics in Scan.AI

1. Local rainfall (cumulative and forecast);
2. Soil texture;
3. Grain and nitrogen prices;
4. Previous crop;
5. Organic matter %;
6. Average historical yields;
7. *Seasonal crop vigor, using satellite imagery
Results

SCAN AI vs FARMERS

2013
Based on Tremblay et al. 2012
16 rules: Soil surface texture * AWDR

2014
Coarse textures added
Same 16 rules + weather forecasts by Env. Can.

2015
Meta-analysis results on Qc DB = 2 new rules: SOM, Previous crop
Adjustment for historical yield

2016
Optimization on a Qc-On DB
Improved rainfall forecasts
Soil texture on a continuous scale
Improved adjustment for economic ratio

Average benefit: CAN$ 37 ha⁻¹
($25 to $49 depending on the year)
# Results

## SCAN.AI TESTED

### Mitchell Advanced Agronomy Group

**Split Nitrogen Trial - 2018**

<table>
<thead>
<tr>
<th>Sites</th>
<th>Profit ($)</th>
<th>Quantity of N used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SCAN.AI</td>
<td>Control</td>
</tr>
<tr>
<td>Lealess</td>
<td>$248,66</td>
<td>$182,49</td>
</tr>
<tr>
<td>DBL Acres</td>
<td>$268,04</td>
<td>$253,84</td>
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<tr>
<td>Hillmanor</td>
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<td>$121,86</td>
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<tr>
<td>Vandewalle</td>
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<td>$368,48</td>
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<tr>
<td>VanLoon</td>
<td>$135,36</td>
<td>$157,92</td>
</tr>
<tr>
<td>Wienecke</td>
<td>$218,37</td>
<td>$213,62</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>$217,97</strong></td>
<td><strong>$176,78</strong></td>
</tr>
</tbody>
</table>
## Results

**SCAN.AI TESTED IN 2018 QUEBEC**

<table>
<thead>
<tr>
<th>Test FieldApex 2018 - Logiag</th>
<th>FieldApex</th>
<th>Producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client name</td>
<td>Parcel number</td>
<td>N kg/ha</td>
</tr>
<tr>
<td>Gruer</td>
<td>MR</td>
<td>95</td>
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<tr>
<td>Dublay</td>
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<td>135</td>
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<tr>
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<td>LS140</td>
<td>60</td>
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<tr>
<td></td>
<td>LS146</td>
<td>110</td>
</tr>
</tbody>
</table>
Results

IDENTIFIED LIMITATIONS

1. Lack of soil quality information (neither quantified, nor available as of yet) may interfere with SCAN.AI performance;

2. Access to parcel level weather data is critical.
Results

BEST PRACTICES USING SCAN.AI

1. SCAN.AI estimations are a good starting point for each year and each parcel;

2. Agronomists’ and farmers’ knowledge should be part of the final recommendation.
FieldApex solution

SINGLE AND VARIABLE RATES

By plot, season 1

By plot, season 2

Single rate

Variable rate

High rate
Normal rate
Low rate

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Achievements

SCAN.AI

- Evidence-based
- Proven better (official systems, farmers)
- Environmentally sound
- Continuously improved
A comprehensive roadmap for the future

INTERCONNECTING USER DATA
(IN PROGRESS)

In discussion with several others…
A comprehensive roadmap for the future

ALGORITHM SELF-IMPROVEMENT USING DEEP LEARNING

Learning sources
- As applied maps;
- Yield data;
- Yield patterns from imagery

Learning blocs (exemple)
- 50 lbs / acre
- 25 lbs / acre
+ 50 lbs / acre
+ 25 lbs / acre
FOR MORE INFORMATION

Web app and documentation available on: www.fieldapex.com

Questions:

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CRITICAL IMPACT OF WEATHER (RAINFALL)