Results and lessons learned on the new applications for technologies in Brazilian agriculture.

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Introduction
OPERATIONAL STRUCTURE
With our own operations, we are present in 5 countries!

The Jacto Group has 15 plants
• 1 in Thailand
• 1 in Argentina
• 2 commercial units (United States and Mexico)
• 1 R&D center,
• 4 distribution centers,
• 3 in-houses
• 1 logistic company.

Jacto is a leading company in the sprayer machines segment, present in more than 100 countries, also manufactures coffee harvesters, fertilizer spreader and develop equipment and technology for precision agriculture.
Agriculture technologies adoption – USA

- Smart scouting using an app on a mobile device (44%)
- UAV or drone for internal dealership purposes (43%)
- Field mapping with GIS (34%)
- GPS to manage vehicle logistics (34%)
- Telematics (24%)
- Soil electrical conductivity (EC) mapping (22%)
- Chlorophyll/greenness sensors (ground) (9%)
- Other soil sensors for mapping (ground) (9%)

- Satellite/aerial imagery (52%)
- GPS guidance systems (light bar) (55%)
- Auto sprayer boom section or nozzle control (73%)
- GPS guidance systems (autosteer) (78%)
- Precision agronomic services for customers (81%)

- Whole Product Solution
- Minimum Feature Set

Innovators 2.5%
Early Adopters 13.5%
Early Majority 34%
Late Majority 34%
Laggards 16%

People Who Want Newest Things
People Who Want Complete Solutions and Convenience
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Soil Analysis

Problem: time and money consuming, chemical waste, etc.

Proposal: using spectroscopy techniques
### Macronutrient Uptake in Winter Wheat

<table>
<thead>
<tr>
<th>Nutrient removal</th>
<th>kg/t of harvested grain, 100 % dry matter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheat (Spring &amp; Winter)</strong></td>
<td></td>
</tr>
<tr>
<td>Grain only</td>
<td>23</td>
</tr>
<tr>
<td>Grain plus straw</td>
<td>28</td>
</tr>
<tr>
<td><strong>Durum wheat</strong></td>
<td></td>
</tr>
<tr>
<td>Grain only</td>
<td>26</td>
</tr>
<tr>
<td>Grain plus straw</td>
<td>30</td>
</tr>
</tbody>
</table>

http://www.yara.in/crop-nutrition/crops/wheat/key-facts/nutritional-summary/
Soil analysis – before lab

• Soil sampling
  1. Determine soil grid area (points per hectares)
  2. Move to each point
  3. Collect soil samples (composed or not)
  4. Mix and crush it
  5. Place it in a shipping container (plastic bag)
  6. Repeat for all points

• Time and money consuming ($)
• Limited soil sampling quantity (poor soil info)
Soil analysis – lab procedures

http://soiltest.cfans.umn.edu/soil-testing-procedures-graphic
Basically...

https://physics.stackexchange.com/questions/138075/homemade-spectrometer

http://www.mdpi.com/1424-8220/15/2/3262/htm
Spectroscopy

Spectroscopy

• Using Spectrophotometer
• Illuminating soil sample
• Capturing soil reflected light (Spectro)
• Analyzing soil reflected light (Spectro)
• Generating mathematics algorithms
• Correlating real soil analysis (chemical) and soil Spectro

• Automatizing the analysis of some soil chemical properties. (Phosphorous, Potash, Calcium...)
Soil analysis – macro activities

- **Field scouting**
- **Soil preparation**
- **Portable sensors**
- **Reports Downloads**
- **Algorithms**

**≈ 3 days**

- **Farmers**
- **Customers**
- **Consultants**

- **Transportation**
- **Arrangement**
- **Soil preparation**
- **Chemical analysis**
- **Chemical waste**

**≈ 10 days**
Fertilizer application

**Problem:** applying fertilizer in wrong rate and place.

**Proposal:** a new approach and sensor usage to determine the real crop needs
Wheat field

- Considered as 1 area
- Same treatment
  - Rate
  - Fertilizer
  - Yield potential

*Is that true?*

- Let’s scan it!
Wheat field – scanning

Wheat field

- Considered as 1 area
- Same treatment
  - Rate
  - Fertilizer
  - Yield potential

- *Is that true?*
- *NO!*
• Is that true?
  • No!

• The algorithms designed to predict the yield potential says:

• The difference between high and low yield potential is 3700 kg.ha⁻¹

• Total area: 127 hectares
• Is that true?
  • No!

• The algorithms designed to predict the yield potential says:
  • The difference between high and low yield potential is 2500 kg.ha\(^{-1}\)
  • Total area: 16 hectares
Pest detection

**Problem**: not checking the traps, late detection and time and labor force cost, etc...

**Proposal**: using connected smart traps – IoT
Figura 1. Número médio de aplicações de inseticidas para o controle de pragas no algodoeiro, inclusive o bicudo. Fonte: Belot et al. (2016).
Economical impact

The female can lay up to 150 eggs over a 12 to 15 day period;

Average longevity: 42 days for male and 37 days for female;

50 could become in to 500,000;

Cost control per year:
- 2011/2012: 400,00 US$/ha
- 2012/2013: 500,00 US$/ha

Average production cost: 2,176,00 US$/ha

9% of the cost is spent to control;

20 times, is the average numbers of chemical applications.

https://www.infoteca.cnptia.embrapa.br/infoteca/bitstream/doc/1066728/1/Manejodobicudodoalgodoeiro.pdf
SMART TRAP SOLUTION
Smart-Trapp: main parts and features

- Communication antenna
- Solar panel
- CPU + Communication + Moisture sensor + Temperature sensor + Camera + Battery
- Pheromone
- Trap

- Mesh Network – Communication between traps
- Mobile signal NOT needed (*gateway only*)
- Auto setup (re-connection)
- Easy maintenance
- Capable to receive different sensors (*micro weather, temperature, light, moisture,...*)
- Energy supply independence – Batteries installed
Field trials

lessons learned
Trials

Total: 20 traps
Area: 677 ha

100 ha
176 ha
130 ha
117 ha
154 ha

http://zenipa.blogspot.com.br/2012/06/um-campo-de-algodao.html
GRUPO CAIMBÉ Farm, total area: 150 km² (grain)
Cotton area only: 30 km²
Experiment (PoC): 6.8 km² (≈ ¼ of Rural area of BILBAO)
Web dashboard

Traps locations

Details and photos

Temp.

Moist.
Web dashboard

Boll Weevil counts

Graphic:
- Moisture
- Temperature
Report

Quantidade de insetos

Histórico:
Field events!
Field events
Field events

Thank you very much,
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