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

THE INTERNET OF THINGS WEEK 2018 BILBAO

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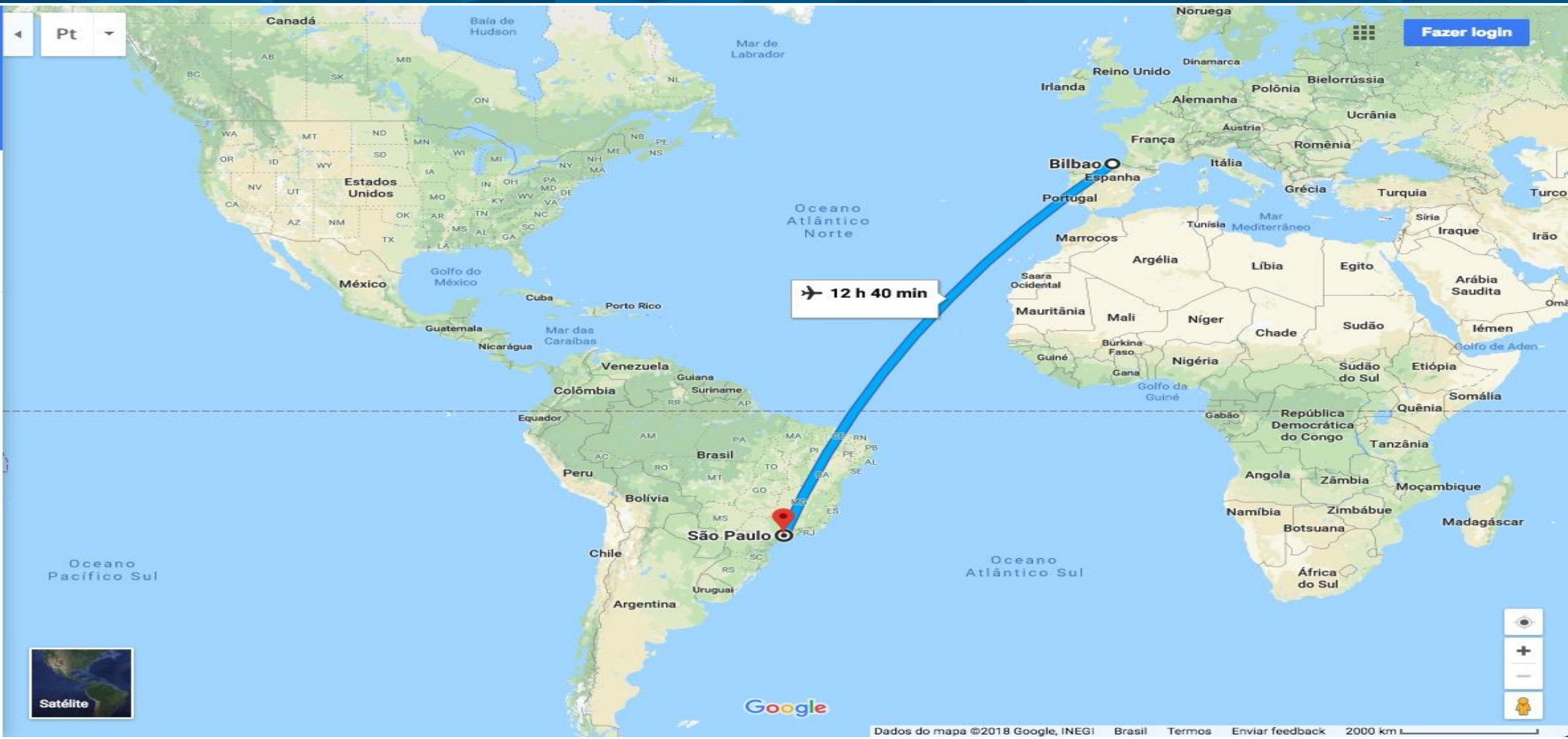
Brazil (São Paulo) – Spain (Bilbao)



Introduction

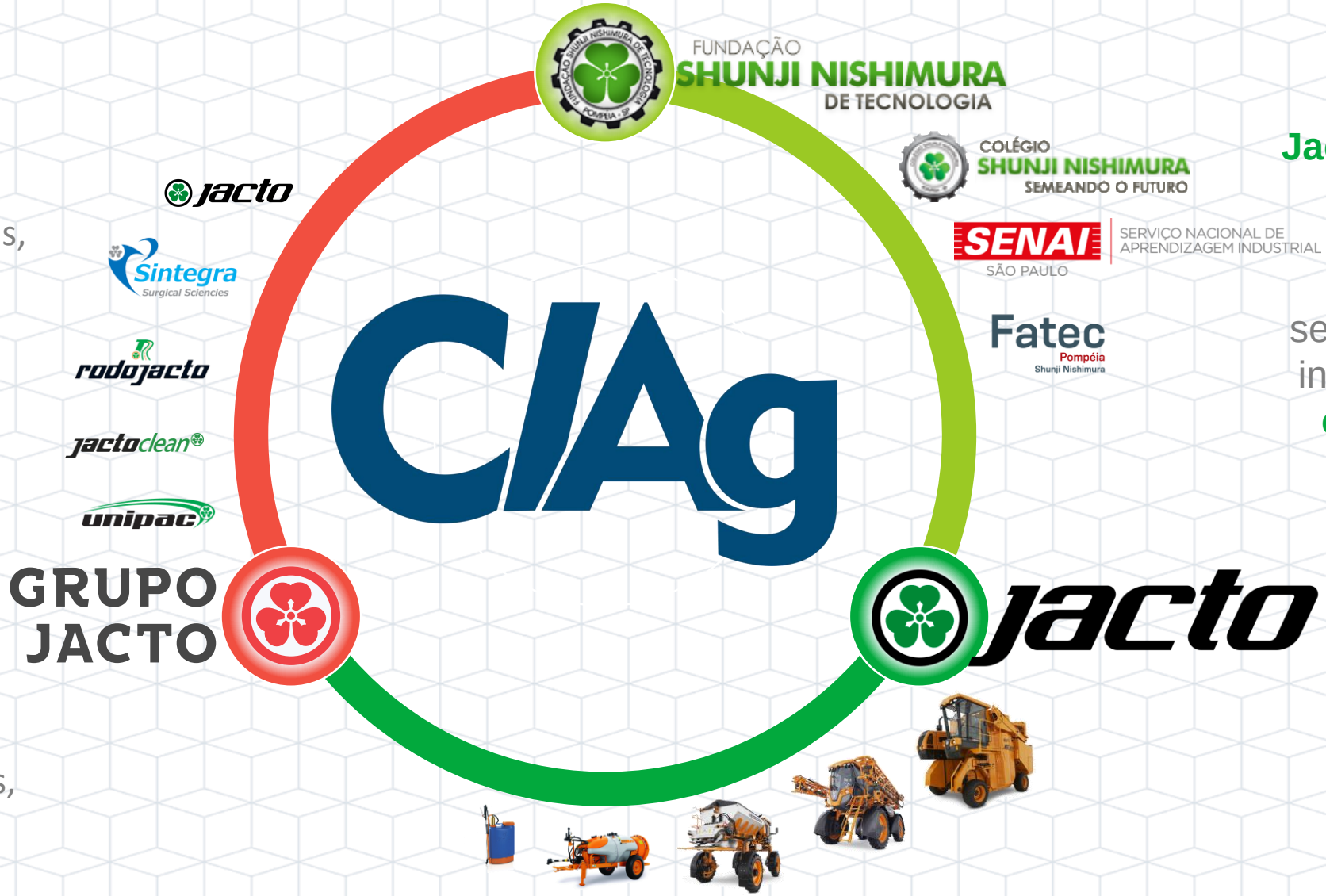
Introduction

OPERATIONAL STRUCTURE

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

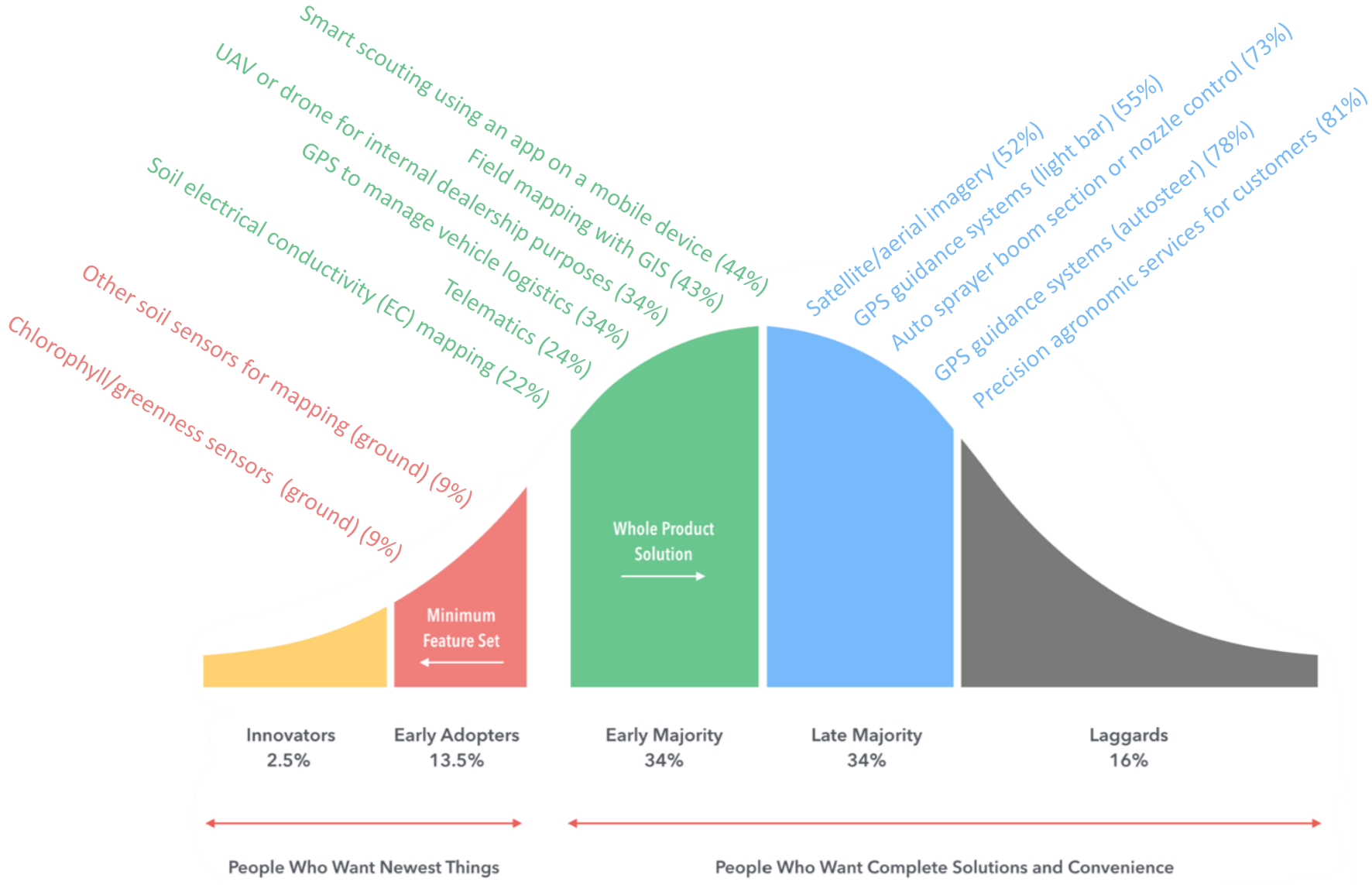
The Jacto Group has 15 plants

- 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.

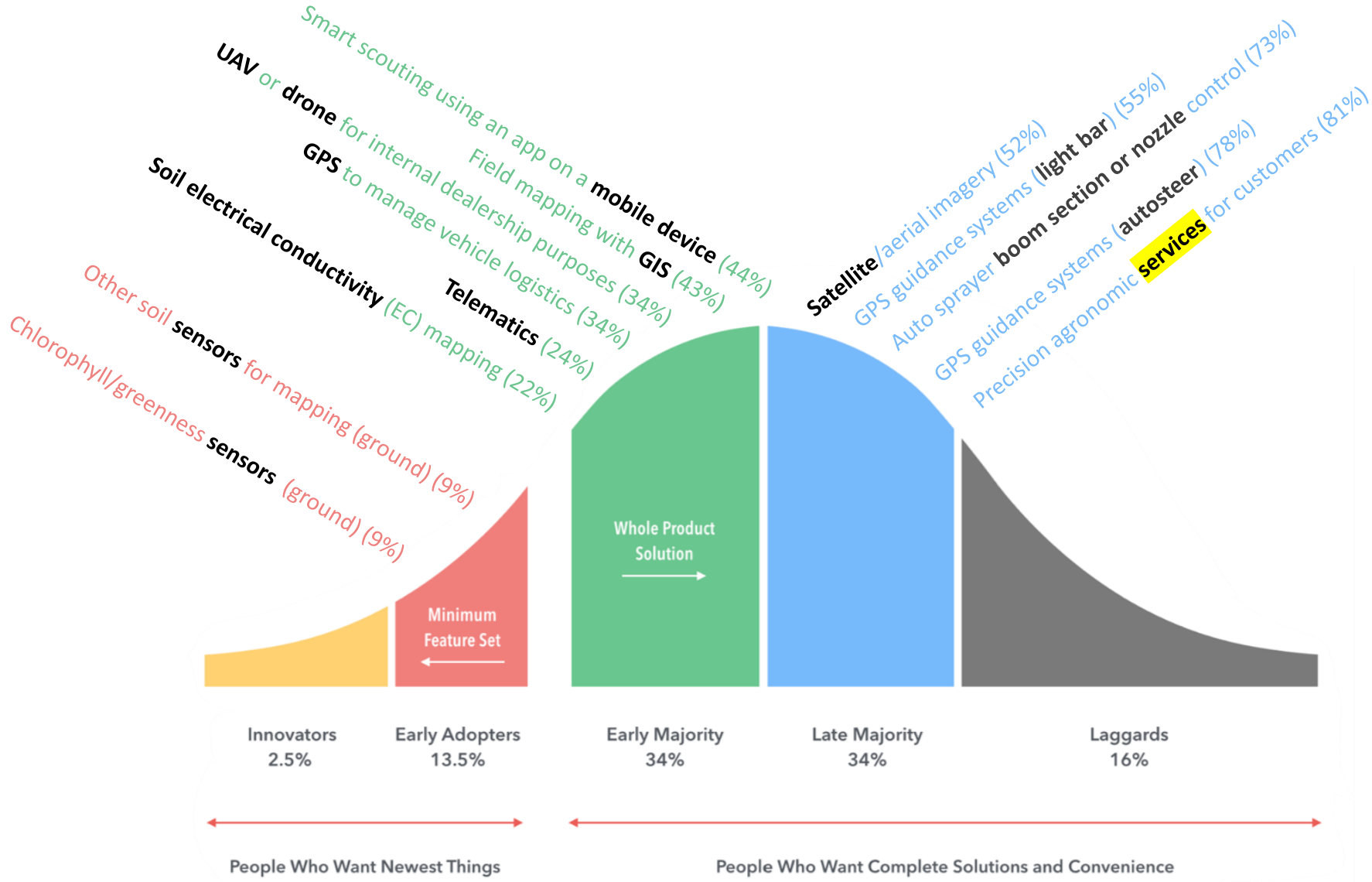


Jacto is a leading company in the **sprayer machines** segment, present in more than **100 countries**, also manufactures **coffee harvesters, fertilizer spreader** and develop equipment and technology for **precision agriculture**.

Agriculture technologies adoption – USA



Agriculture technologies adoption – USA



Soil Analysis

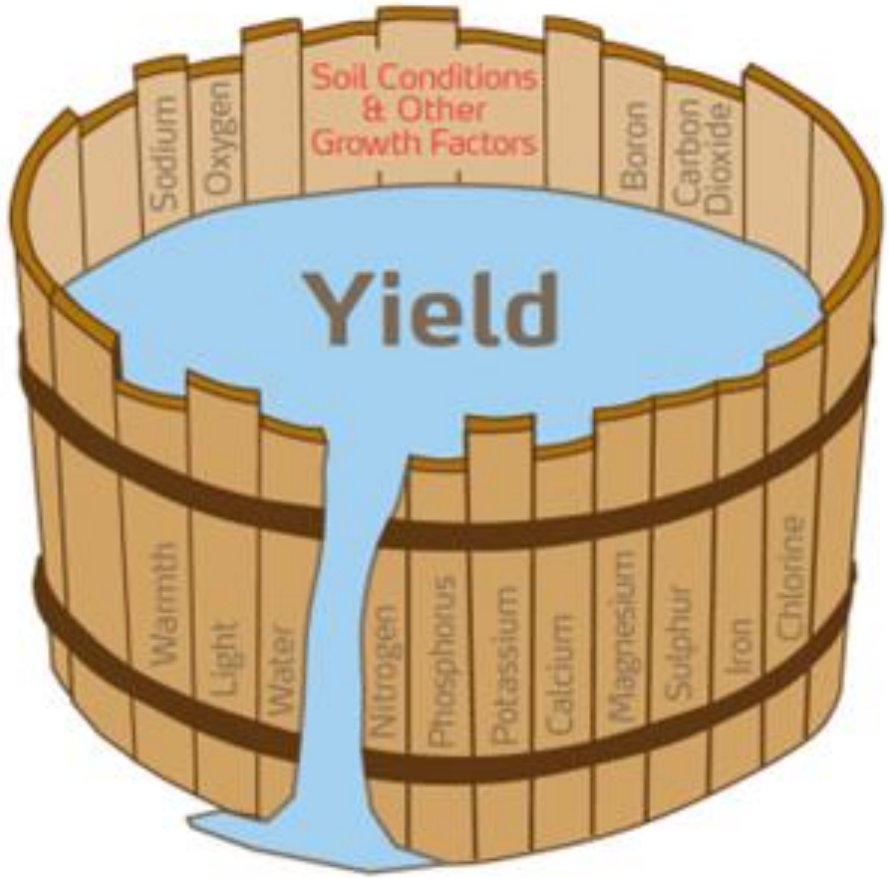
Problem: time and money consuming, chemical waste, etc.

Proposal: using spectroscopy techniques

Soil analysis – why?

Macronutrient Uptake in Winter Wheat

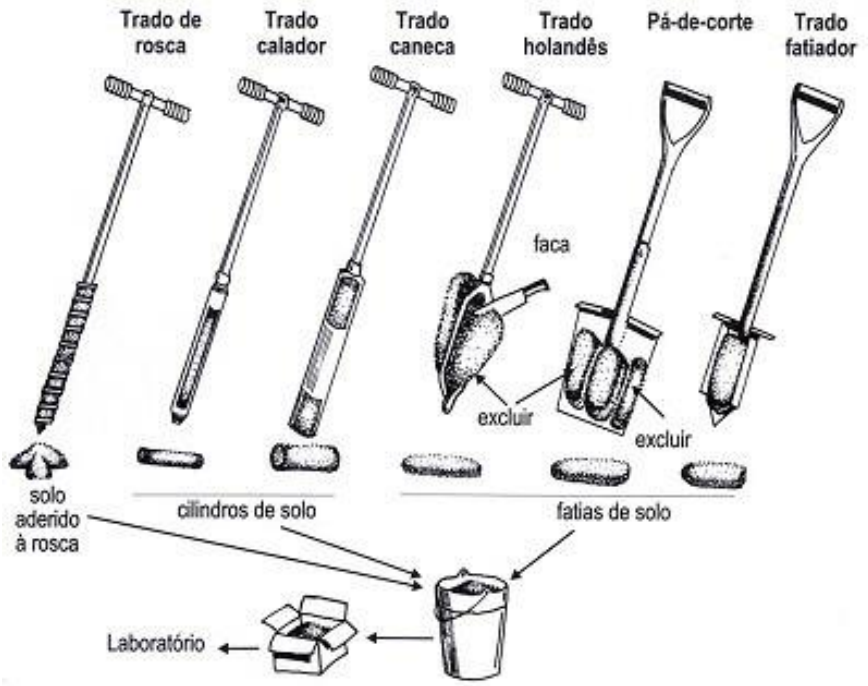
Nutrient removal		kg/t of harvested grain, 100 % dry matter				
Wheat (Spring & Winter)		N	P	K	Mg	S
	Grain only	23	4	5.7	1.4	2.3
	Grain plus straw	28	5.2	18	2.6	3.1
Durum wheat						
	Grain only	26	4	5.7	1.4	2.3
	Grain plus straw	30	5.2	18	2.6	3.1



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

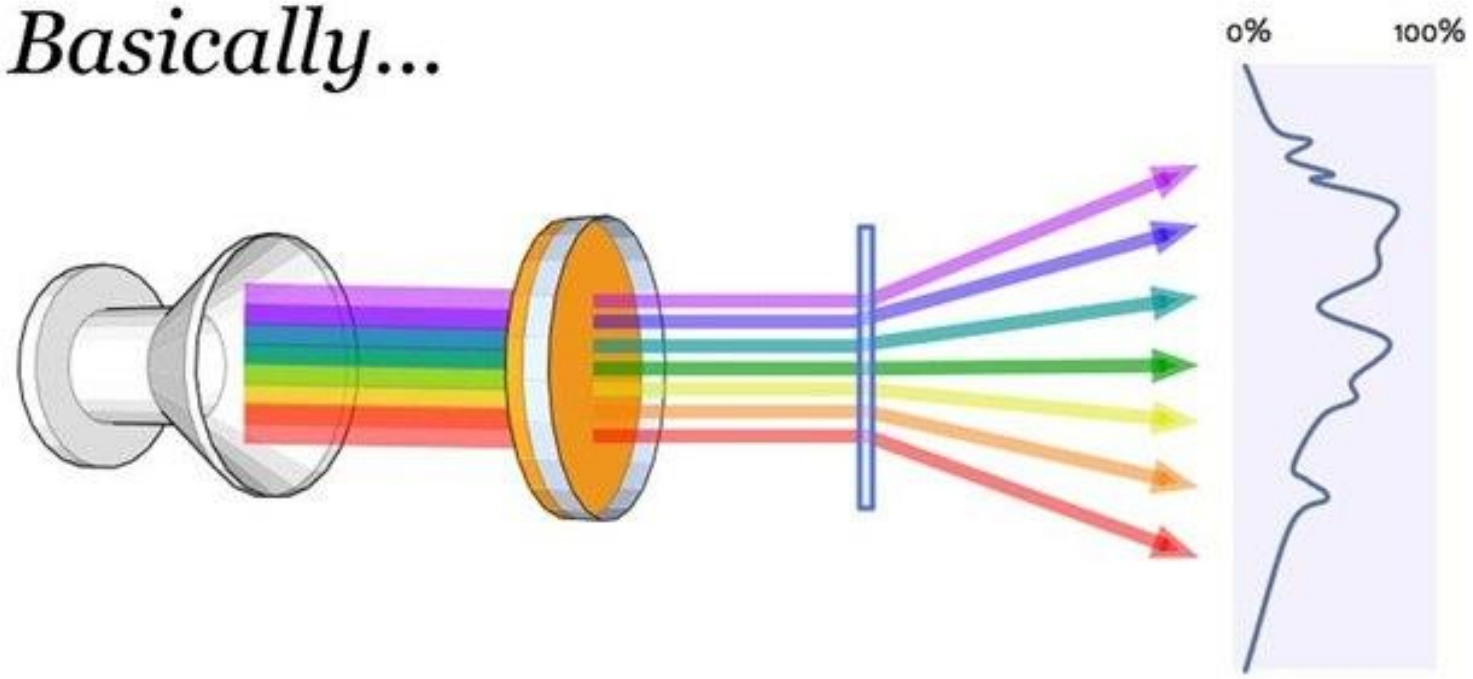


- Time and money consuming ($)
- Limited soil sampling quantity (poor soil info)

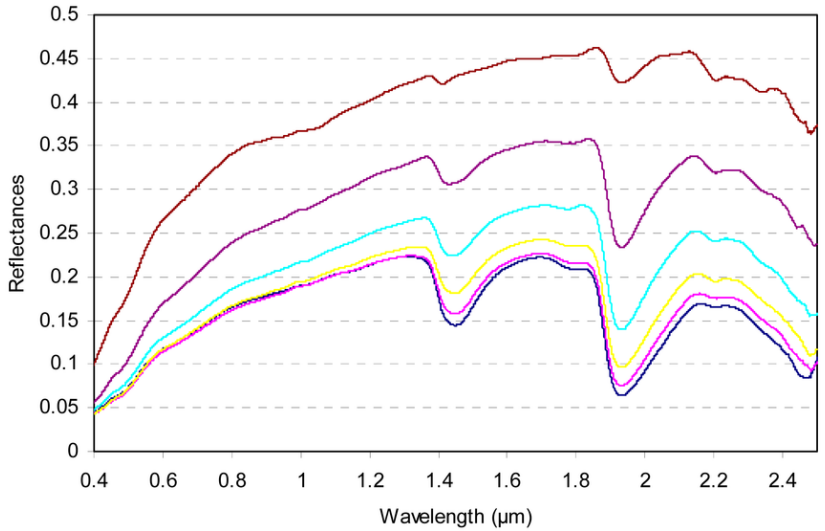
Soil analysis – lab procedures

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

Spectroscopy

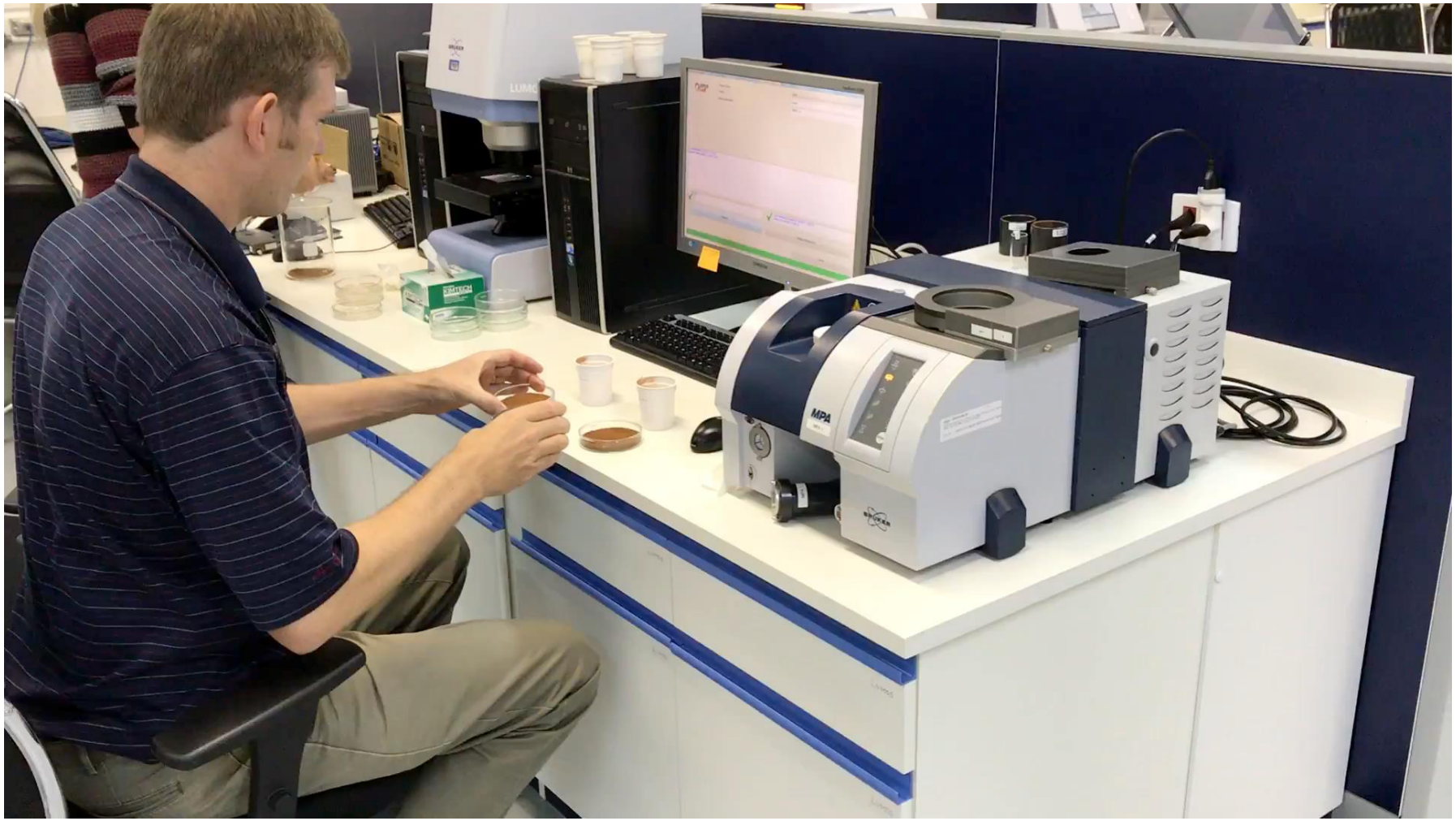


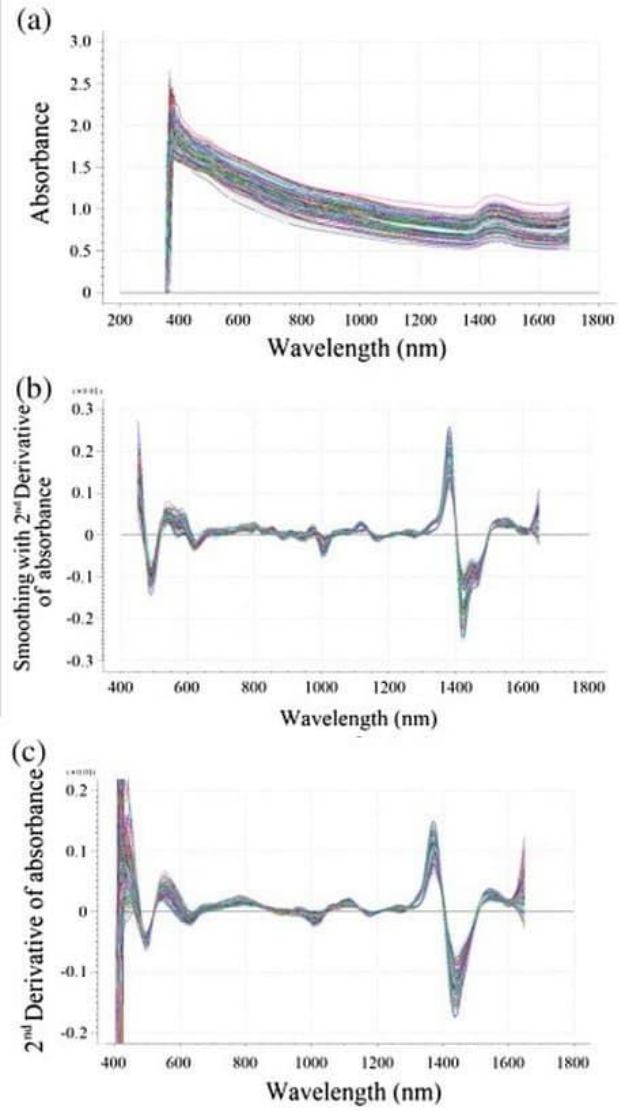
https://physics.stackexchange.com/questions/138075/homemade-spectrometer



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

Spectroscopy



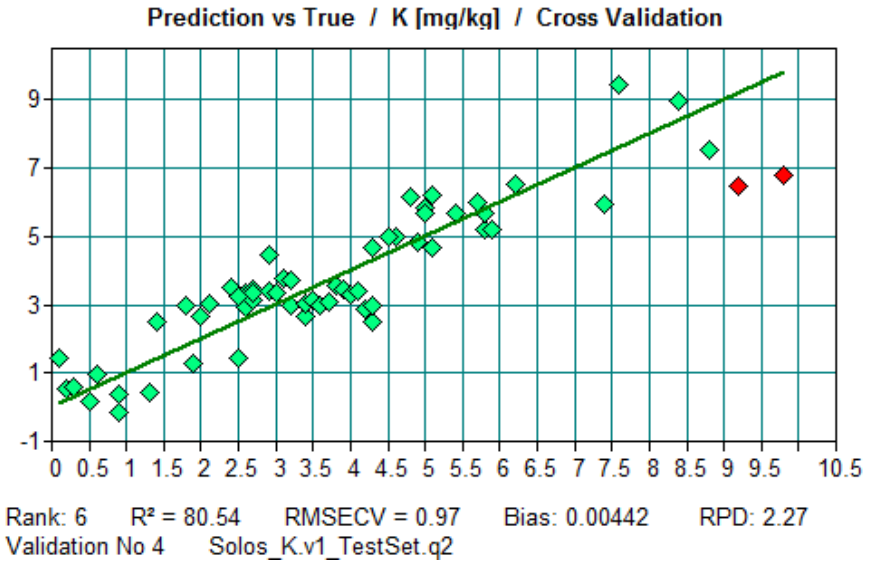


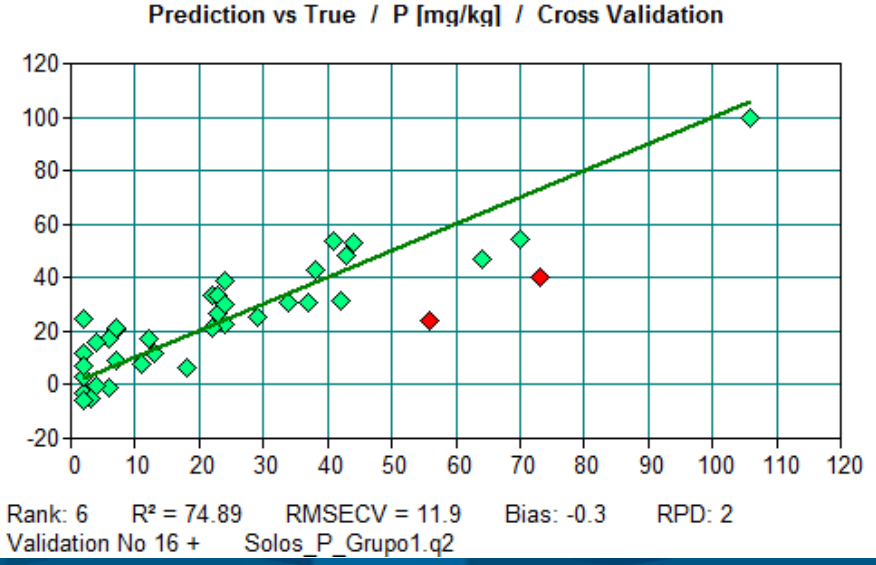
https://www.stellarnet.us/using-a-mobile-real-time-soil-visible-near-infrared-sensor-for-high-resolution-soil-property-mapping/

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

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

http://www.agleader.com/products/directcommand/optrx-crop-sensors/

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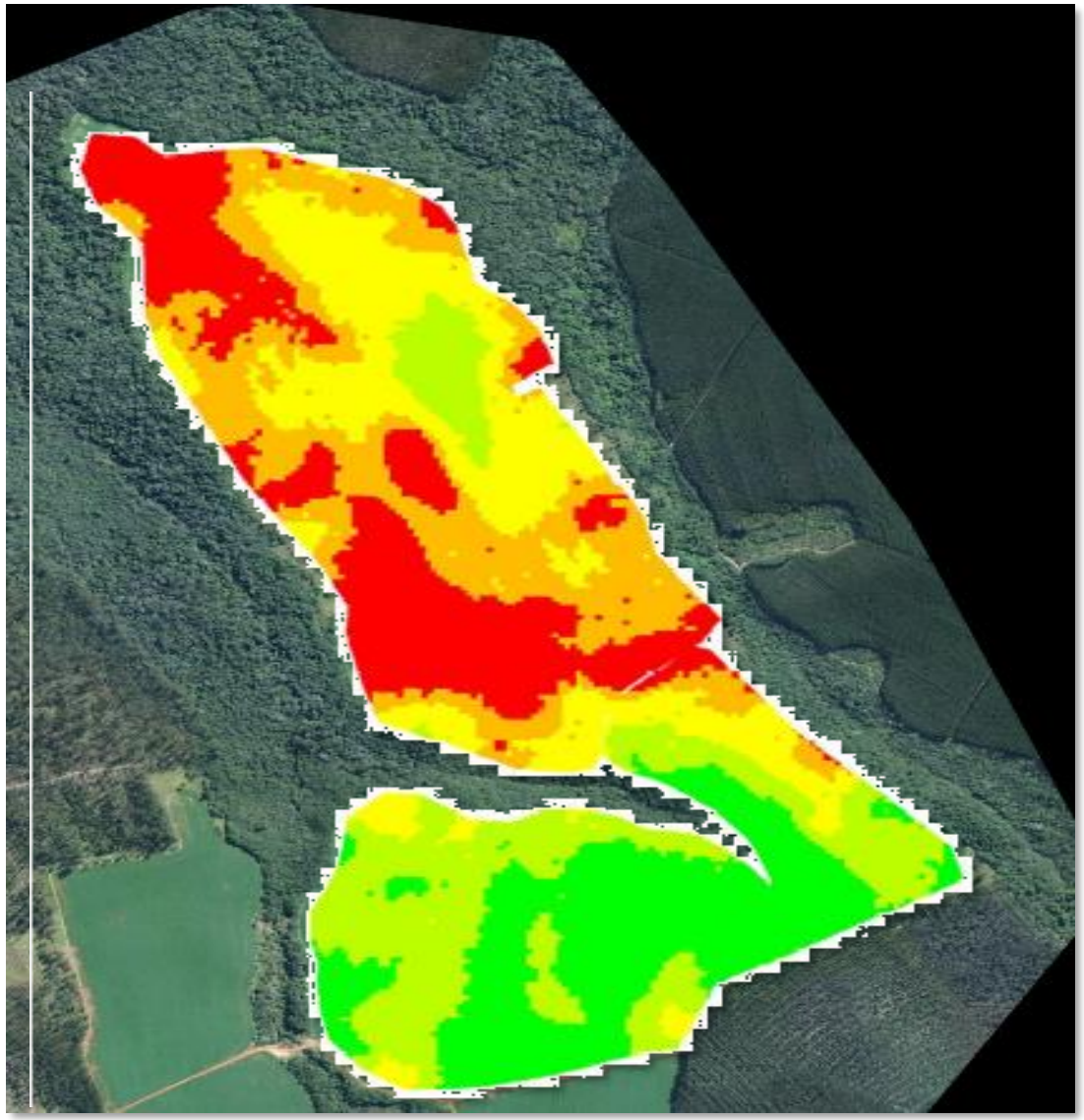
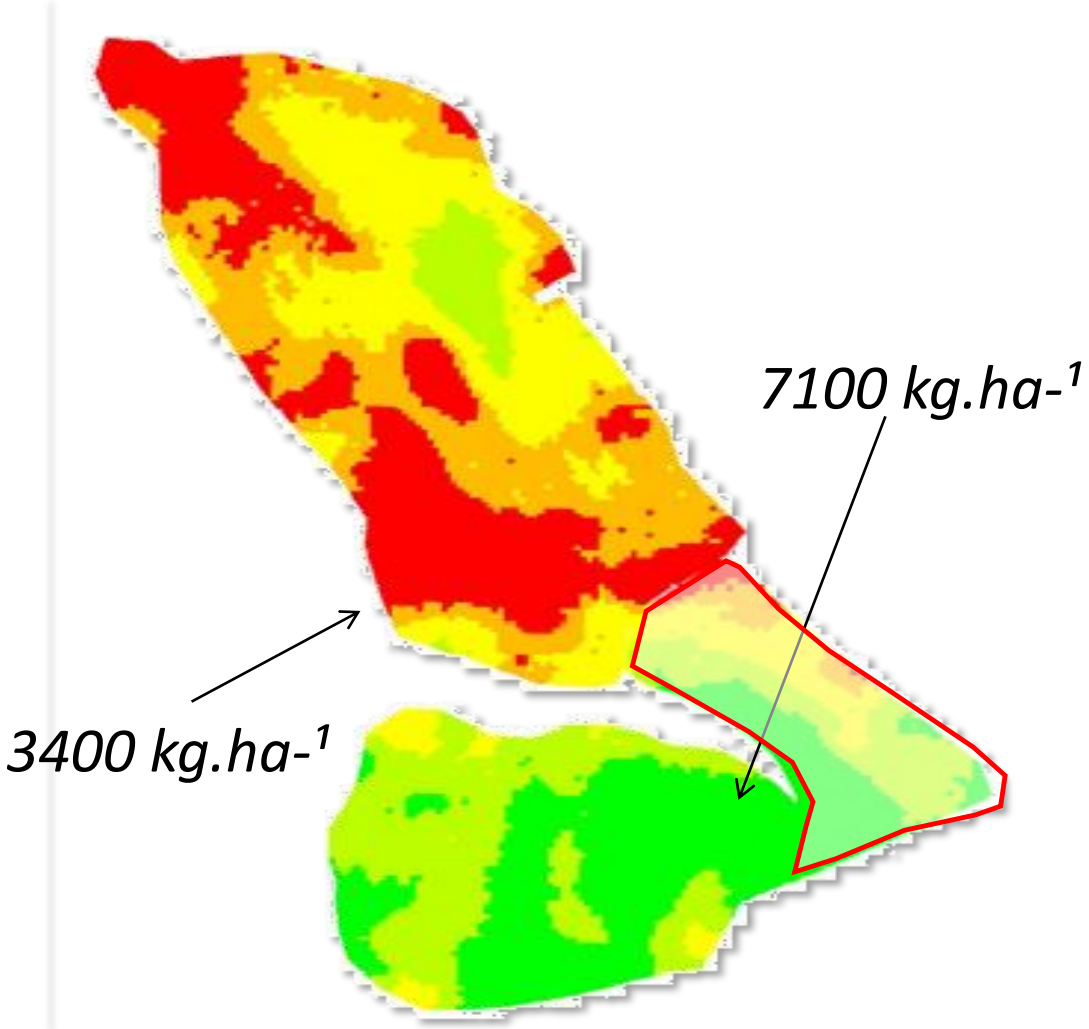
Wheat field



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

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

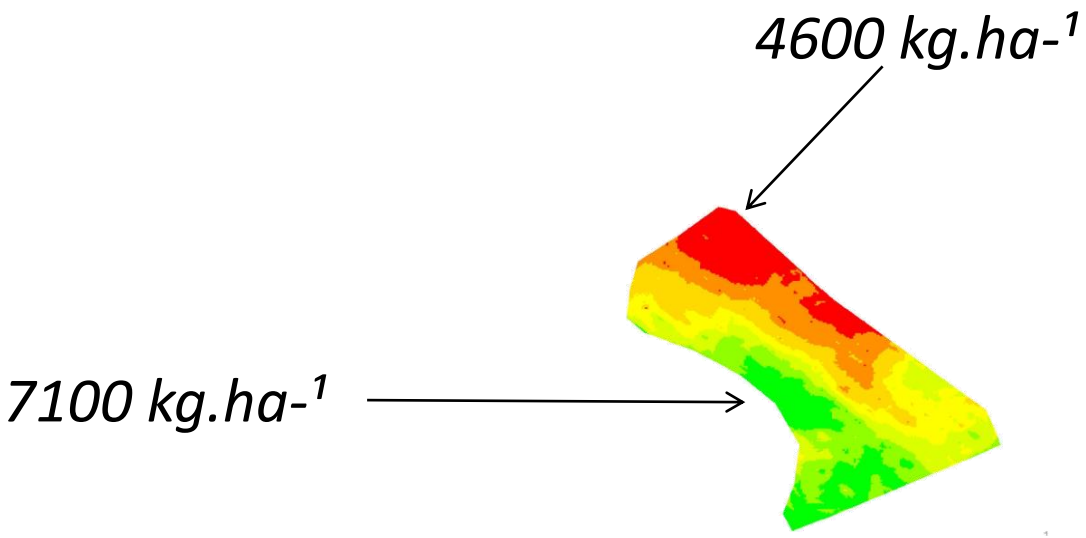
Wheat field – yield potential



- *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

Wheat field – yield potential



- *Is that true?*
  - No!

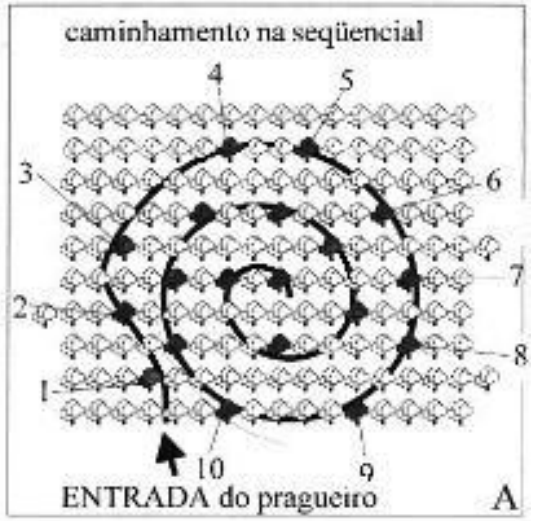
- The **algorithms** designed to predict the yield potential says:
- The difference between high and low **yield potential** is **2500** kg.ha-1
- Total area: **16** hectares

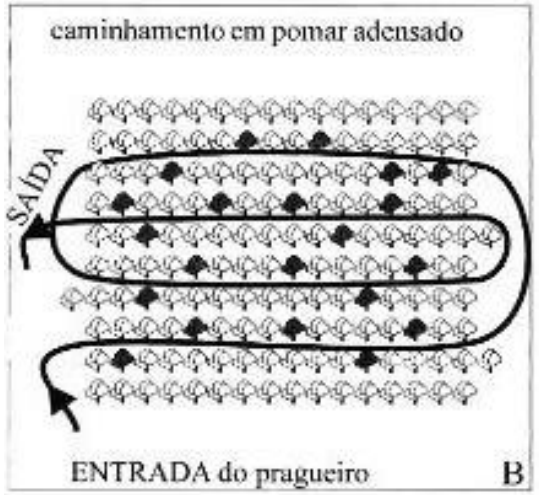
Pest detection

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

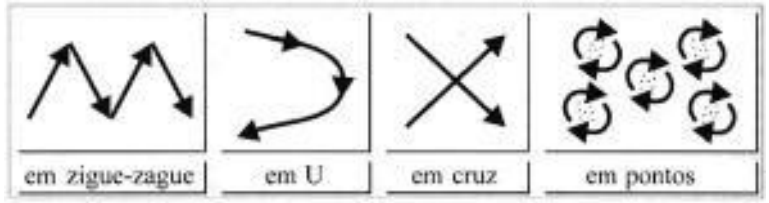
Proposal: using connected smart traps – IoT

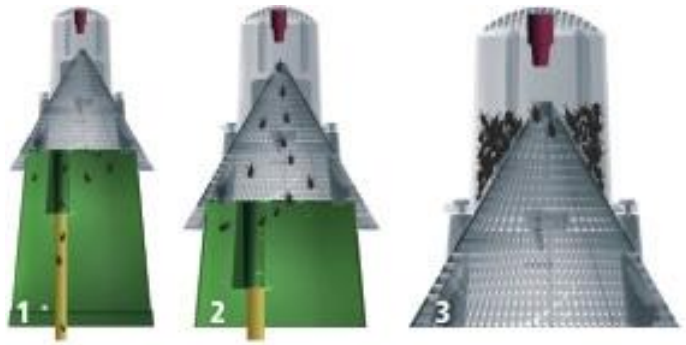
Today





http://www.ebah.com.br/content/ABAAAA5K8AL/entomologia-agricola-2?part=10





http://www.isca.com.br/pt/produtos/p/cf355c5c-bb09-4527-a208-d76b49cf7156/iscabw

http://www.biocontrole.com.br

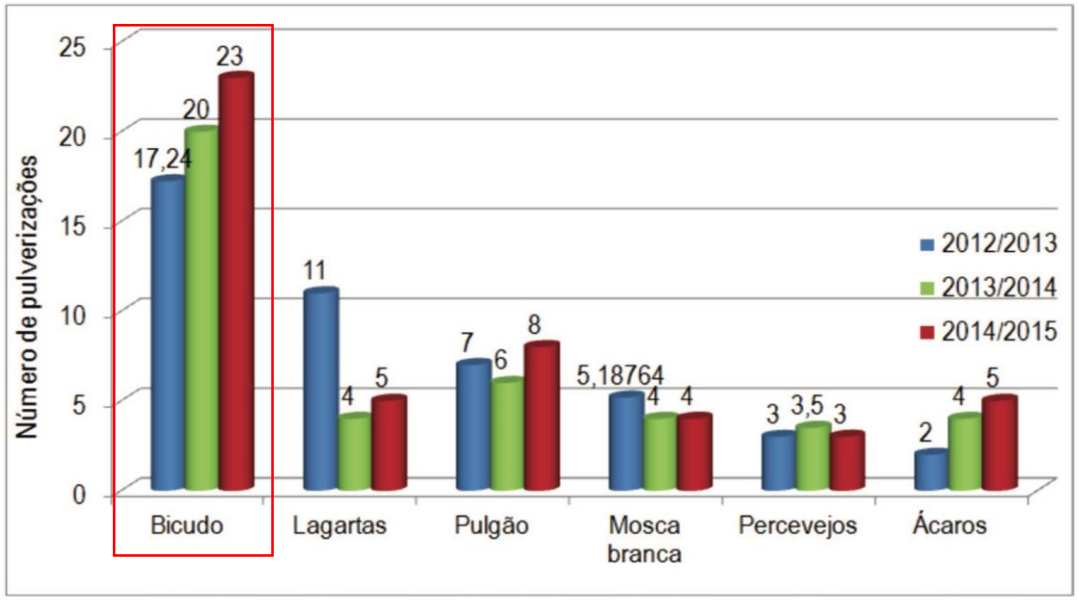


Figura 1. Número médio de aplicações de inseticidas para o controle de pragas no algodoeiro, inclusive o bicudo.
Fonte: Belot et al. (2016).

Boll Weevil

Economical impact

Tabela 2. Número de pulverizações e porcentagem do custo com controle das pragas (por grupos) na cultura do algodoeiro. Safras 2012/2013 e 2013/2014.

Praga	Número de pulverizações*		% do custo de controle de pragas	
	2012/2013	2013/2014	2012/2013	2013/2014
Lagartas	11	4	45,0	7,0
Bicudo	17	20	29,3	35,0
Pulgões/mosca branca	12	10	10,8	24,0
Ácaros	2	4	5,2	22,0
Percevejos	3	3,5	5,2	11,0
Outros	3	3	4,5	1,0

* As pulverizações não são cumulativas, pois costumam ser feitas para mais de um alvo.
Fonte: Belot et al. (2016).

Tabela 3. Custo de produção de algodão, custos com controle do bicudo e perdas ocasionadas pelo inseto[1].

	Parâmetros	Valores médios/ha (mínimoe máximo)
1	Custo de produção de algodão	US$ 2.176,00 (1.700,00 – 2.700,00)
2	Custo com controle químico do bicudo-do-algodoeiro	US$ 192,25 (150,00 – 244,20)
3	Custo com medidas complementares de controle do bicudo-do-algodoeiro[2]	US$ 68,15 (50,00 – 107,70)
4	Perdas estimadas ocasionadas pelo bicudo-do-algodoeiro[3]	5,7 @ de pluma (3 – 15)
5	Custos de controle e perdas envolvendo o bicudo-do-algodoeiro (itens 2+3+4)	US$ 375,00

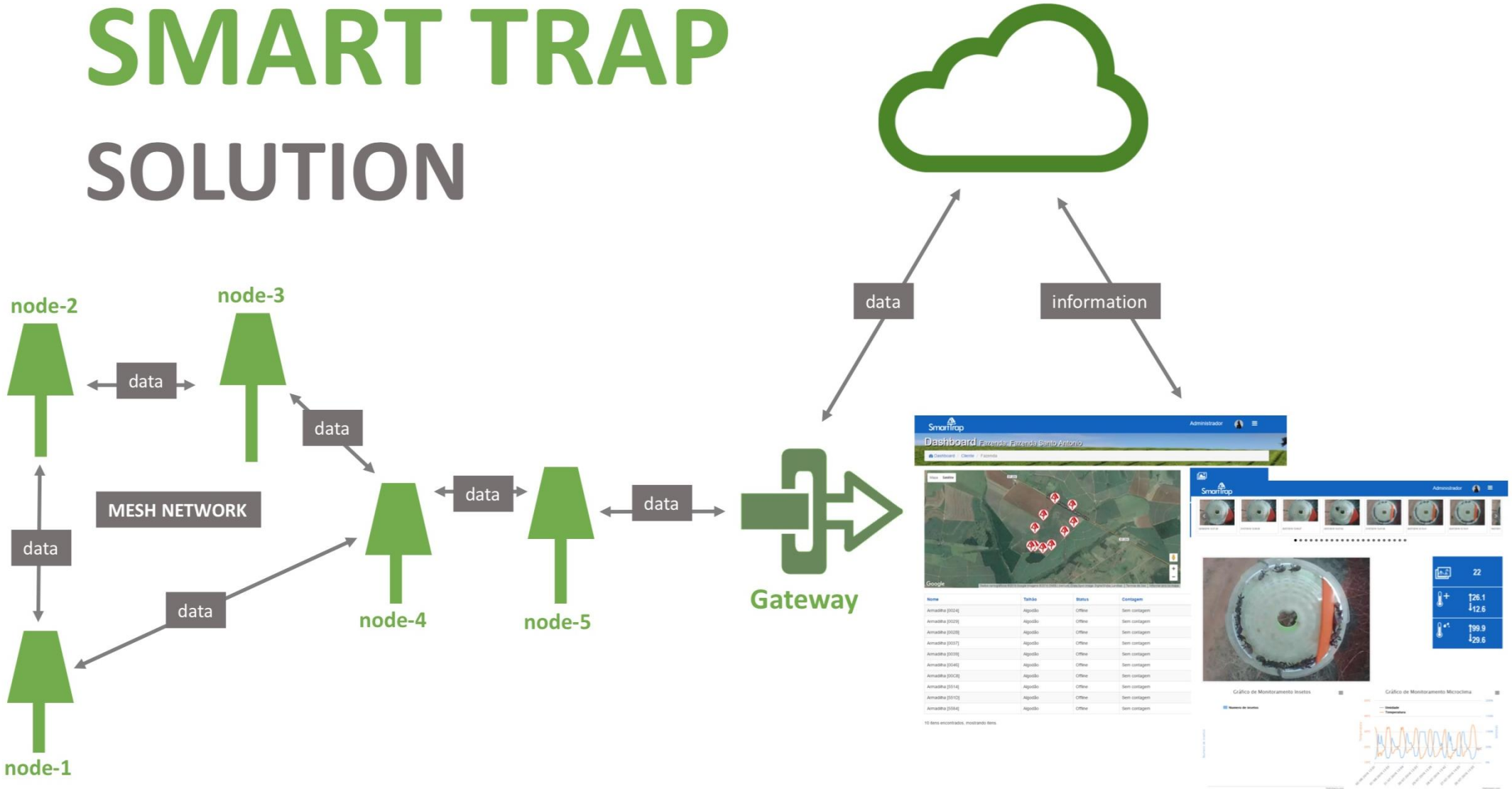
[1]Incluindo destruição de restos culturais, eliminação de plantas tigueras, inclusão de inseticidas em desfolha e/ou dessecação, instalação de Tubo Mata Bicudo, armadilhas etc.
[2]Destruição de restos culturais e plantas voluntárias de algodoeiro, instalação de TMB e uso de inseticidas na desfolha.
[3]As perdas ocasionadas pelo bicudo foram calculadas considerando o valor médio da arroba de pluma de R$76,00 (Fonte: Instituto Mato-grossense de Economia Aplicada – IMEA, em 08/03/2016), transformado em dólar, considerando a cotação US$ 1,00 = R$ 3,78.
Fonte: Belot et al. (2016).

- THE BOLL WEEVIL
- 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**.

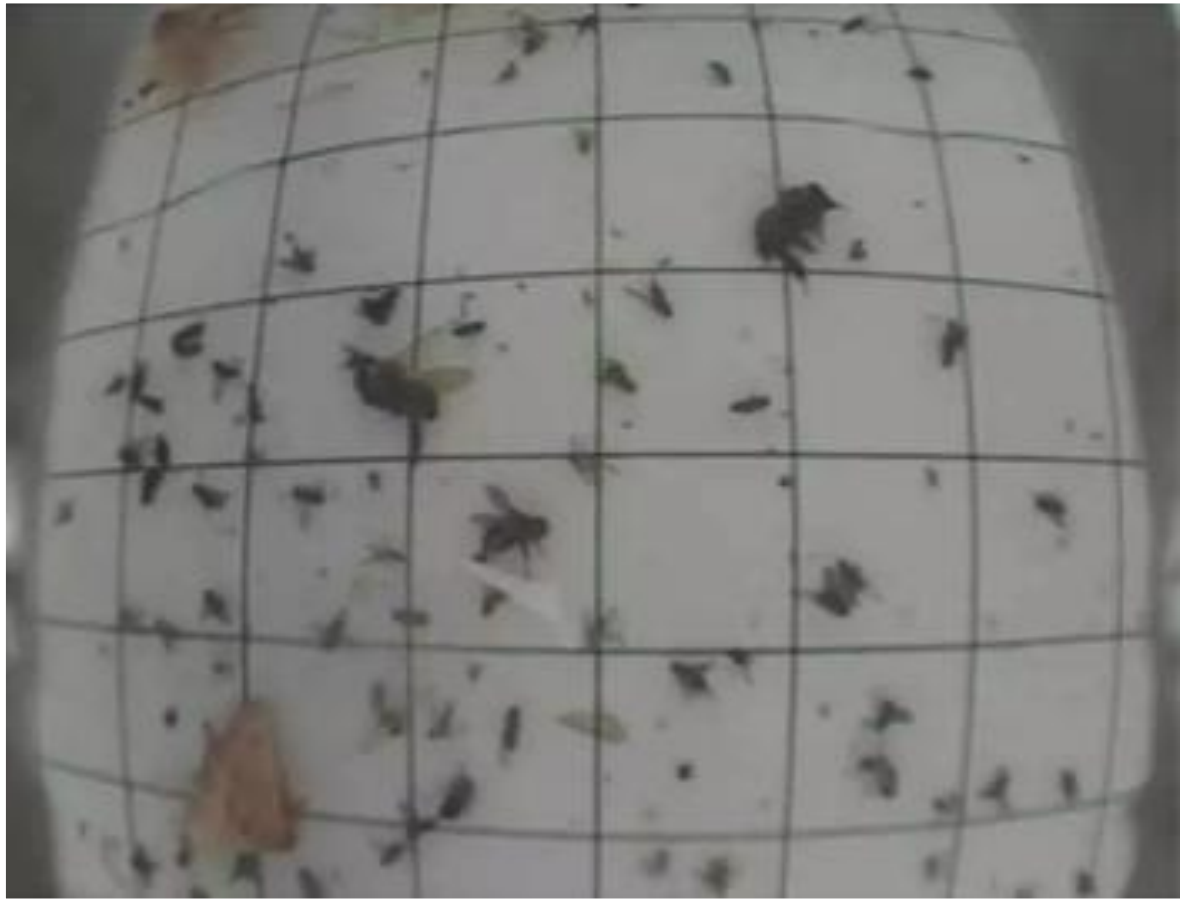
https://www.infoteca.cnptia.embrapa.br/infoteca/bitstream/doc/1066728/1/Manejodobicudodoalgodoeiro.pdf

CIAg's Solution

SMART TRAP SOLUTION



Real data from the field



Smart-Trapp: main parts and features

Communication antenna

Solar panel

CPU + Communication +
Moisture sensor +
Temperature sensor +
Camera + Battery

Pheromone

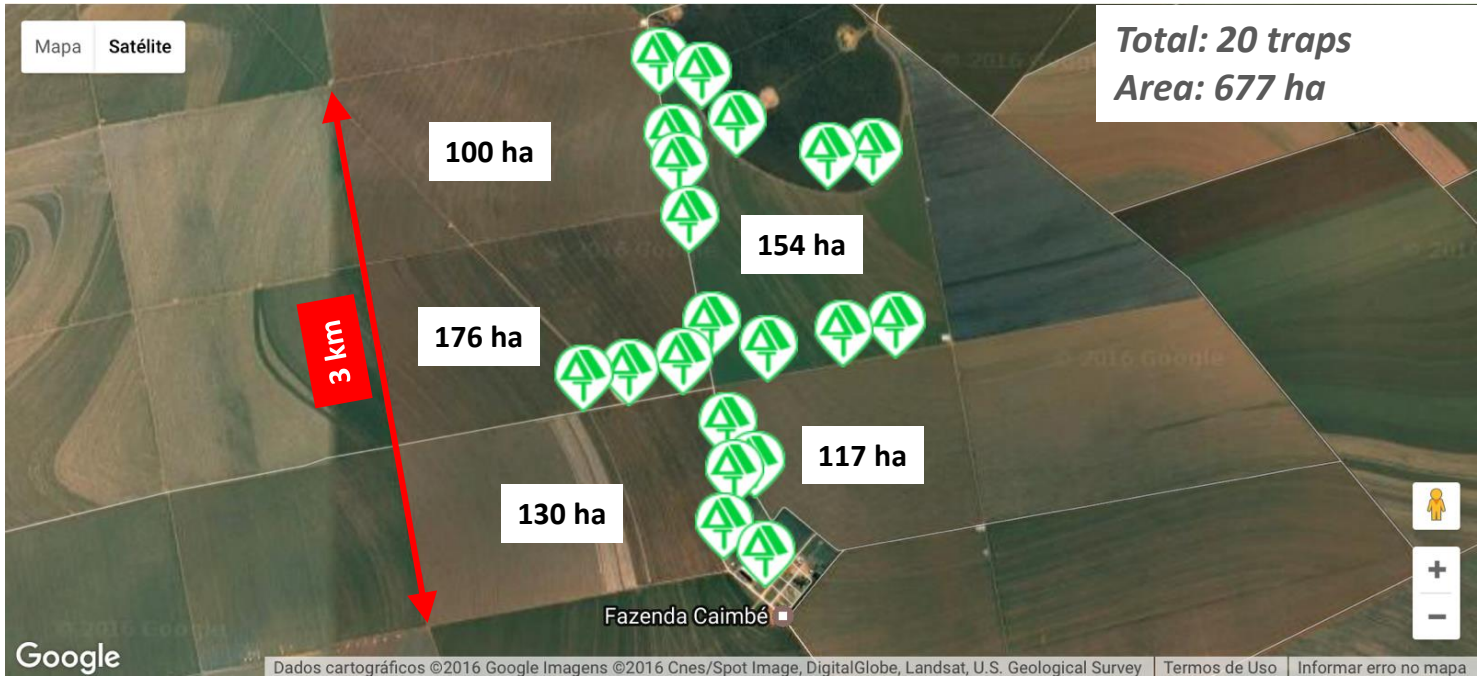
Trap

- 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

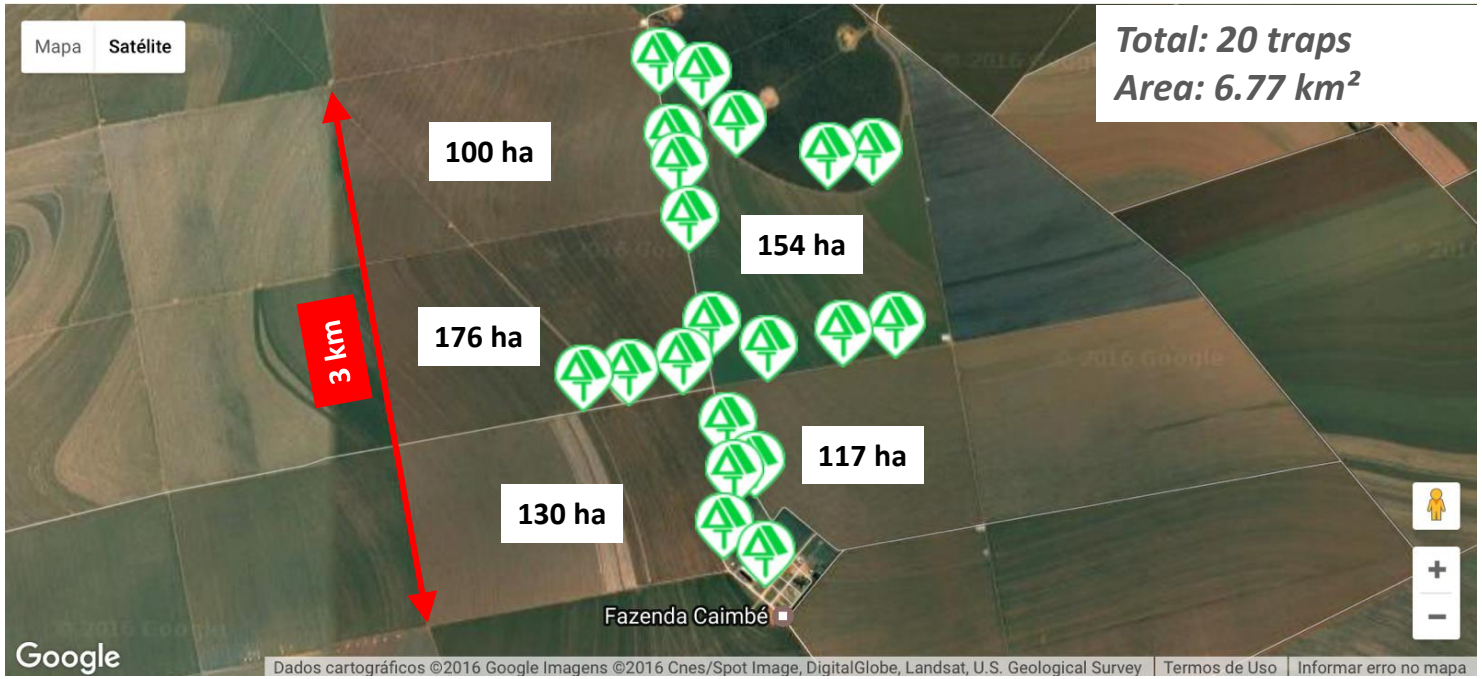
Trials



http://www.grupobdm.com.br/site/index.php?page=diadecampo

http://zenipa.blogspot.com.br/2012/06/um-campo-de-algodao.html

Trials

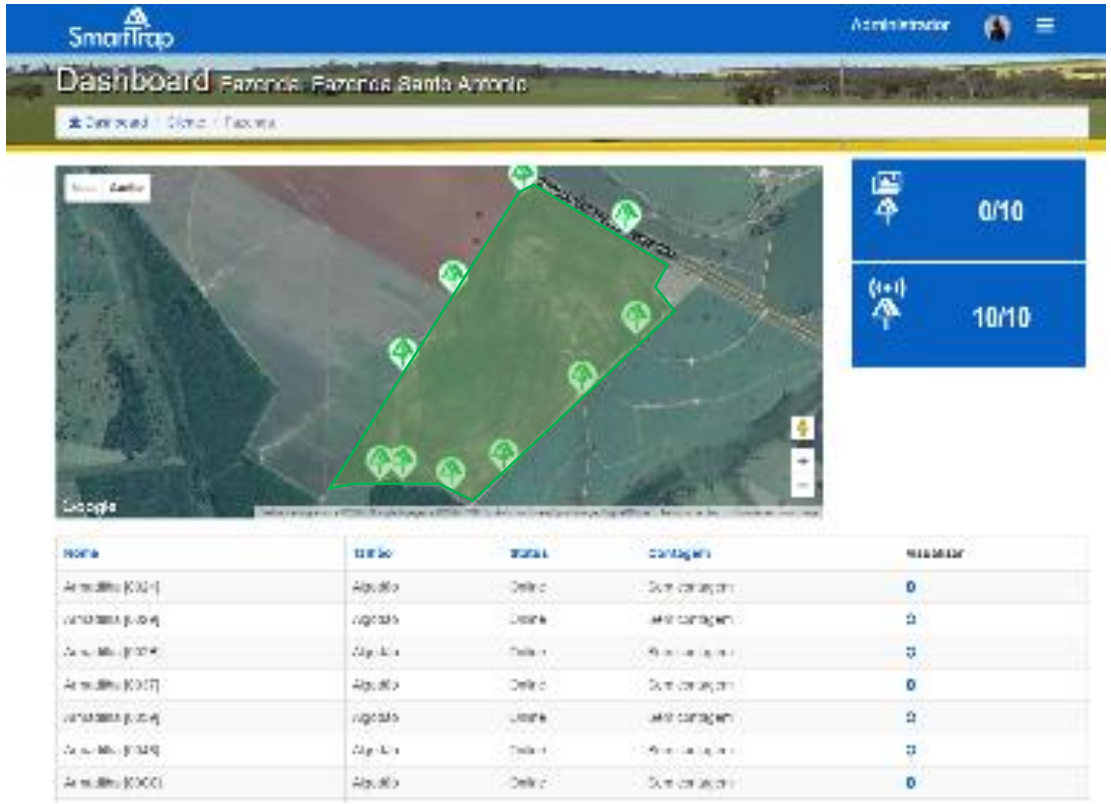


BILBAO flag

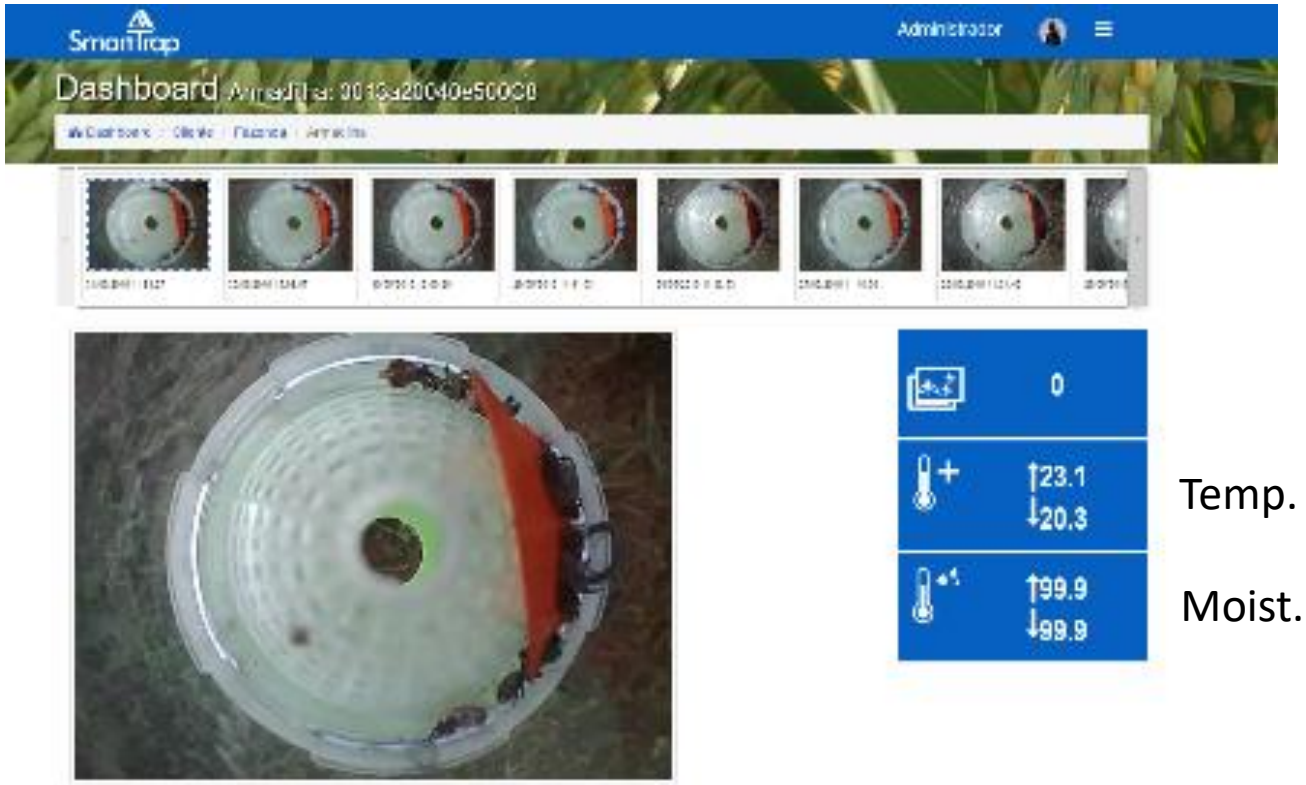
BILBAO area	
• Municipality	41.50 km^2
• Urban	18.22 km^2
• Rural	23.30 km^2

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



Temp.

Moist.

Details and photos

Web dashboard

Boll Weevil counts

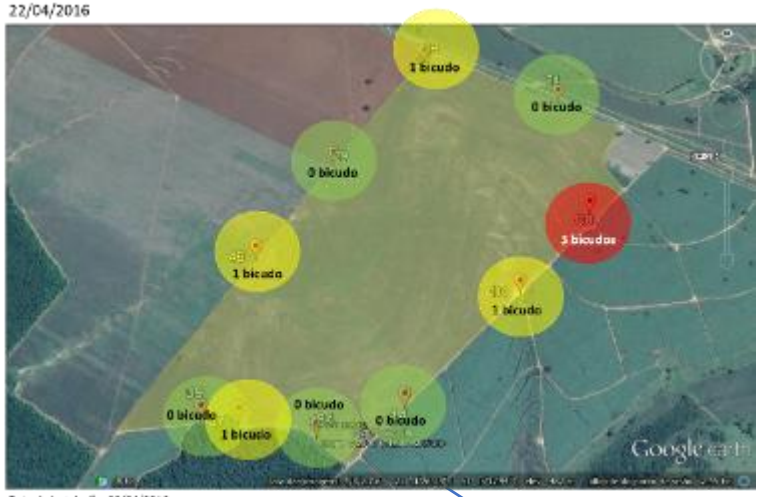
Graphic:

Moisture

Temperature

Report

22/04/2016



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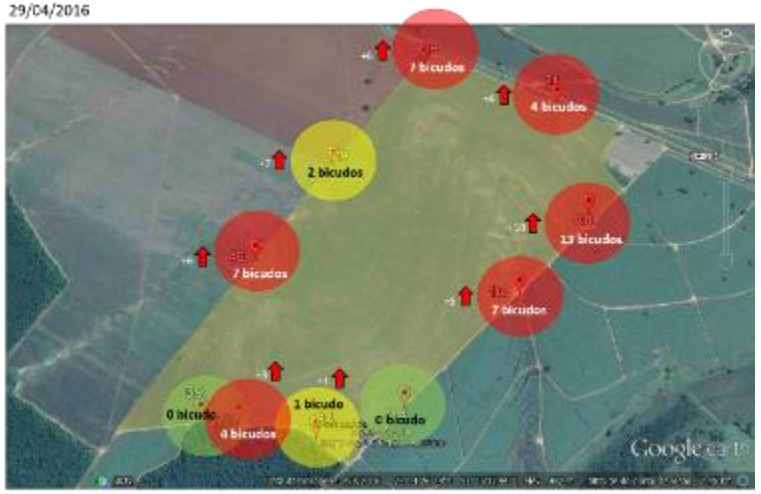
29/04/2016



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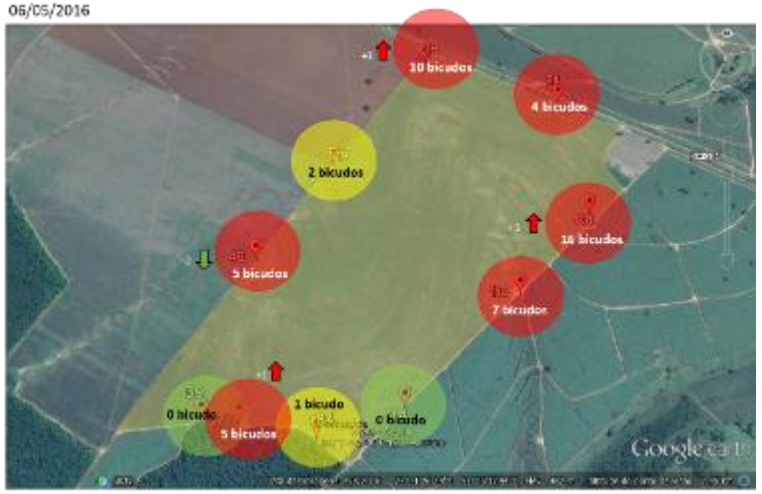

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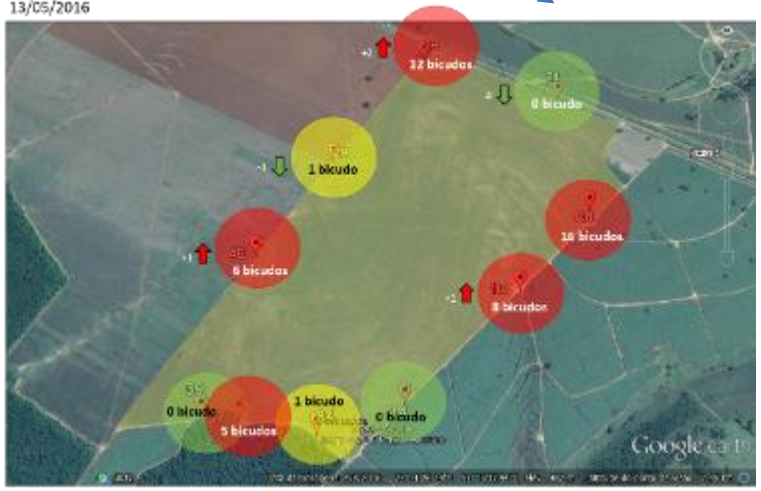

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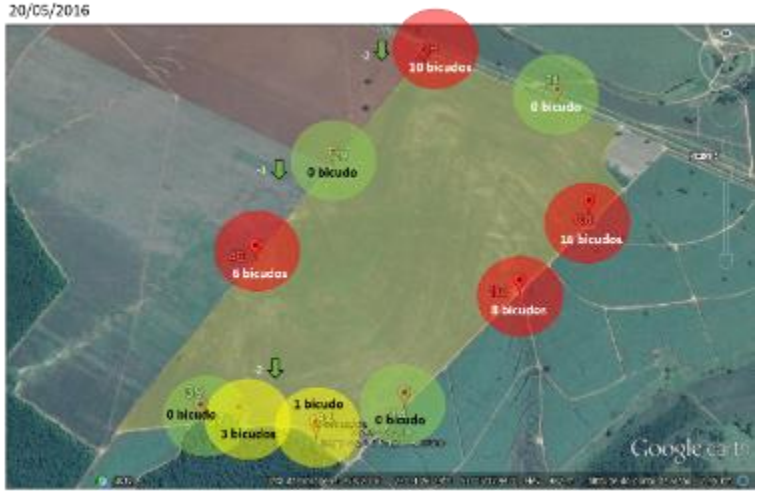

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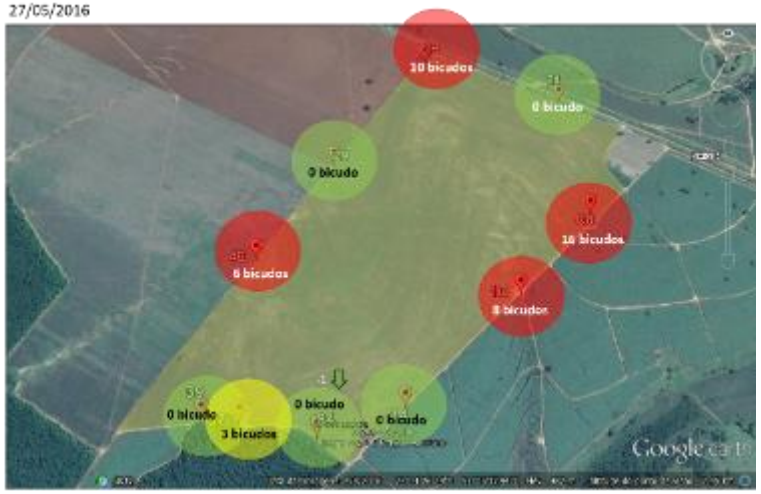

Data da instalação: 22/04/2016

Field events!

Field events

Field events

Boll Weevil

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CIAg

Thank you very much,