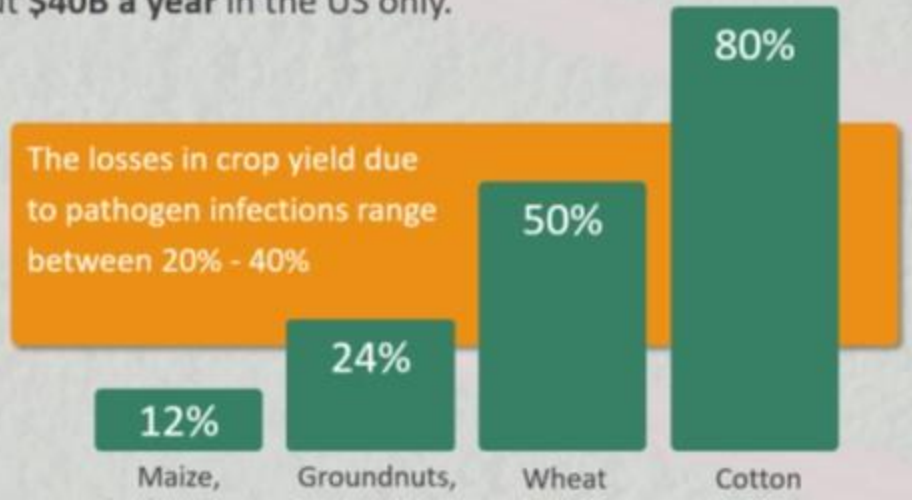
AGROWING

Aerial feet-on-the-ground Multispectral sensing

"To make agriculture sustainable, the grower has got to be able to make a profit." *Sam Farr*

THE ECONOMIC LOSSES

Due to pathogen infections,
are about **$40B a year** in the US only.

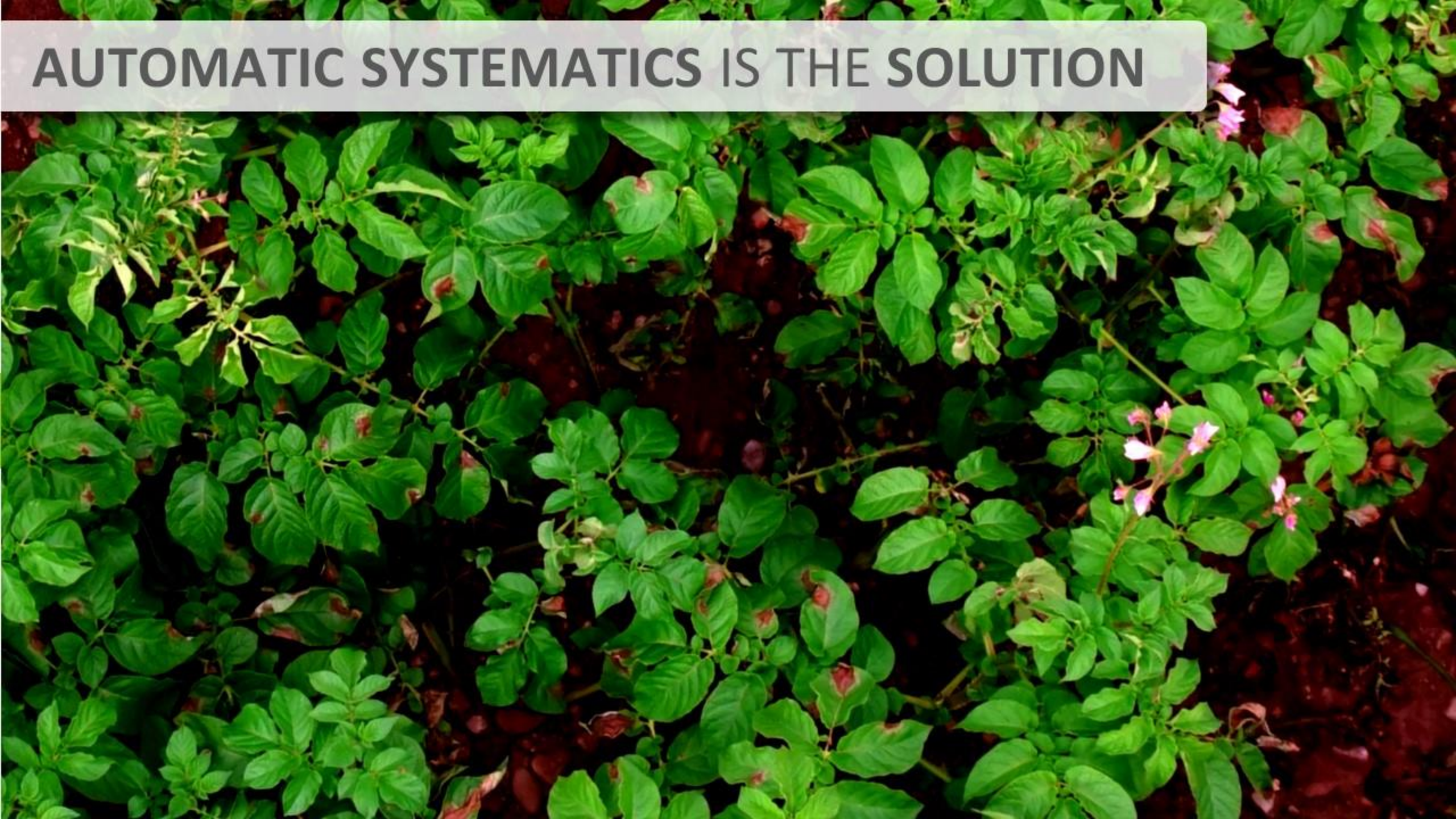



HIGH ALTITUDE
NDVI & NDRE
PROVIDE US WITH ONLY
A VAGUE PICTURE
OF THE CROP'S HEALTH


MULTISPECTRAL AG METRICS
ALLOW SPOTTING AREAS OF INTEREST

BUT **FARMERS** CAN NOT USE VAGUE INFORMATION **THEY NEED ACTIONABLE DATA**

AUTOMATIC SYSTEMATICS IS THE SOLUTION

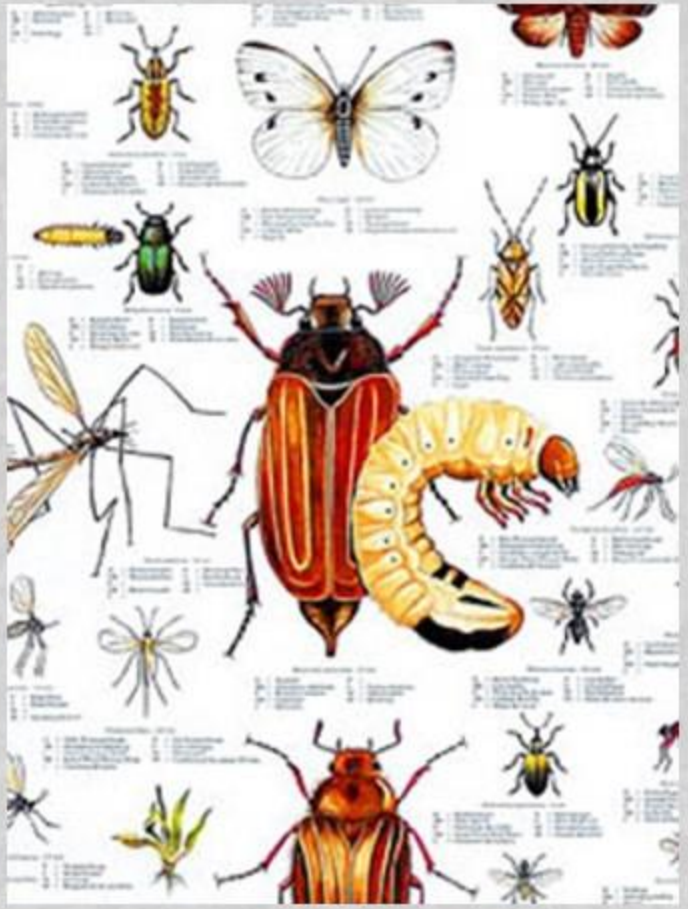


MACHINE-VISION PROCESSING IS **A MUST**

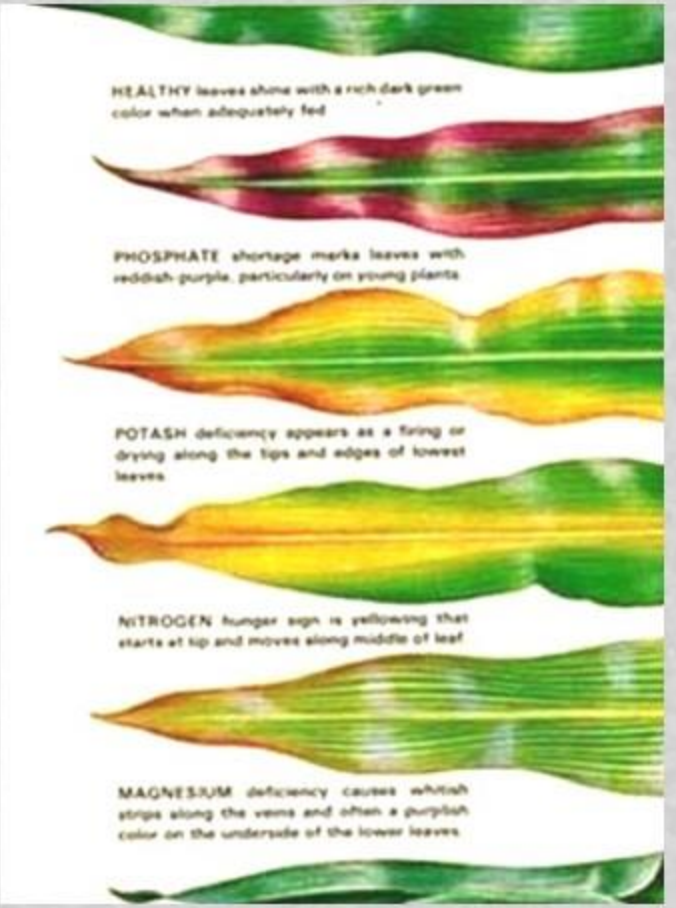
WE ARE BUILDING AND EXPANDING
THE WORLD'S FIRST MULTISPECTRAL BIG DATA BANK

STRESS

PESTS



IRREGULARITIES




HOW DOES ONE ACQUIRE **CLOSE RANGE MULTISPECTRAL** IMAGES, WHEN **NO EXISTING SENSOR CAN DO IT?**

AGROWING'S REVOLUTION – ENABLING REMOTE & CLOSE
MULTISPECTRAL IMAGERY ACQUISITION

AGROWING'S
FIRST SENSOR:

- **8 MEGAPIXELS PER CHANNEL**
- **4 NARROW BANDS**

AQUIRING IMAGES FROM A WIDE RANGE OF ALTITUDES: FROM **2.5m** to **2,500m** ALTITUDE

AGROWING'S 8MP IMAGE ACQUIRED AT
3M RANGE ABOVE THE CROP
1.8M HFOV

0.5 millimeter PER PIXEL

SATELLITE SENSORS
AND ALL OTHER SENSORS IN
USE **CAN NOT ACQUIRE**
MULTISPECTRAL IMAGERY
AT CLOSE RANGE

1.8m HFOV 0.5mm pixel

AN **ALL-NEW PARADIGM** (COMPARED TO **SATELLITES**) AND THE CURRENT **STATE-OF-THE-ART SENSORS**

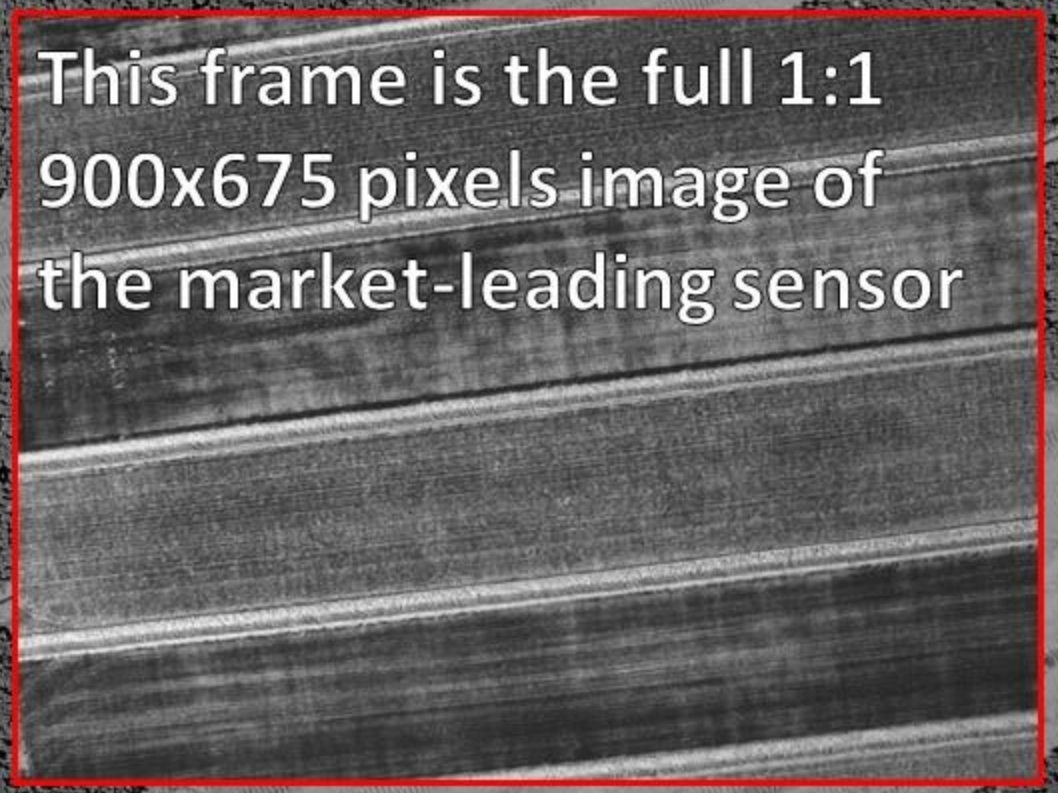
	Leading State of the Art Sensor		QX1/R10/Alpha 5000 (cm/p)		Venus Satellite	
Alt (m)	cm per pixel	Pixels per sq. meter	cm per pixel	Pixels per sq. meter	cm per pixel	Pixels per sq. meter
3.75	NA	NA	0.053	3,546,590 355 per sq. cm	530	**0.04** per sq. METER
50	3.4	864	0.85	13,840	0.7	NA
100	6.8	216	1.7	3,460	NA	NA
200	13.6	54	3.4	865	NA	NA
1,000	68	2.16	17	34.6	NA	NA

THE TREMENDOUS DIFFERENCE IN DETAILS

between Agrowing's chroma channel and other sensors, comparing two images, both acquired from an altitude of 90m:

The background image is a 40% excerpt of Agrowing's 3.600x2,250 pixels image

This frame is the full 1:1 900x675 pixels image of the market-leading sensor



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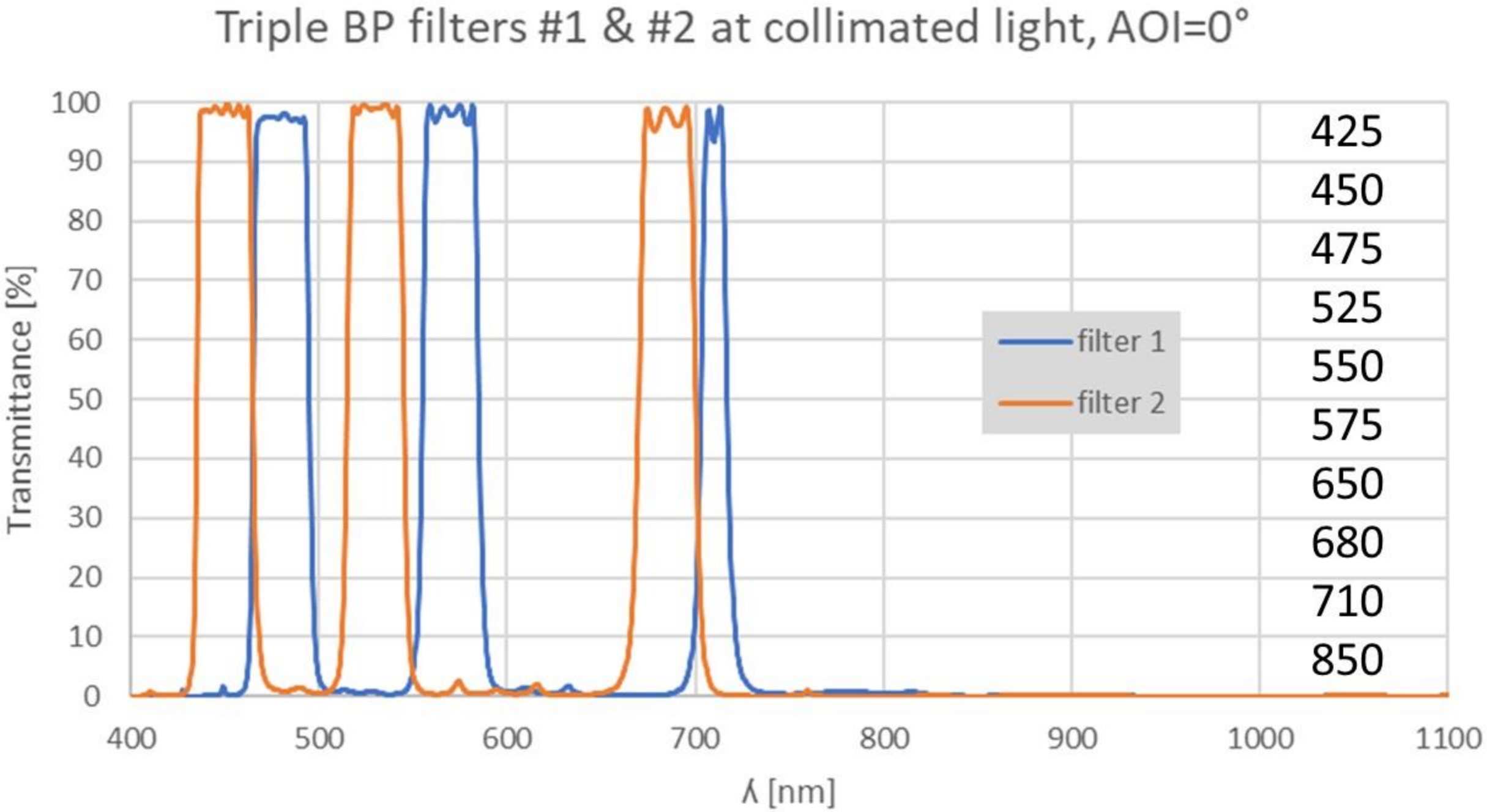
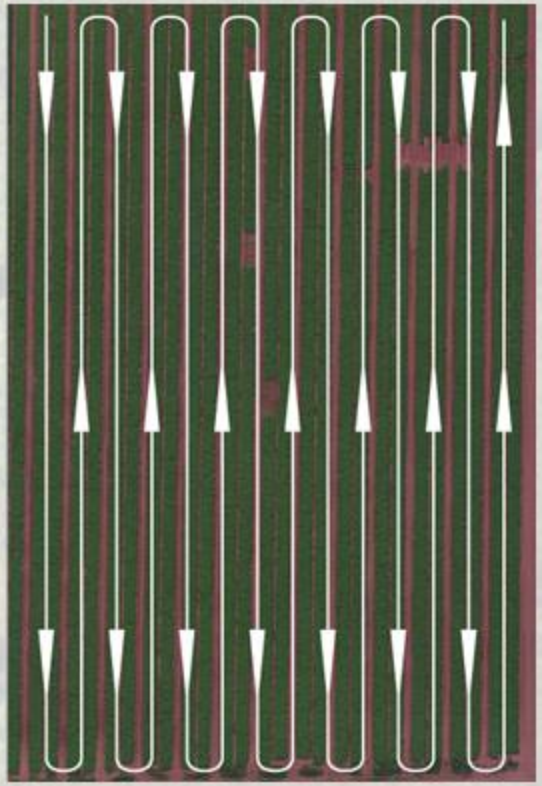

Triple BP filters #1 & #2 at collimated light, AOI=0°
Transmittance [%]
100
90
80
70
60
50
40
30
20
10
0
400
500
600
700
800
900
1000
1100
λ [nm]
filter 1
filter 2
425
450
475
525
550
575
650
680
710
850

THE WORKFLOW

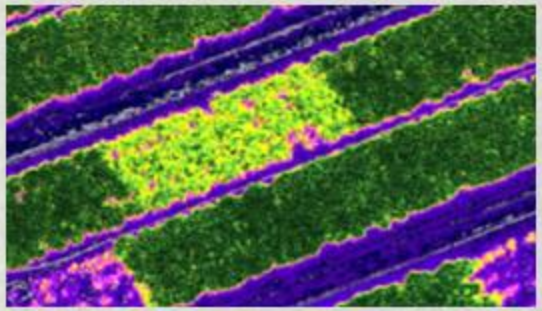
1 SCAN

Scan fields from high altitude (100m-120m) using NDVI and/or other agricultural indices.



2 DETECT

Automatically detecting (by machine vision, based on the type of survey defined) areas of interest (i.e. stress, dryness, weeds). Send a drone to the specific location.



3 ANALYZE

Acquiring high-resolution data from low altitude (3m-15m); scanning and analyzing the imagery (using machine-vision); identifying the cause of anomaly in the predefined outlying areas.

4 SEND

Sending high-resolution close-up images of the problems discovered. Optionally, providing the farmer/service provider with a DSS (decision support system), based on accurate identification of the problem.

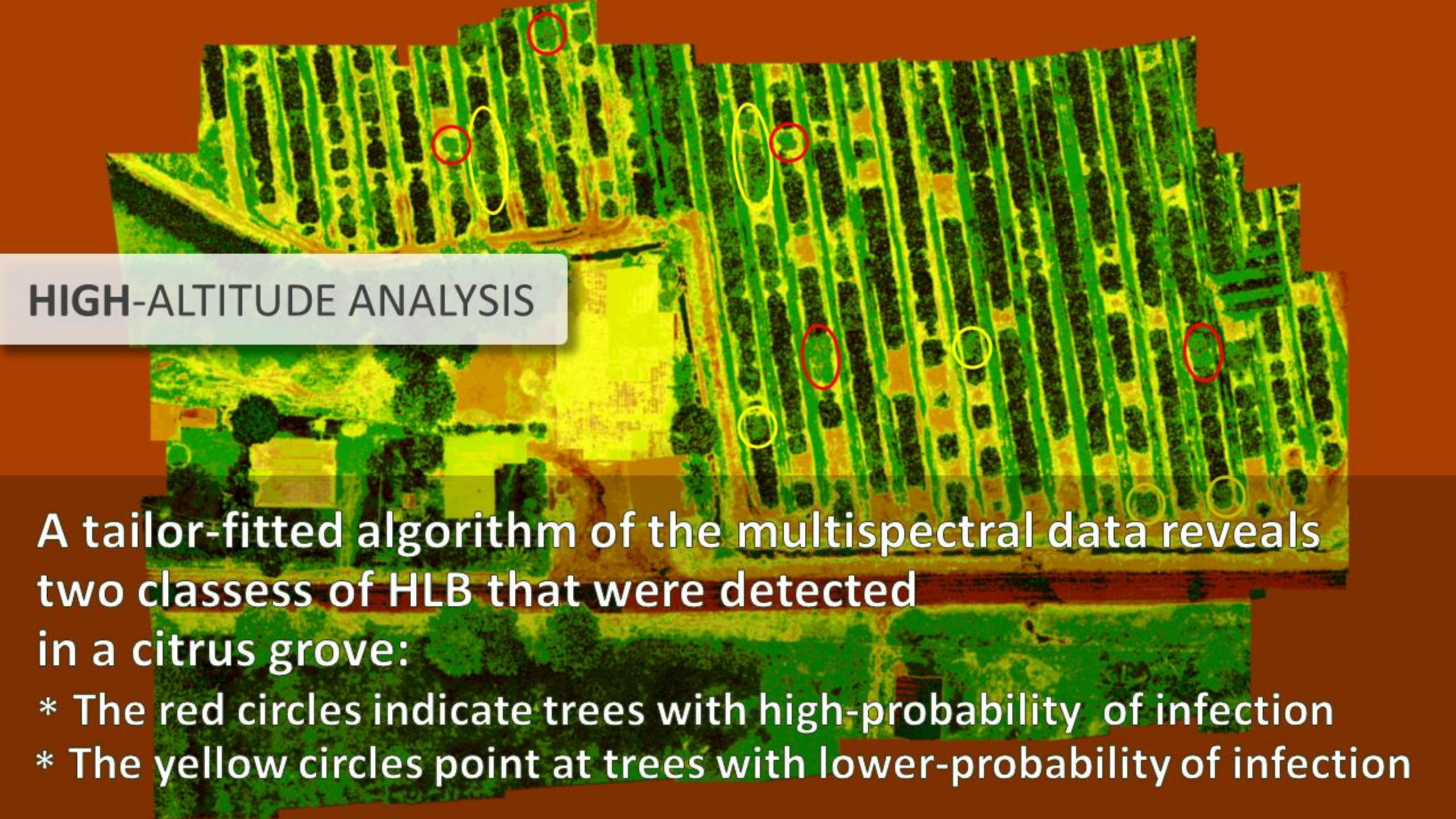
PROOF OF CONCEPT – **VERIFICATION** AND **VALIDATION**

The concept has already been proven

It is now being developed by Agrowing and for commercial deployment with several leading growers

- Banana Black Sigatoka and Potato Blight (fungus)
- Cotton White Fly (aphid)
- Citrus HLB (bacteria)
- Potato Colorado Beetle (insect)
- Pineapple early induction
- Canopy percentage and plantation density

and more…

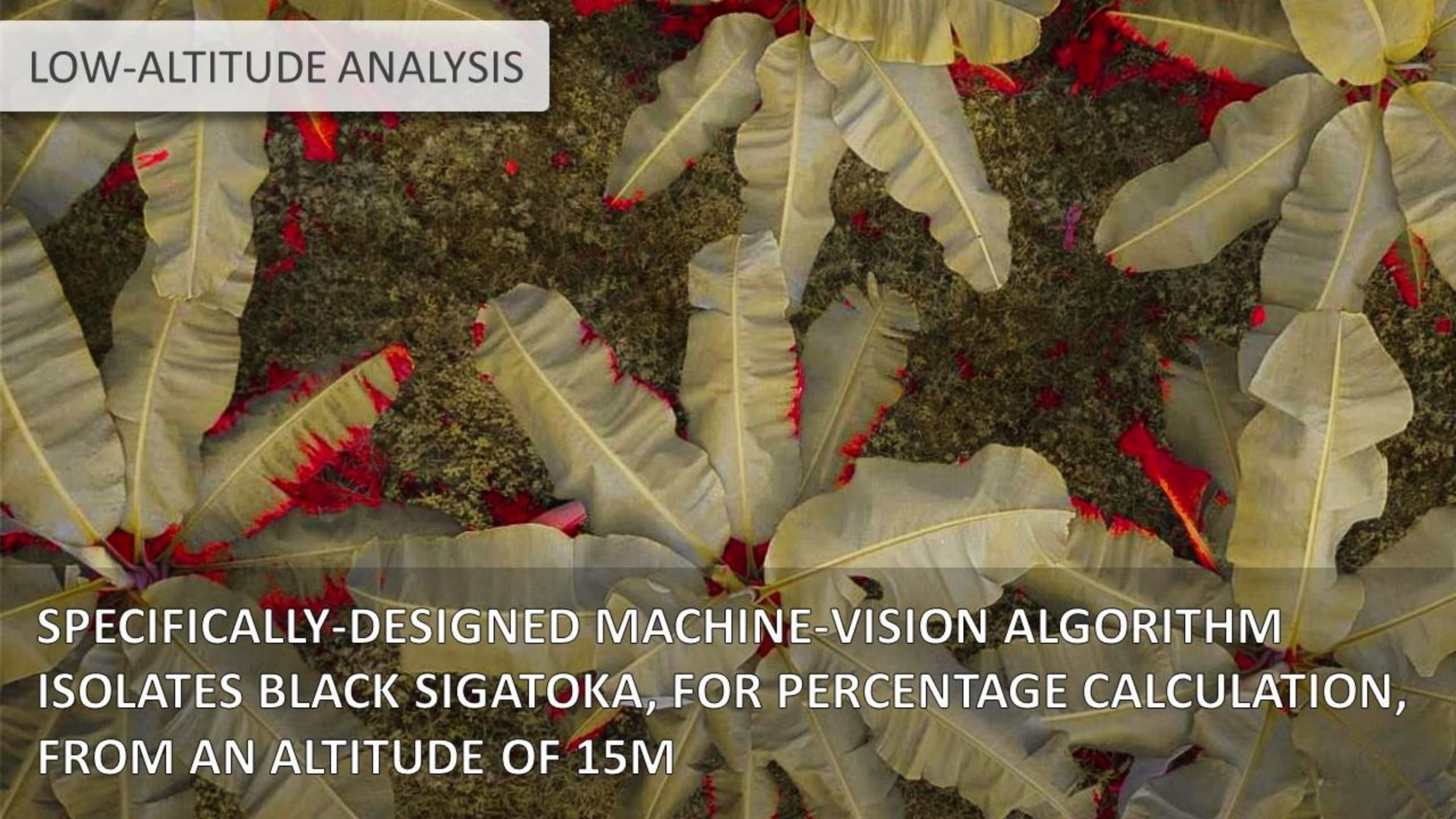


HIGH-ALTITUDE ANALYSIS

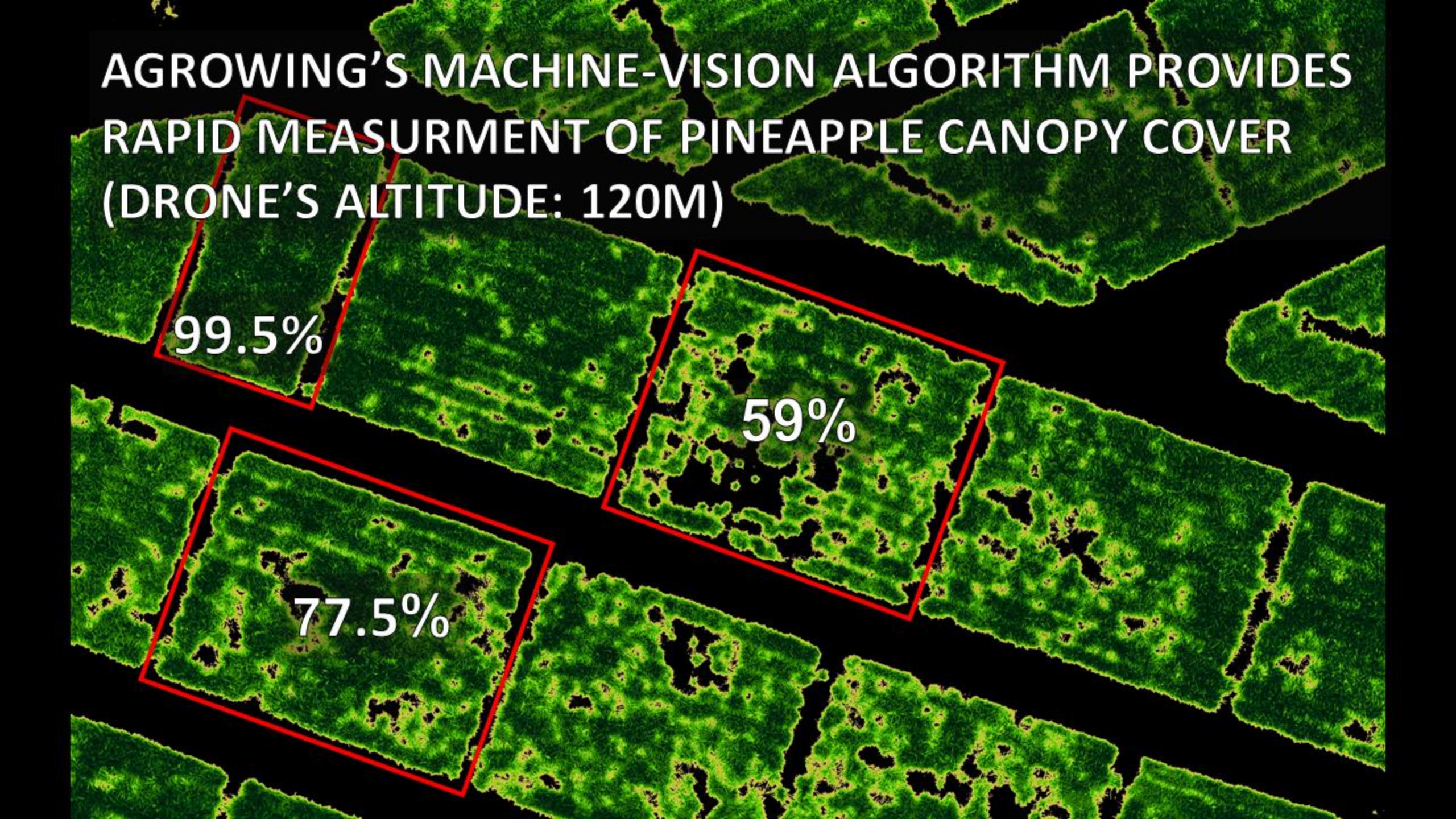
A tailor-fitted algorithm of the multispectral data reveals two classess of HLB that were detected in a citrus grove:

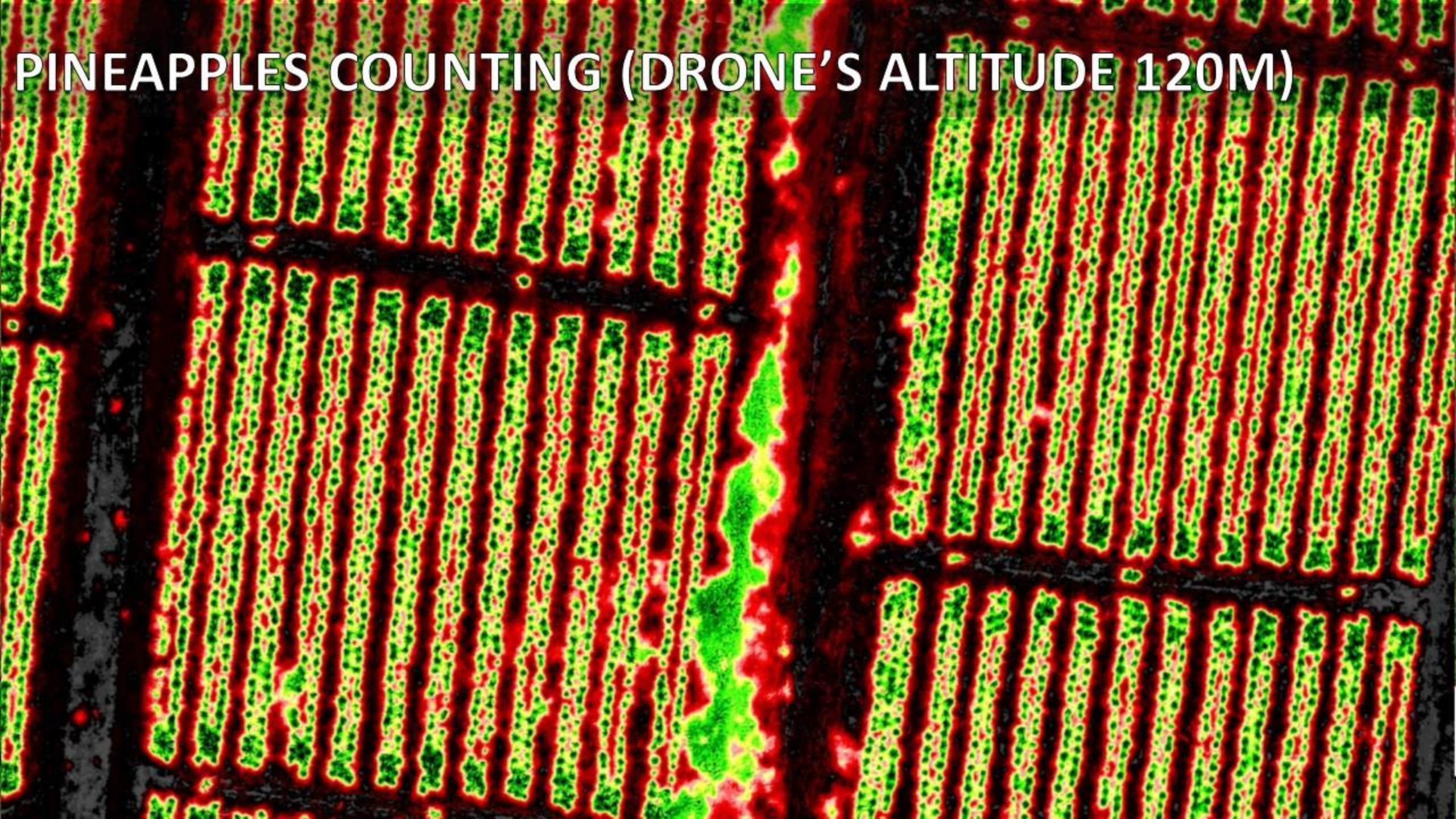
* The red circles indicate trees with high-probability of infection
* The yellow circles point at trees with lower-probability of infection

LOW-ALTITUDE ANALYSIS



SPECIFICALLY-DESIGNED MACHINE-VISION ALGORITHM ISOLATES BLACK SIGATOKA, FOR PERCENTAGE CALCULATION, FROM AN ALTITUDE OF 15M


AGROWING'S MACHINE-VISION ALGORITHM PROVIDES
RAPID MEASURMENT OF PINEAPPLE CANOPY COVER
(DRONE'S ALTITUDE: 120M)
99.5%
59%
77.5%


PINEAPPLES COUNTING (DRONE'S ALTITUDE 120M)

HOW TO DETERMINE THE **SURVEY'S EFFICIENCY**?

THE EFFICIENCY OF AN AERIAL SURVEY CAN BE ESTABLISHED BY **3 MAJOR CRITERIA**:

1. **RESOLUTION** OF THE ACQUIRED IMAGERY
2. **HFOV** (HORIZONTAL FIELD OF VIEW)
3. DEGREE OF REQUIRED **OVERLAPPING** (FOR GENERATING GEOTAGGED MOSAICS)

IN-FIELD COMPREHENSIVE SOLUTION

1 Sensor

8MP and 10MP sensors (for each narrow spectral channel).

NDVI and Red Edge interchangeable lenses.

2 Drone

We collaborate with Xfold, BlueBird, Event 38, Airace and others, offering integrated agricultural drones, flying 25 minutes to 180 minutes.

walkera

EVENT 38 UNMANNED SYSTEMS

BlueBird Aero Systems

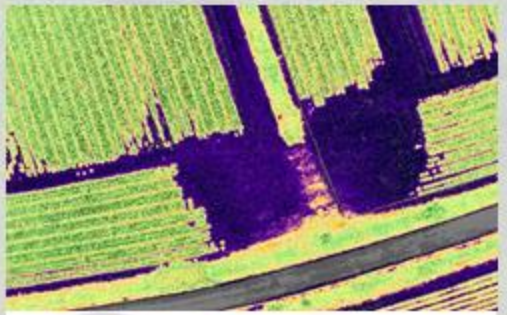
AIRACE

HEUROBOTICS

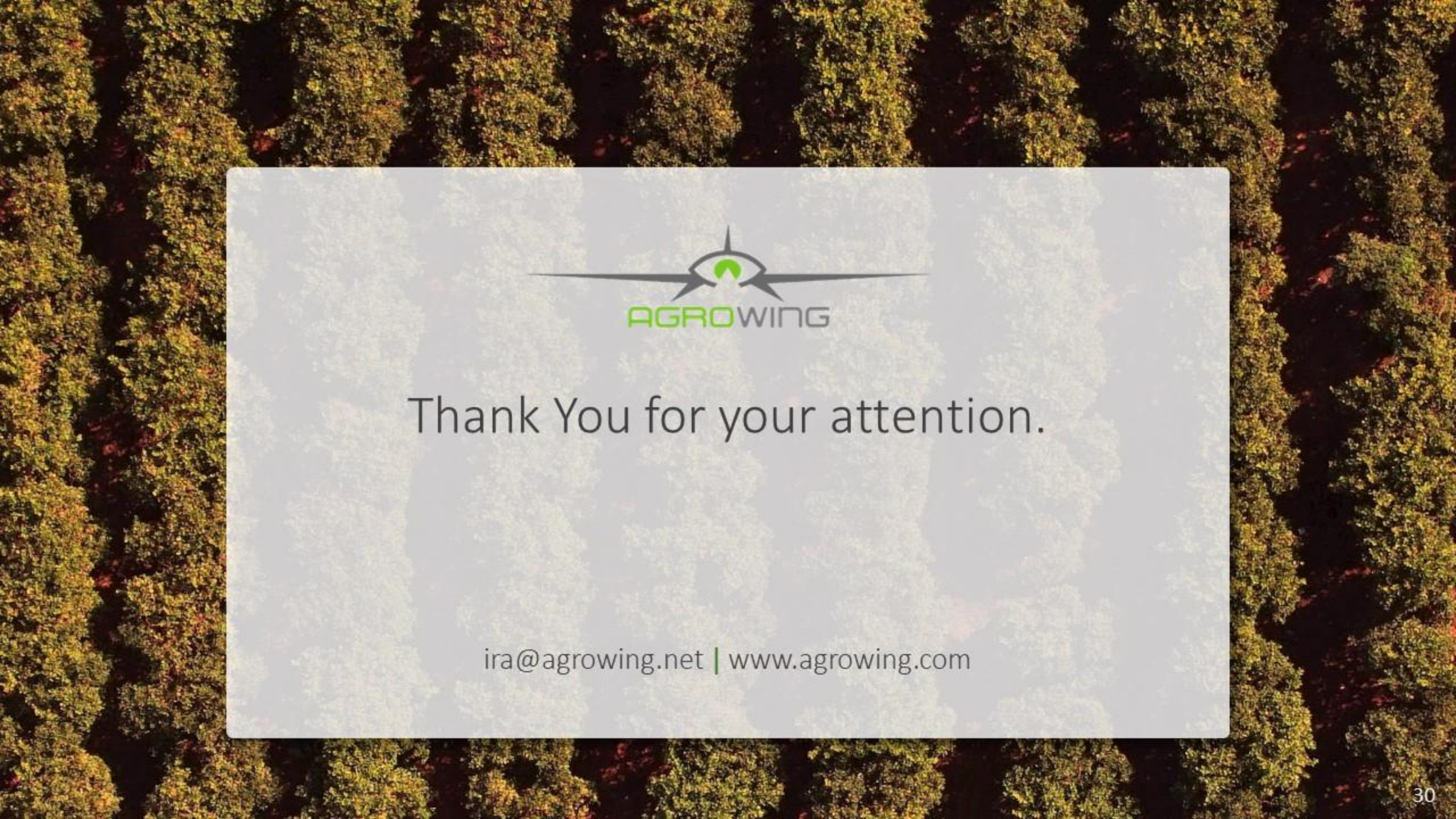
XFOLD

3 Software

Icaros' One Button proven technology completes the package.
In Field orthophoto stitching and over a dozen agricultural metrics.
Adds-On include automatic areas of interest detection.



Imagery Made Simple OneButton ICAROS



Thank You for your attention.

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