Framework conditions for innovation

Agri-Tech Week : Use of crop sensing in field vegetable and potato crops

Monday 9th November 2020

@InnoVeg #INNOVEG #ATW20

Agri-Tech Week 2020

"Soil health and the circular economy; A sustainable future for agriculture"
13th Nov 10am – 12.30pm

"Use of crop sensing in field vegetable and potato crops"
9th November, 9.30-11am

"Back to reality? Pushing the boundaries in agri-tech and innovation"
12th Nov, 16.30pm

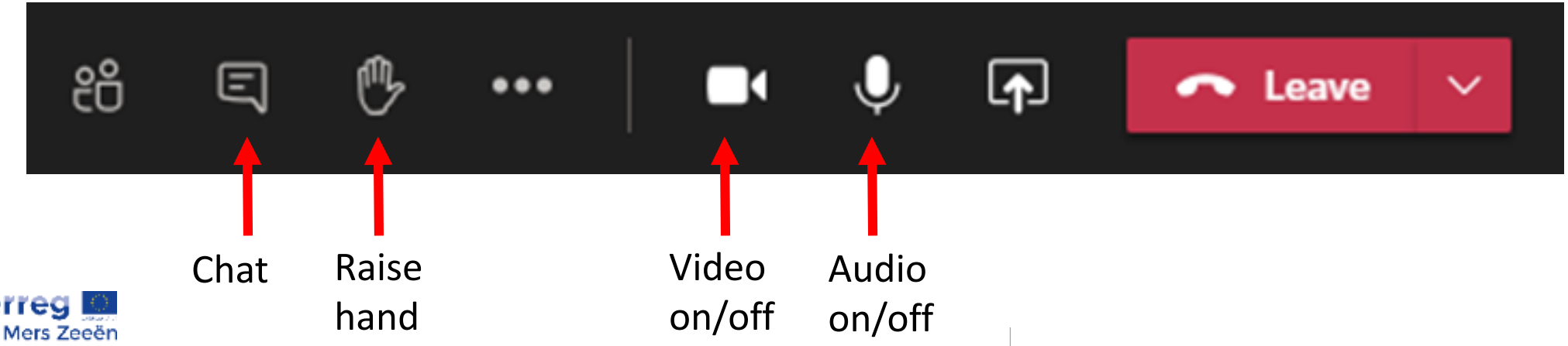
REAP conference
"From micro-scape to landscape: Innovating at the Frontiers"
10th Nov all day

Crops and non-chemical pest control – genetics, environment and biodiversity
12th Nov, 10am - 2pm

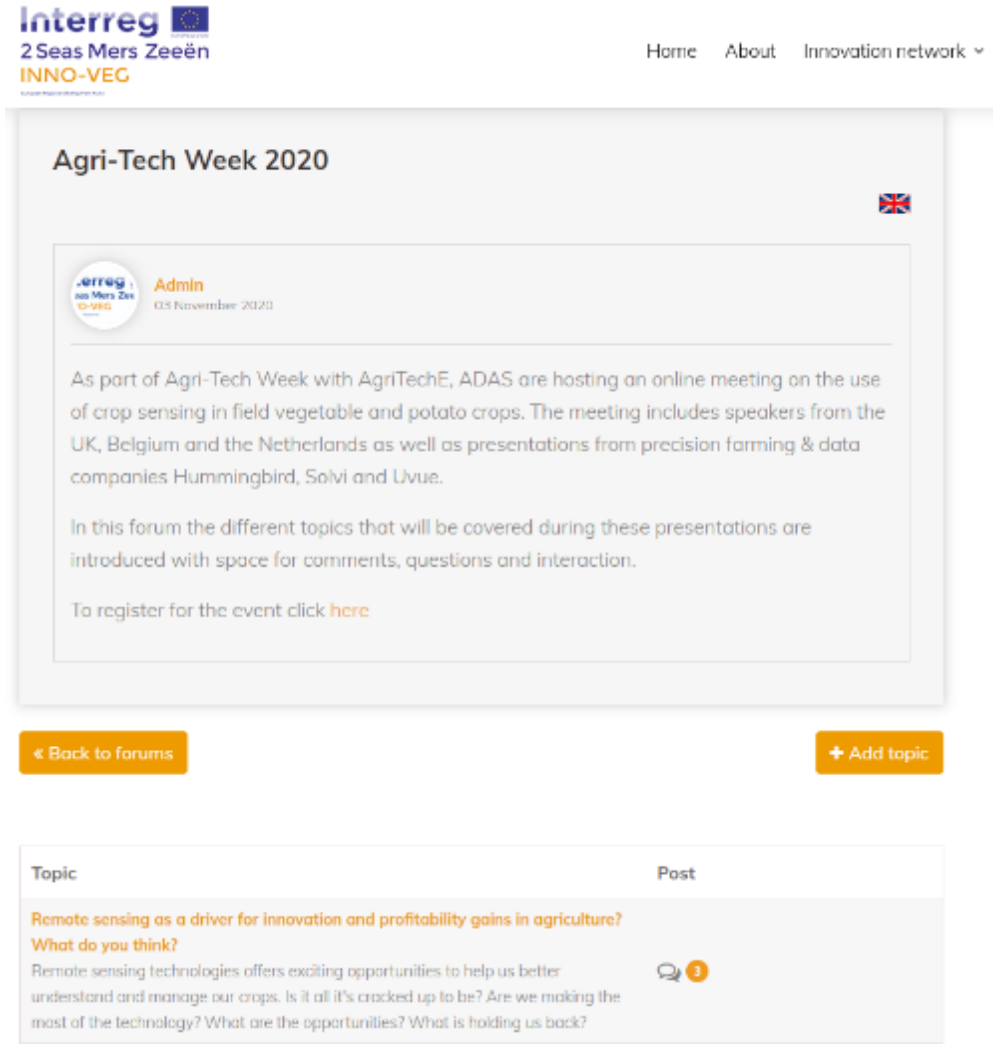
"Technologies to enhance soil monitoring and crop management"
11th Nov, 14.30pm – 17.30pm

Some ‘housekeeping’ rules

- Please turn your audio and video off unless you are speaking
- Raise your hand to ask a question
- Use the meeting chat to ask questions and for discussion during the meeting
- The meeting will be recorded
- 2 BASIS points are available – put your name in the chat & visit https://www.agri-tech-e.co.uk/agri-tech-week-basis-points/



Forum for the meeting on the INNO-VEG website



- Links to information presented
- Links to slides next week
- Register to add comments/ask questions
- https://www.inno-veg.org/en/Forum

Agenda

- Theory and practice: How to use Ag-tech in the real world? (Bert Rijk, Aurea Imaging, The Netherlands)
- Analysis of field scale crop reflectance data using ADAS Agronomics data analysis methods (Susie Roques, ADAS, UK)
- Crop sensing making sense? (Jacob van den Borne, Van den Borne Farm, The Netherlands)
- Validating precision ag tech for vegetables (Julie O'Halloran, Queensland University, Australia)
- Industry view – short presentations from commercial companies working in this area (Hummingbird, Solvi, Uvue)
- Questions and discussion

Discussion: Remote sensing as a driver for innovation and profitability gains in agriculture?

1. What are the biggest opportunities for remote sensing in agriculture in the next 5-10 years?

2. What are the main trends driving progress in the remote sensing sector?

3. What are the biggest challenges yet to be overcome?

Agri-Tech week: Crop sensing in field vegetable and potato crops

Bert Rijk – Aurea Imaging – November 9th 2020

Aurea

Drones, sensors & Crop Intelligence

Team

93% MSc or PhD degrees

14 employees

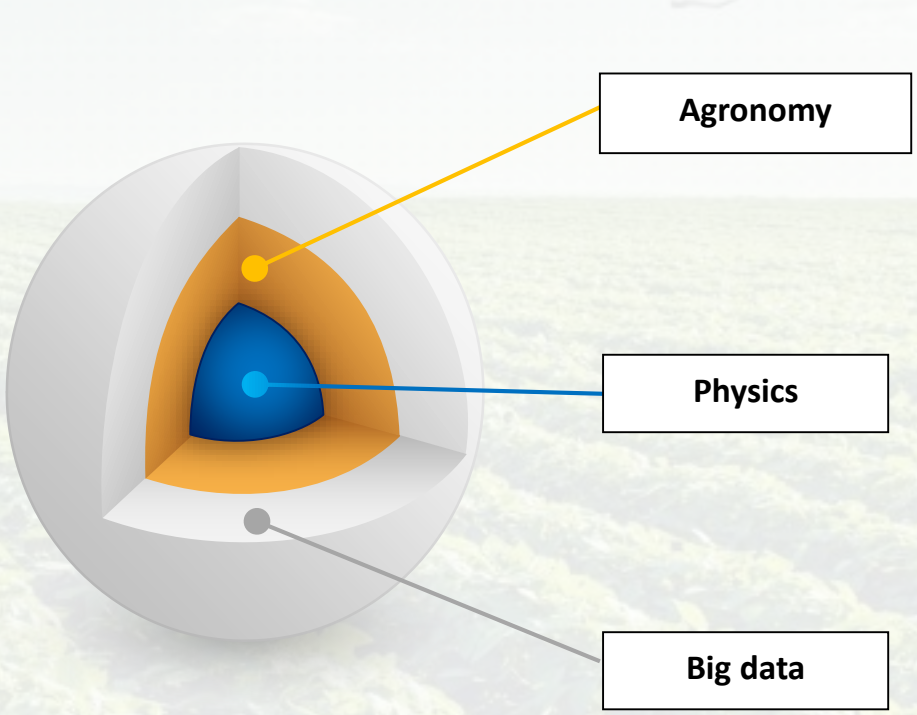
Self-funded

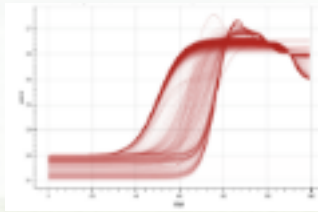
In-house AI development

What we do

Scalable data acquisition with unique analytics

‘Uber’ for drone pilots





Crop Intelligence

Drones

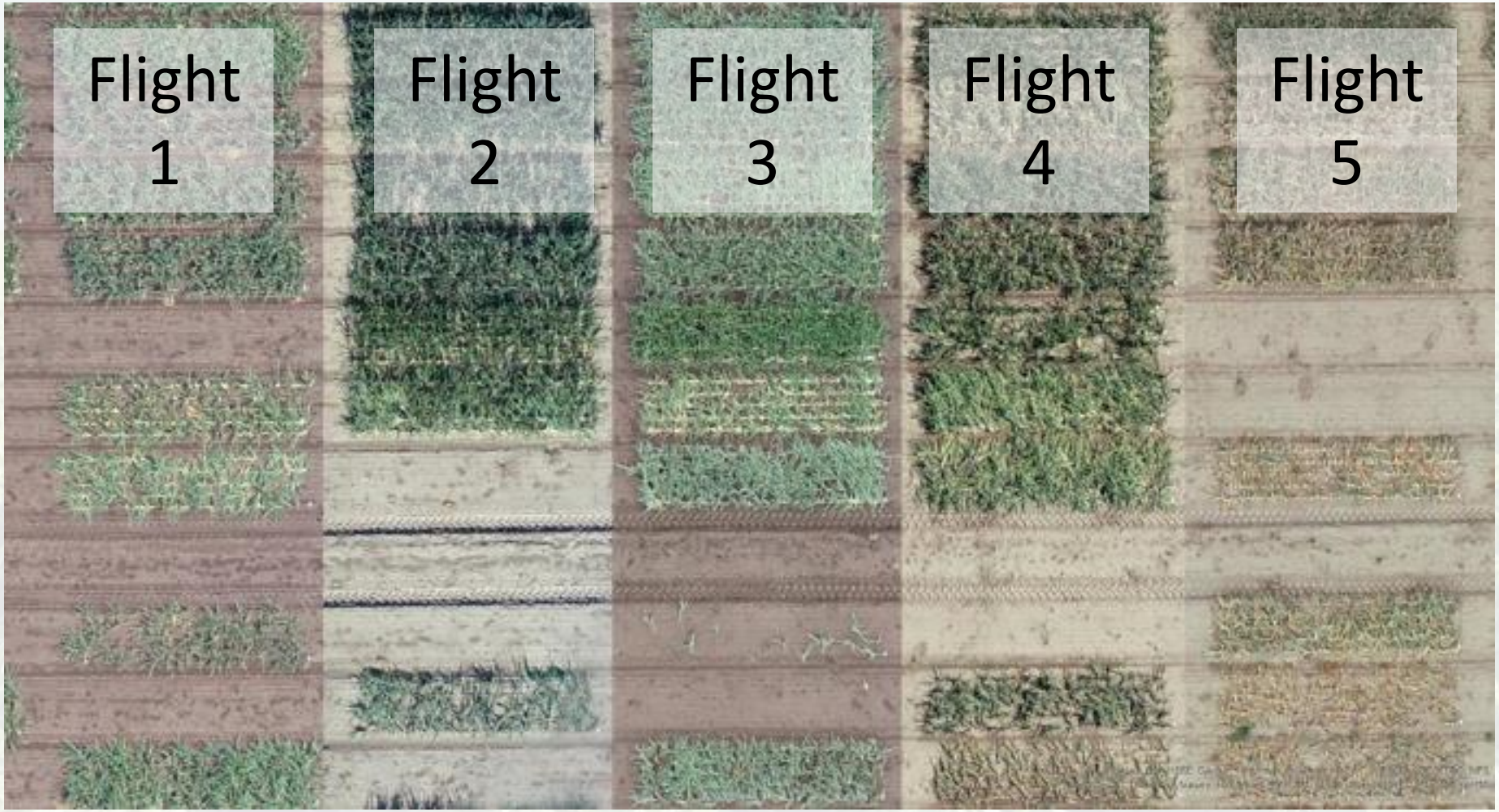
Fixed wing &
copter drones

Different sensors
- Visual
- Multispectral
- Thermal

Start simple!

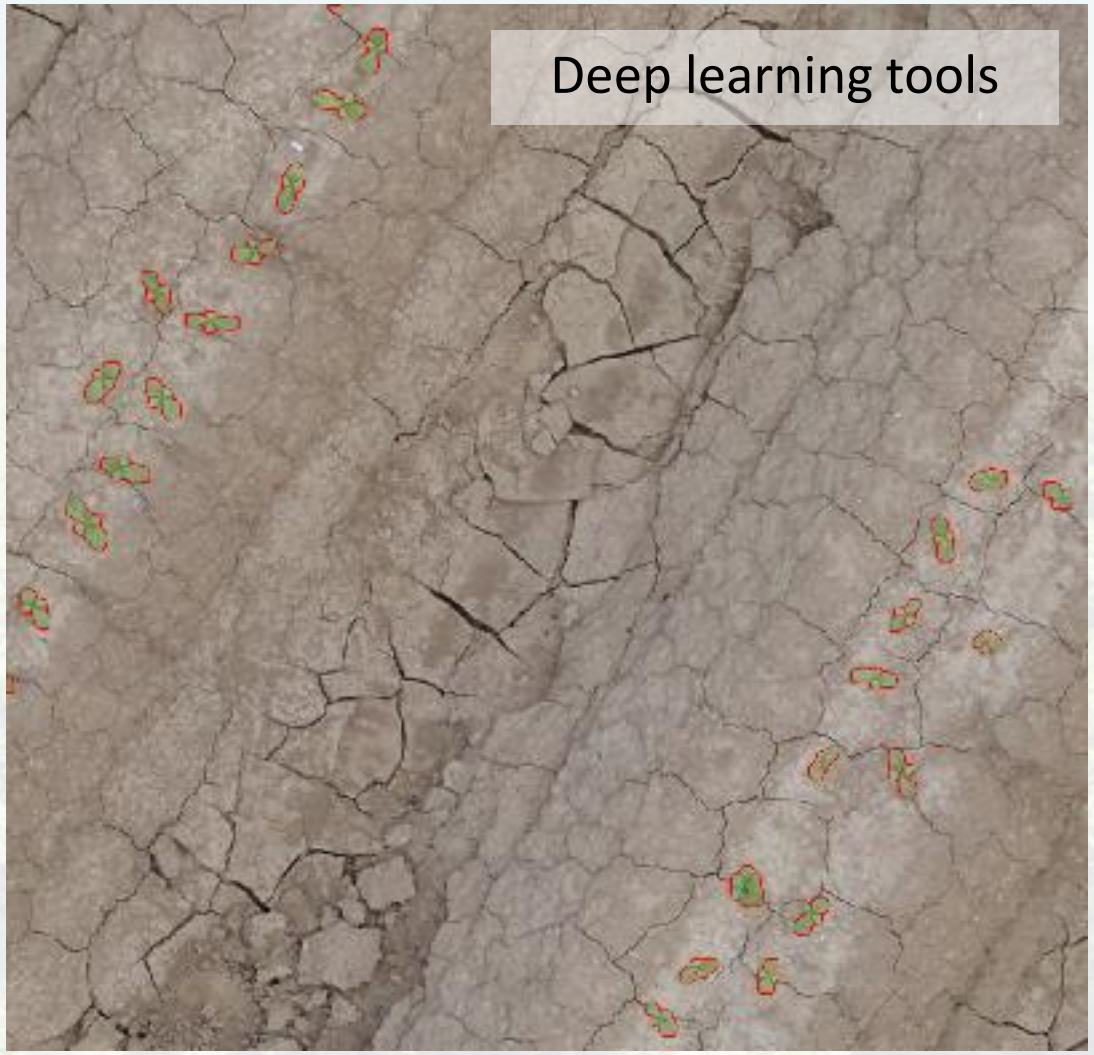
RTK Precision

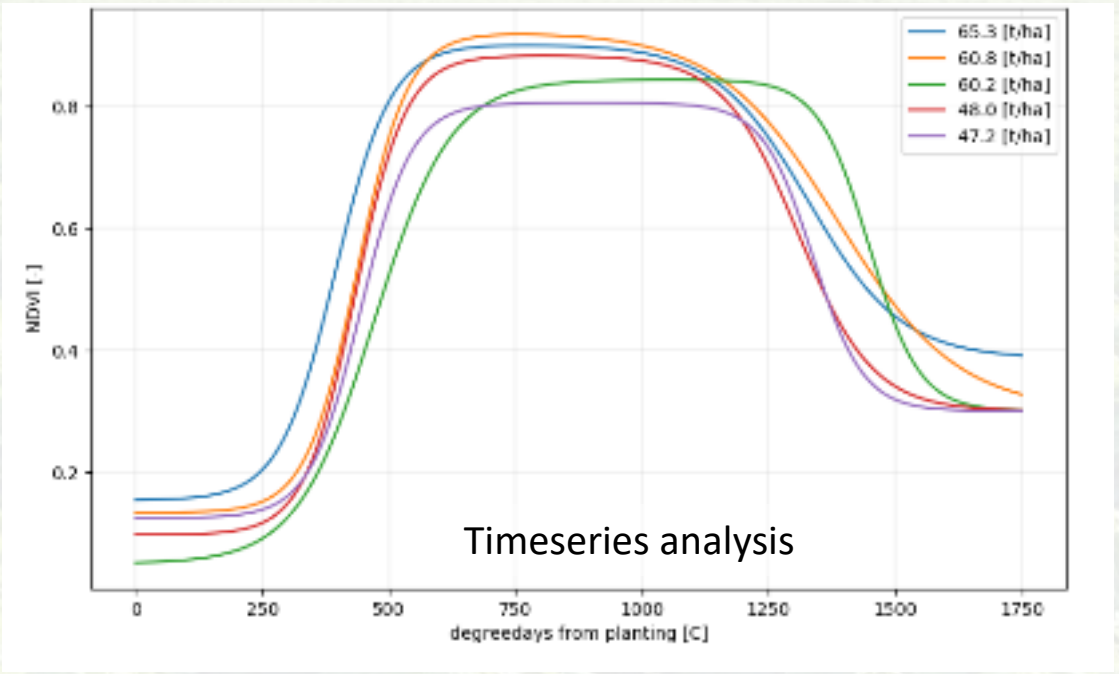
Perfect georeferencing

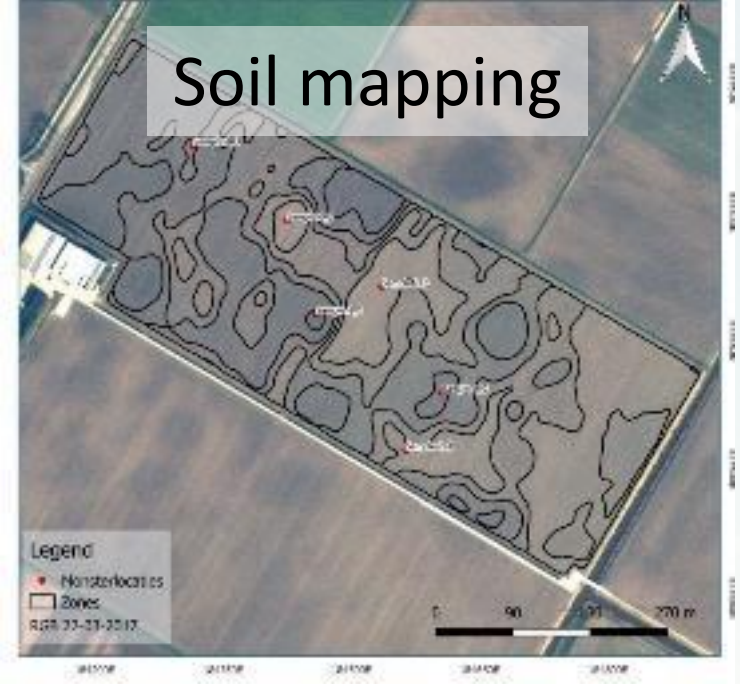


Data & tools

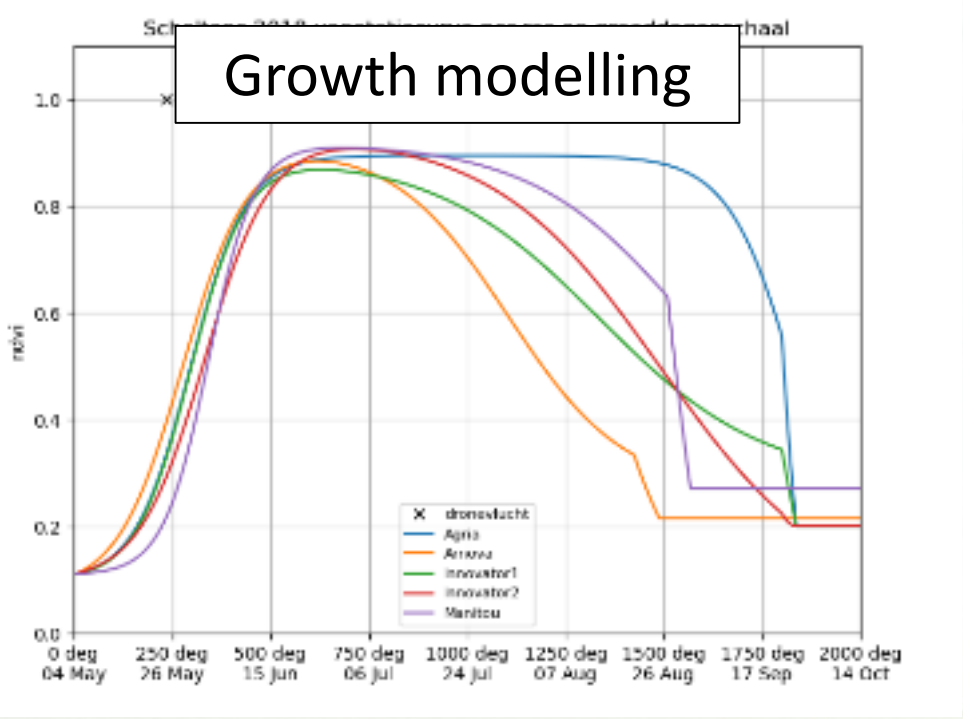

Point clouds

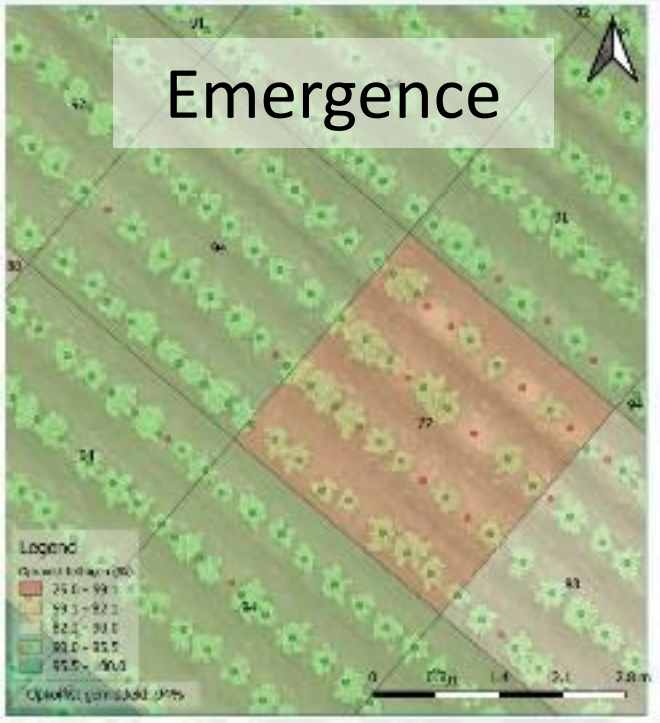

Deep learning tools


65.3 [t/ha]
60.8 [t/ha]
60.2 [t/ha]
48.0 [t/ha]
47.2 [t/ha]
NDVI [ ]
0.8
0.6
0.4
0.2
0
250
500
750
1000
1250
1500
1750
degreedays from planting [C]
Timeseries analysis

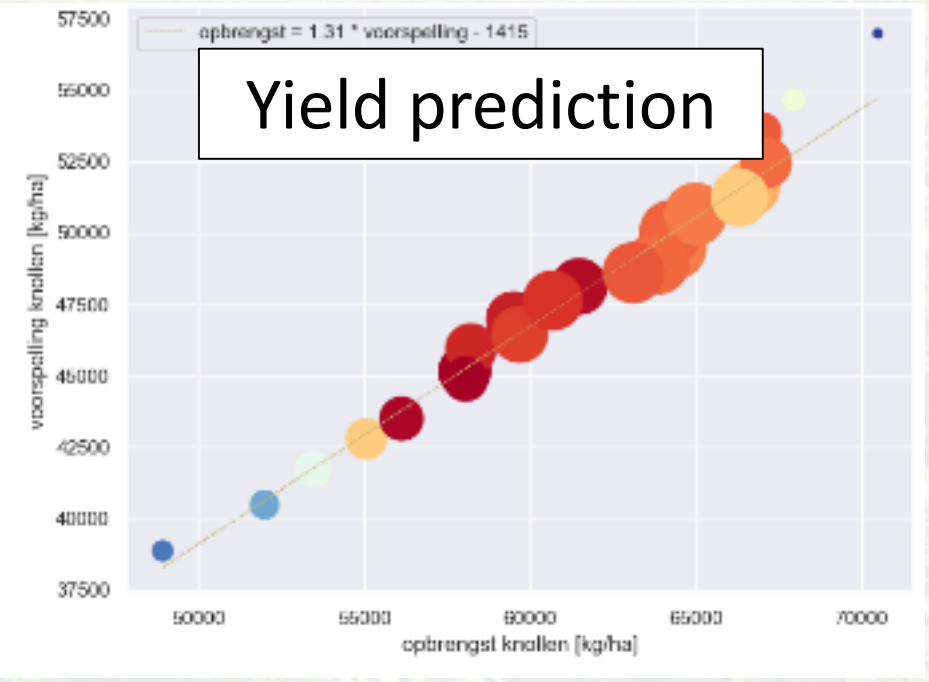


Potato





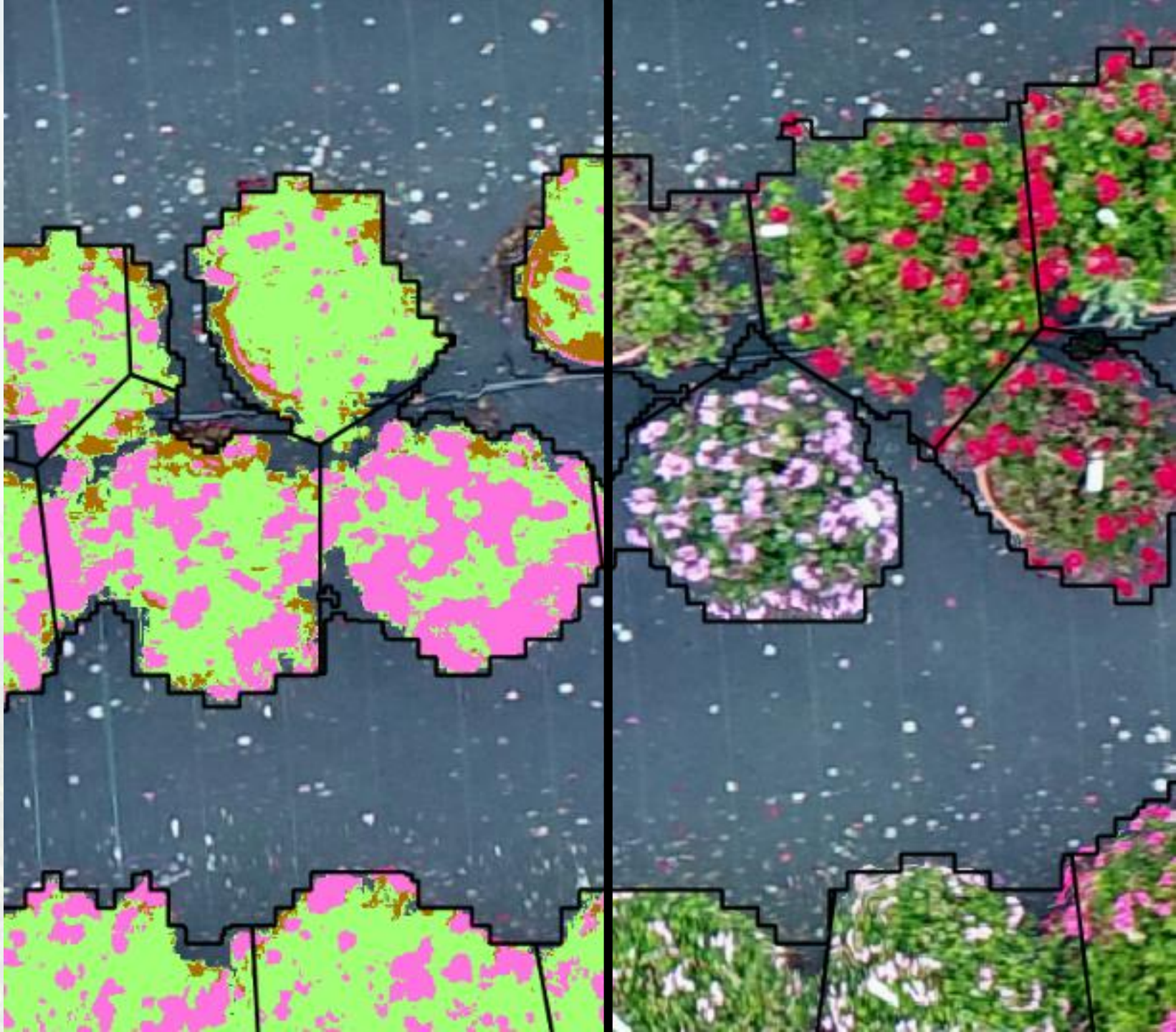
What can farmers manage?



Precision orchard management

Management on tree level

Flower breeding



Lessons learned

- Business first
- Don’t overpromise
- Focus
- Measure what you can manage

Precision horticulture ‘ecosystem’

BORECO

ABEMEC
Continu in beweging

Aurea Imaging
the crop intelligence company

GPX SolutionsBV

RAVEN

WAGENINGEN
UNIVERSITY & RESEARCH

Delphy

Future: Digital Twins

- Towards a ‘Digital Twin’ of the field: IoT + AI
- Further understanding of field characteristics & plant physiology variation
- Agronomic advice on fertilizer & irrigation
- Automated Decision Support

Kubota & Aurea Imaging Pilot - Quarterly report, July 2020

Framework conditions for innovation

Analysis of field scale crop reflectance data

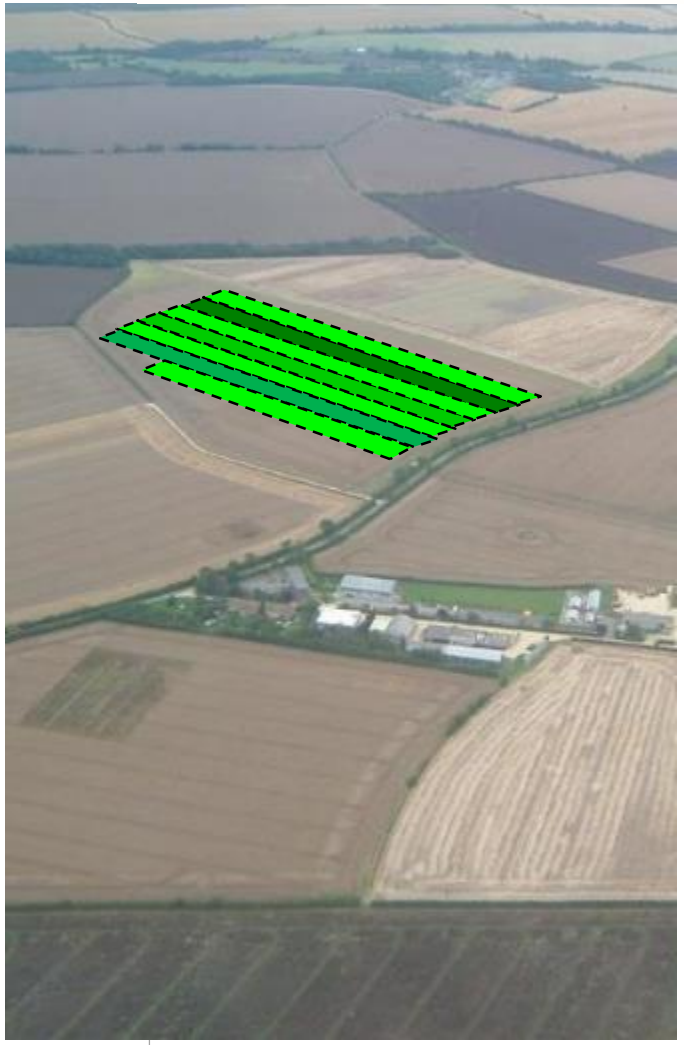
Susie Roques, ADAS

@InnoVeg #INNOVEG #ATW20

Agronomics field scale experimentation

Agronomics

- Agronomics approach developed 2013-2017 for cereal yield maps
- New statistics to model treatment effects, after accounting for underlying spatial variation
- New software to clean, process and analyse yield map data
- Statistics and software also work for other spatial data, e.g. drone/satellite crop reflectance



Innovate UK
Technology Strategy Board

AG Space

BASF
The Chemical Company

BGS 1835

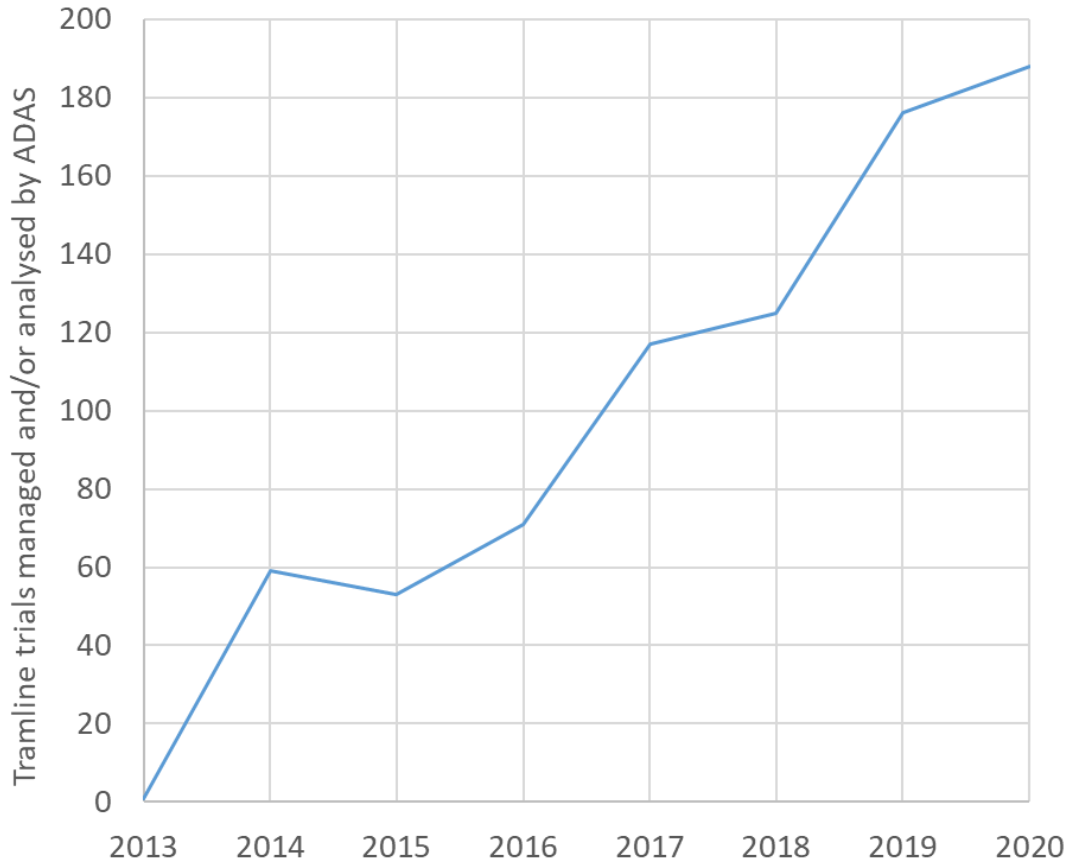
Harvesting the future
TRIALS EQUIPMENT

vsn

Interreg
2 Seas Mers Zeeën
INNO-VEG

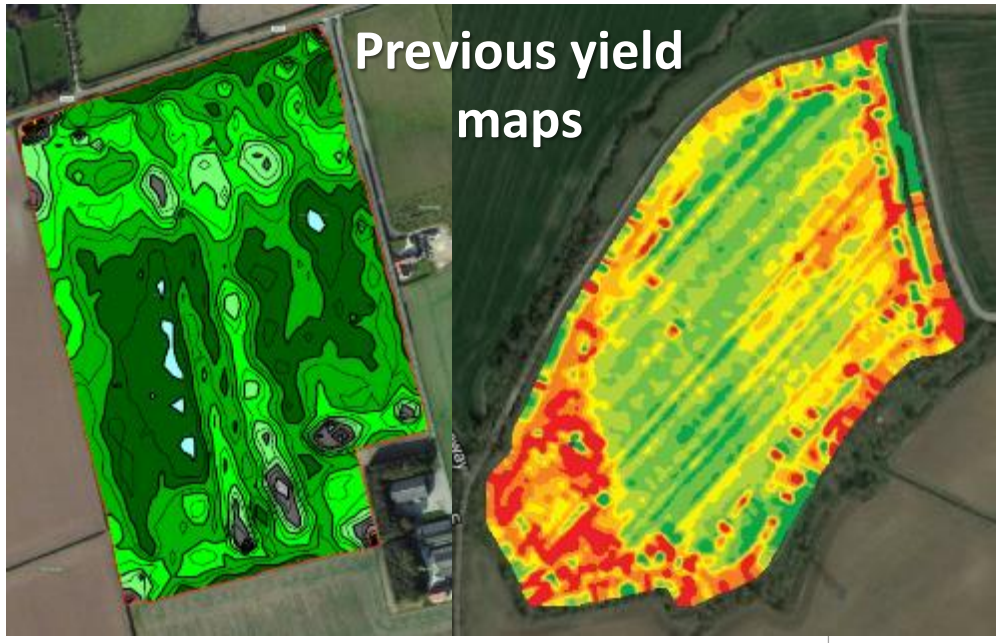
Growth of Agronomics

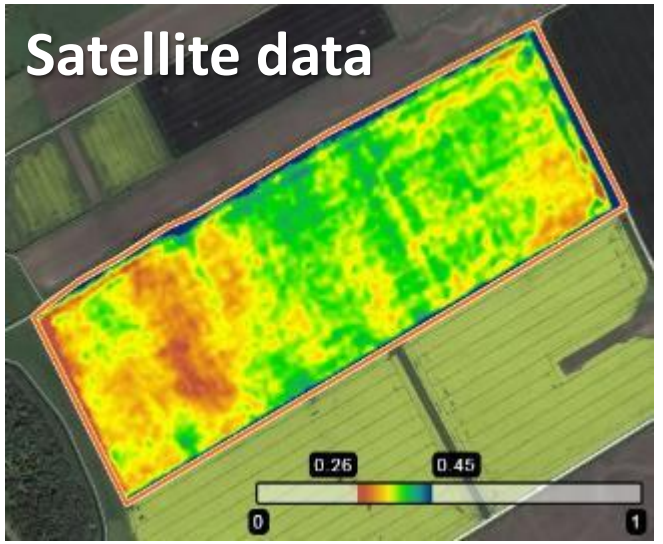
- Crops include WW, WB, SB, triticale, OSR, forage maize, grass sileage, grass seed, vining peas, onions
- Topics include fungicides, herbicides, fertilisers, VR N, VR PGR, VR drilling, biostimulants, cover crops, cultivations
- Data types include yield maps, quality maps, satellite NDVI, drone NDVI

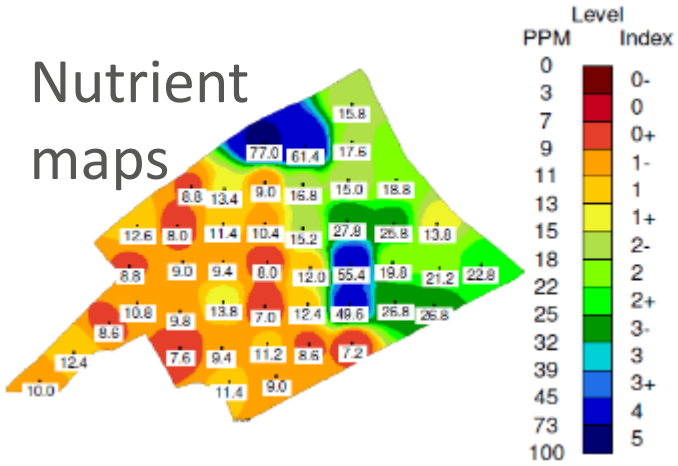


Field choice

- Even fields give more precise results
- Variation across the tramlines is acceptable
- Variation in line with the tramlines is a problem







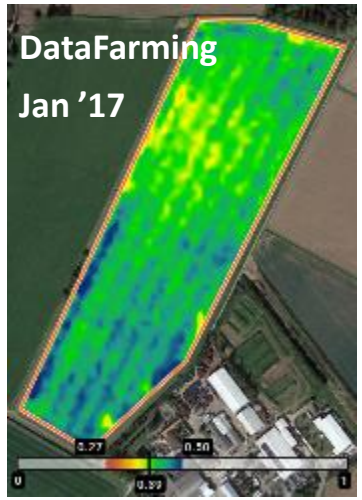
Trial design

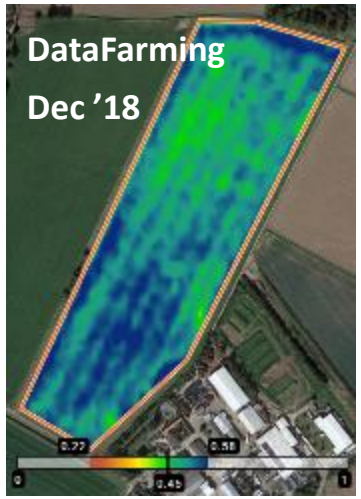
- Avoid confounding treatments with underlying variation
- Best to test fewer treatments
- Replication improves precision / confidence

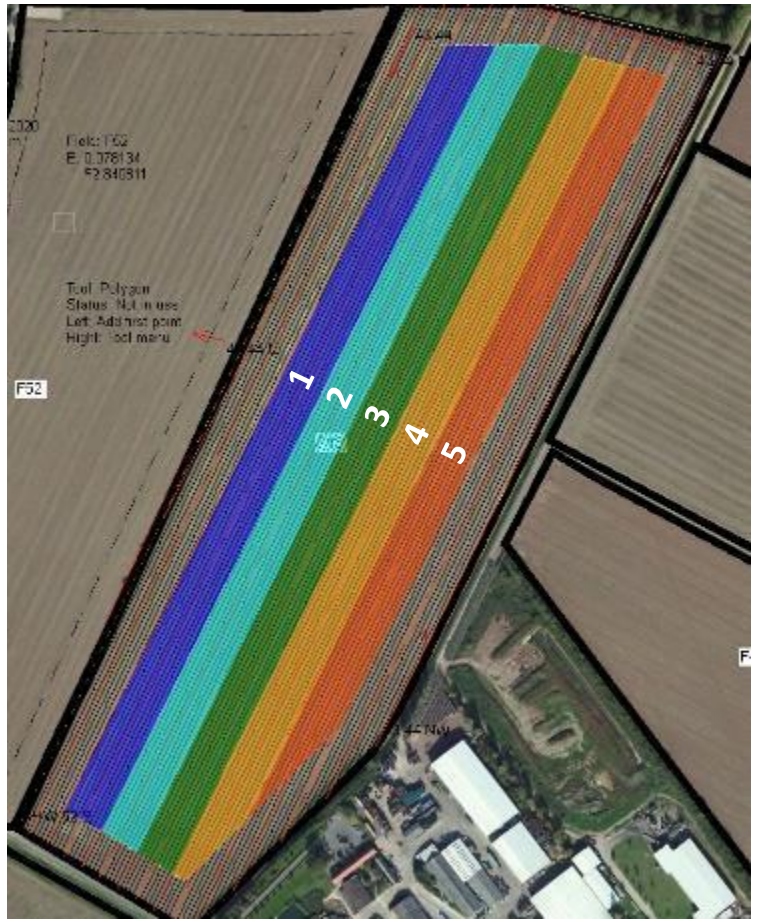
Two test treatments interspersed with farm standard

Case study 1: vining peas – trial design

- Five unreplicated fertiliser treatments
- Plots one tramline (36m) wide
- RGB and NDVI images of previous crops show persistently poor area in NW corner

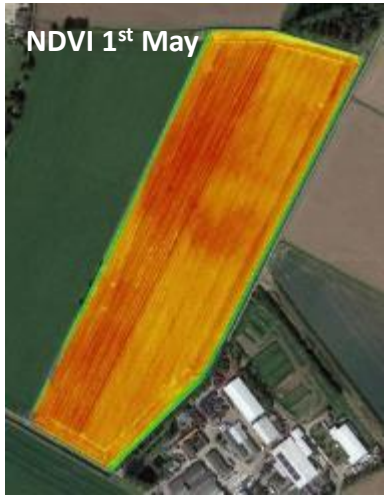


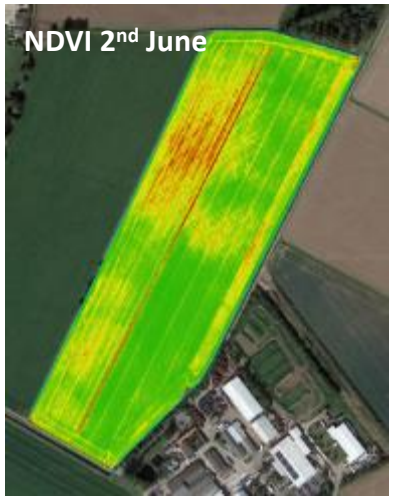


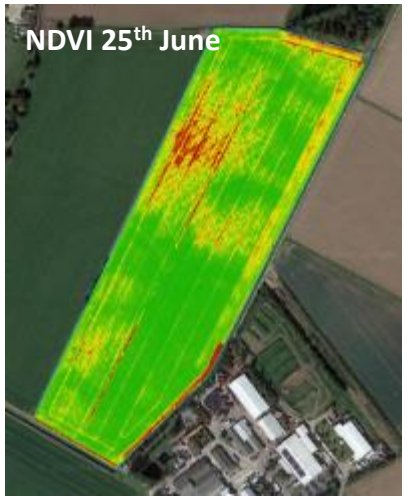


Vining peas – new drone imagery

- Poor patch in northwest corner persisted in 2020
- Additional variation not noted in previous crops: low NDVI coinciding with treatments 1 & 2
- Multispectral images 9th June and 25th June included reflectance at five wavelengths (MicaSense Red Edge drone mounted sensor)

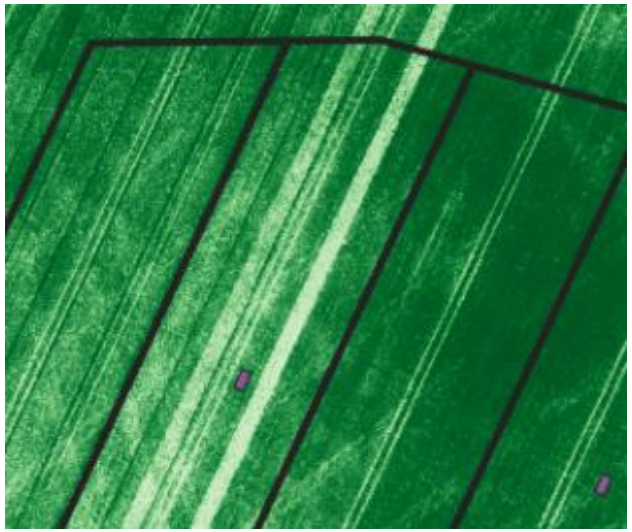




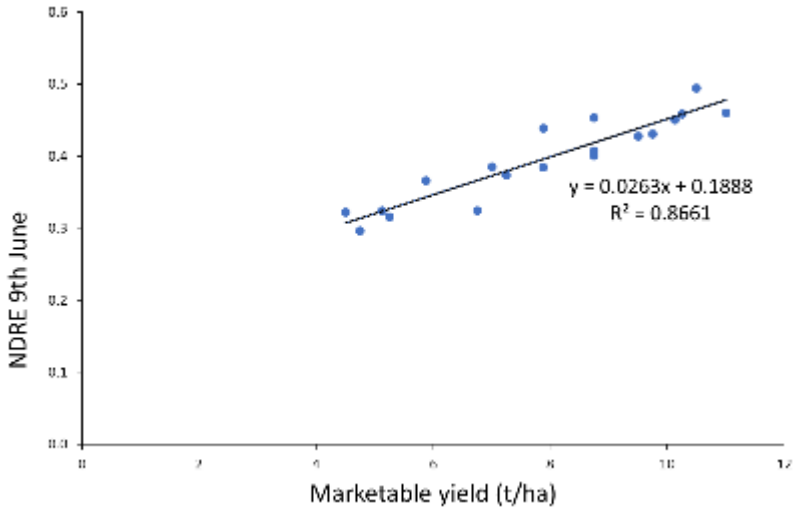


Vining peas – ground truthing

- 20 yield validation plots (4 per treatment); 2m x 4m
- Sampled mean MS bands for each sample plot
- Calculated VIs from averaged MS bands
- Correlated VIs with sample plot marketable yields



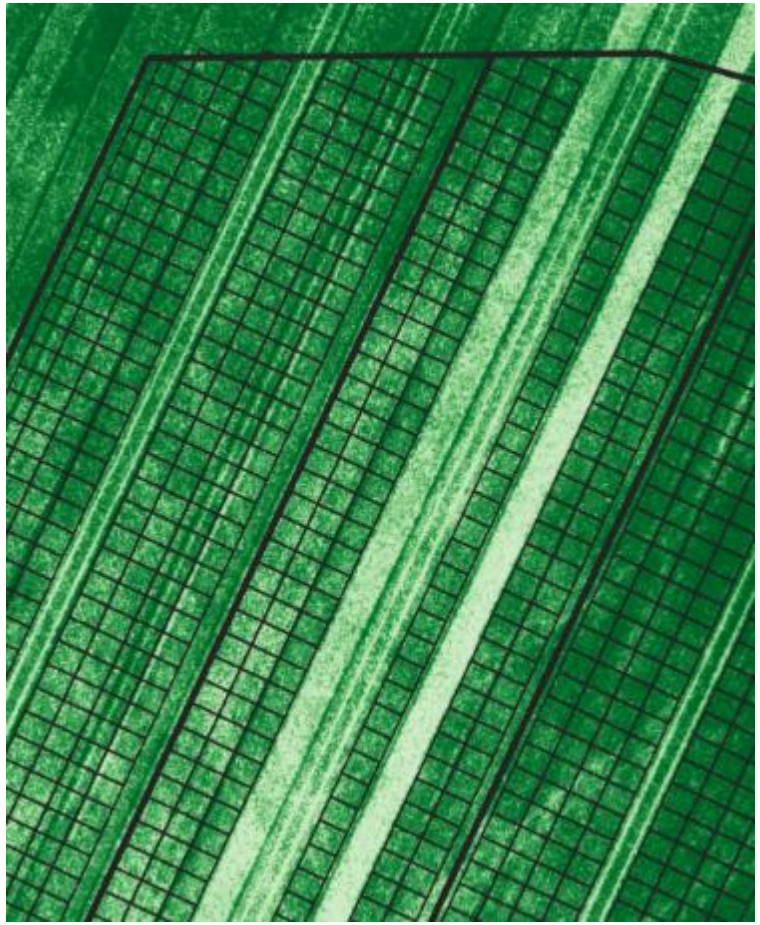
	1st flight (9 June)	2nd flight (25 June)
NDVI	0.86	0.70
MCARI2	0.83	0.77
Clgreen	0.85	0.71
Clrededge	0.85	0.71
MTCI	0.81	0.67
NDRE	0.87	0.70
REIP	0.85	0.62



Vining peas – data processing

Agronomics analysis requires point data, with rows of points in line with treatments

1. Created grid of cells 3.5m wide x 3m long
2. Four rows of cells placed in each half tramline, avoiding wheelings, drill misses and treatment boundaries
3. Mean values for each wavelength calculated for each cell, then converted to points
4. Vegetation indices calculated from averaged data



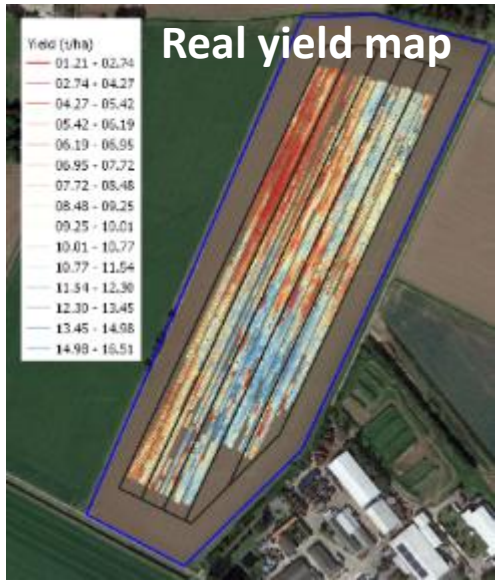
Vining peas – trial results

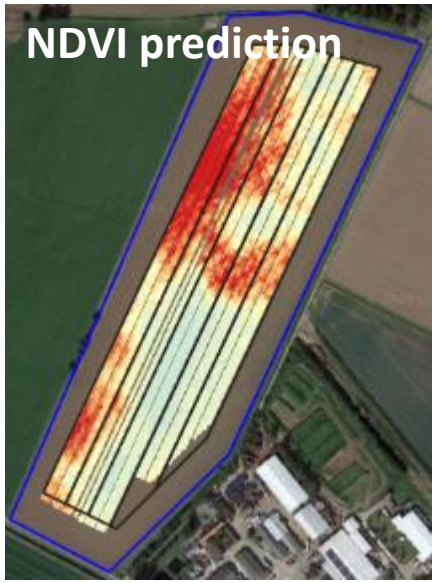
- Yield map supplied by farmer, using fleet of bespoke yield mapping viners.
- Predicted yield maps created from NDRE and NDVI (first drone flight), according to correlations with sample plot yields.
- Results very similar, but far more precise with predicted yields

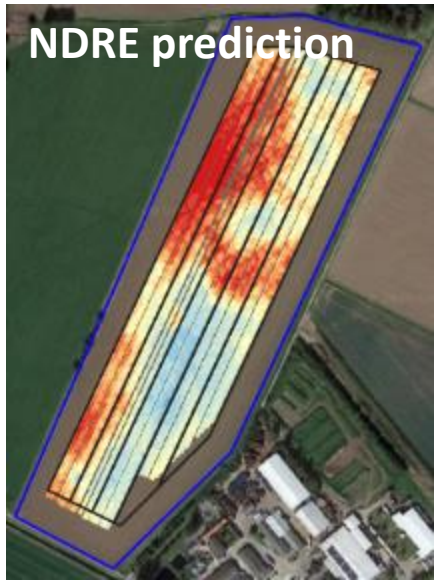
	Yield from yield map	
Treatment	Mean	Modelled difference from trt 3, with 95% confidence interval
1		-3.29 ± 1.44
2		-1.25 ± 1.35
3	9.76	
4		0.41 ± 1.31
5		0.03 ± 1.39

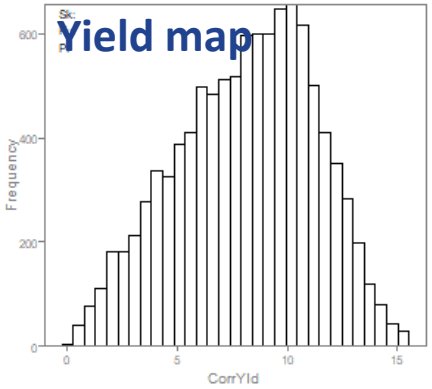
Vining peas – real vs predicted yield maps

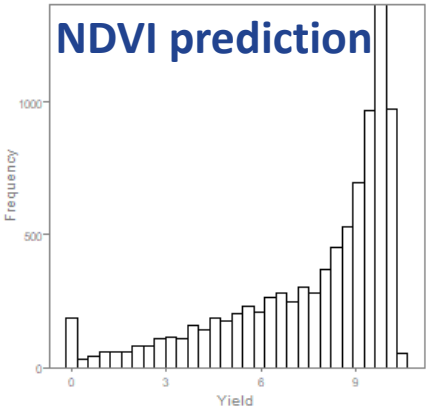
- Real yield map may overestimate field average, as data cleaning removes wheelings, poor patches, etc.
- NDVI prediction underestimates high yields due to saturation.
- NDRE prediction appears closest to real yield map.

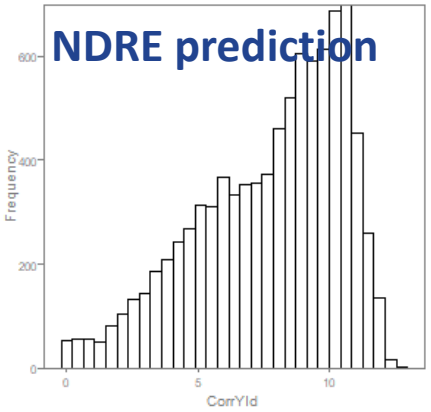








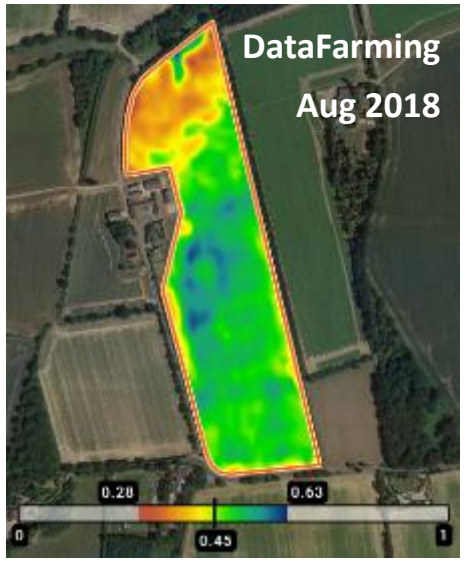


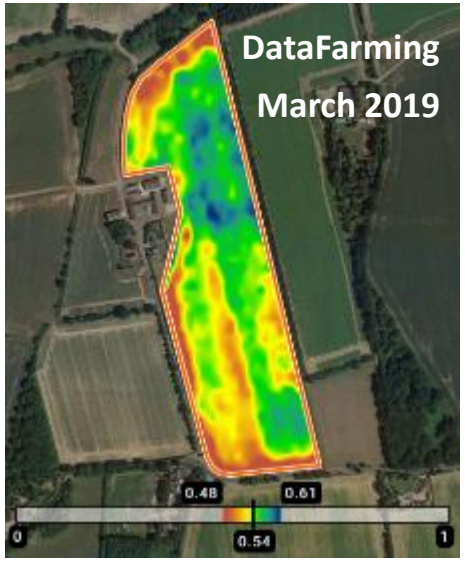


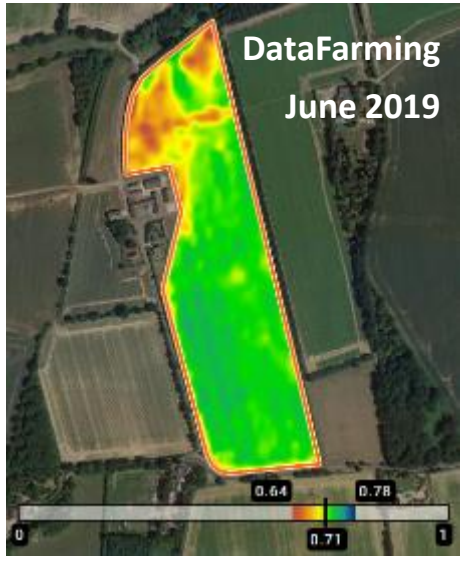
Case study 2: onions – trial design

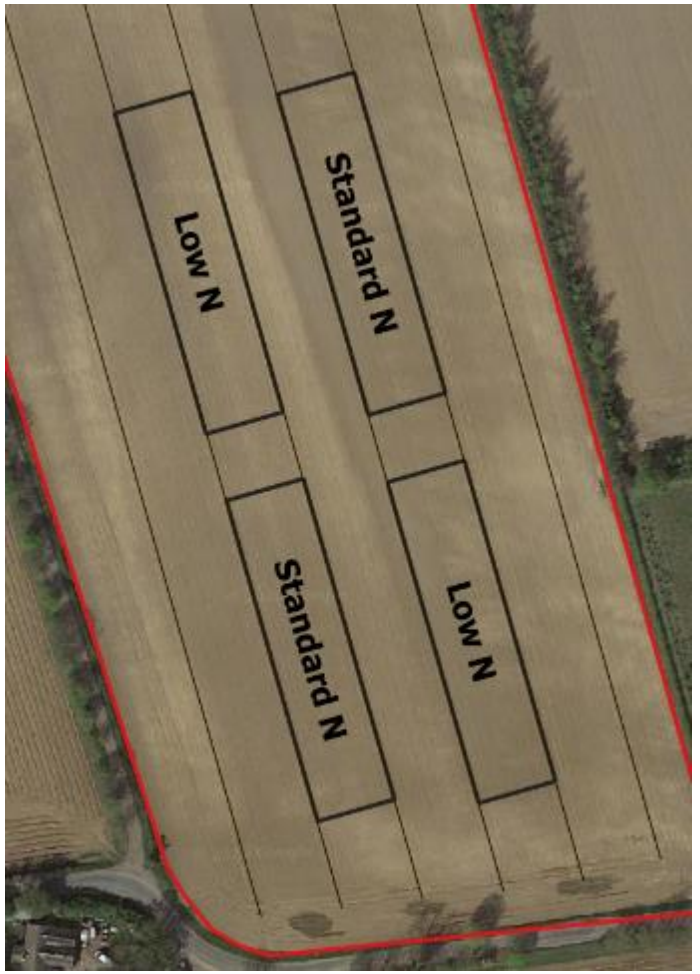
P.G.RIX (FARMS) LTD

- Two replicated N rate treatments, applied to pairs of 24m tramlines
- Trial focused in south end of field as more even



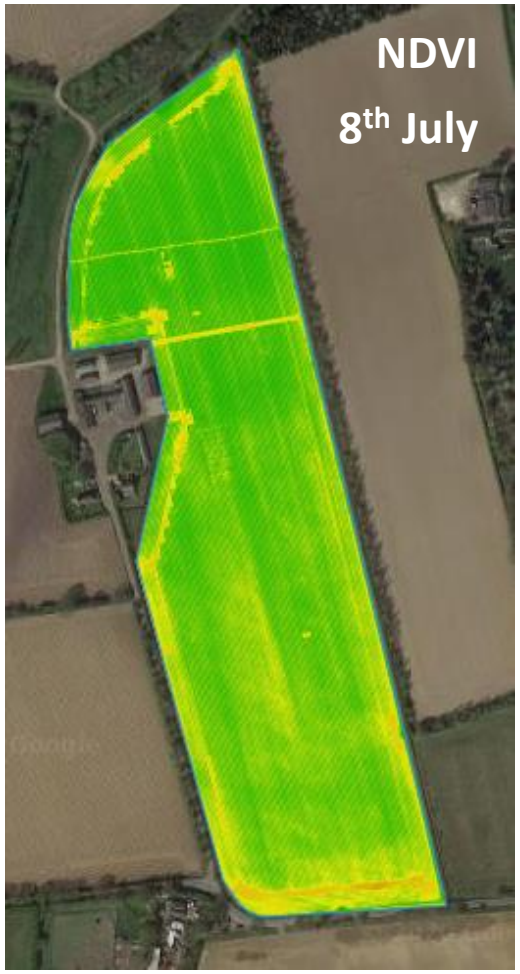


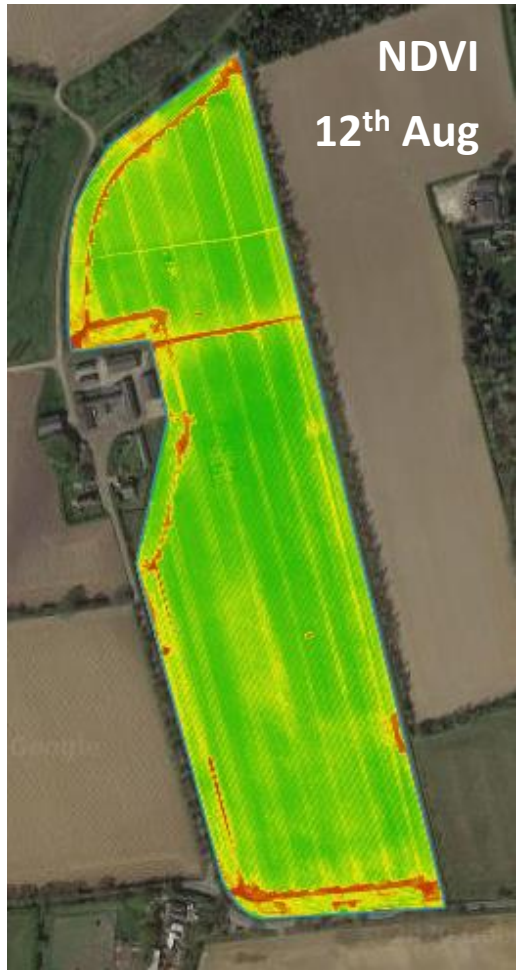




Onions – new drone imagery

- Multispectral images supplied for 8th July and 12th August (MicaSense Red Edge drone mounted sensor)
- Low N areas visible as lower NDVI

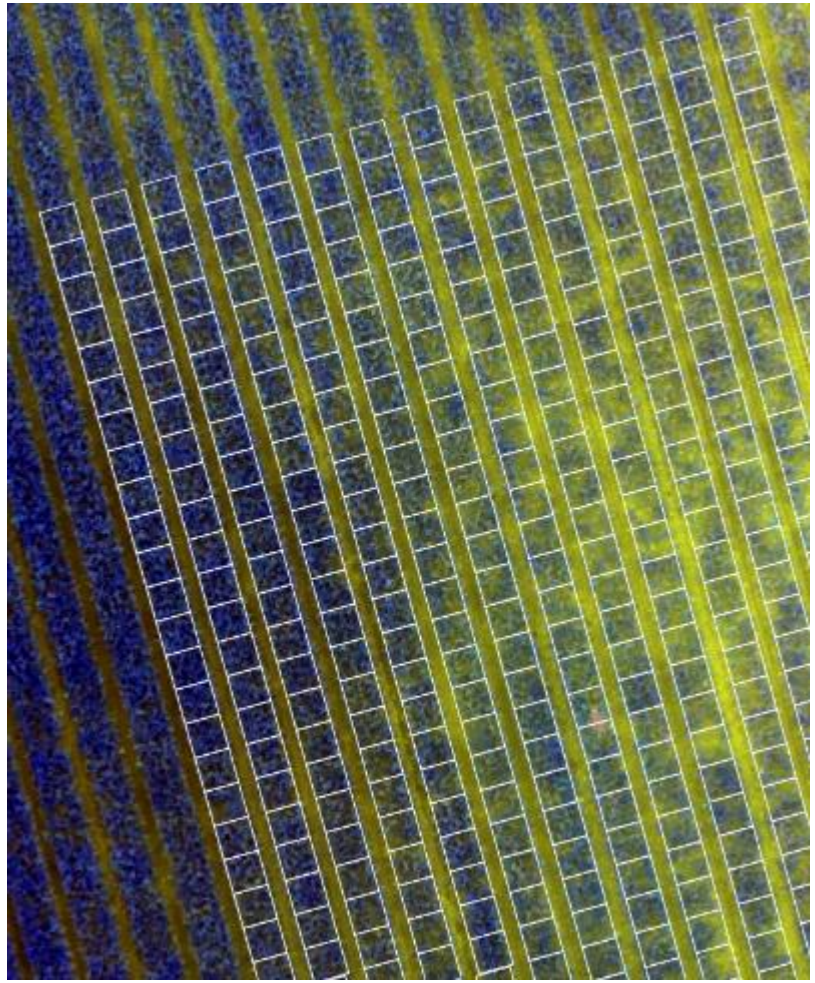




Onions – data processing

Crop grown in beds 1.5m wide with 0.5m gaps

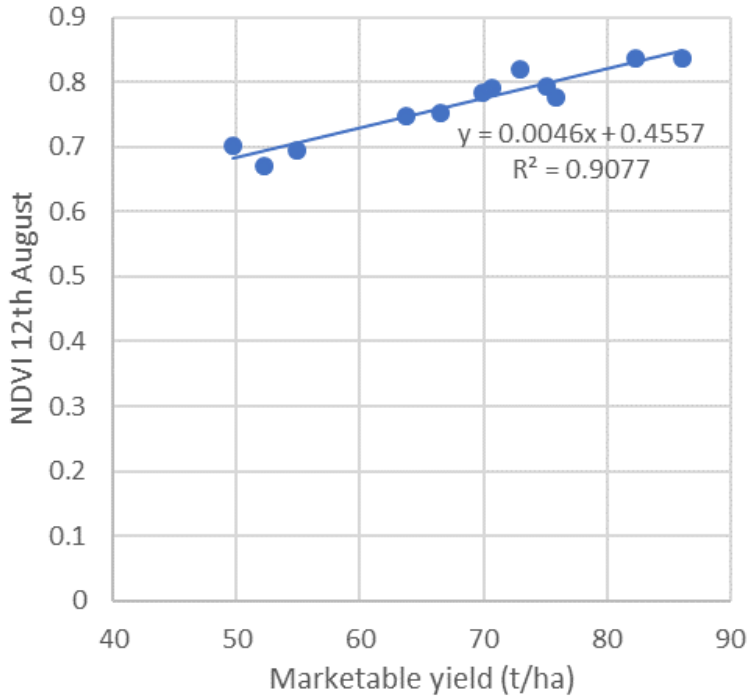
1. Created grid of cells 1.3m wide x 1.3m long
2. Placed cells along beds, avoiding bare soil
3. Mean values for each wavelength calculated for each cell, then converted to points
4. Vegetation indices calculated from averaged data

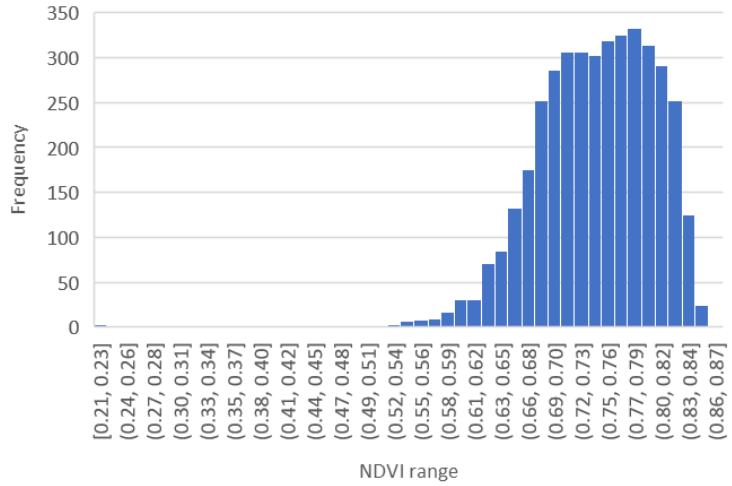


Onions – ground truthing

- 12 yield validation plots (3 per plot); 1 bed x 8m
- Sampled mean MS bands for each sample plot
- Calculated VIs from averaged MS bands
- Correlated VIs with marketable yield

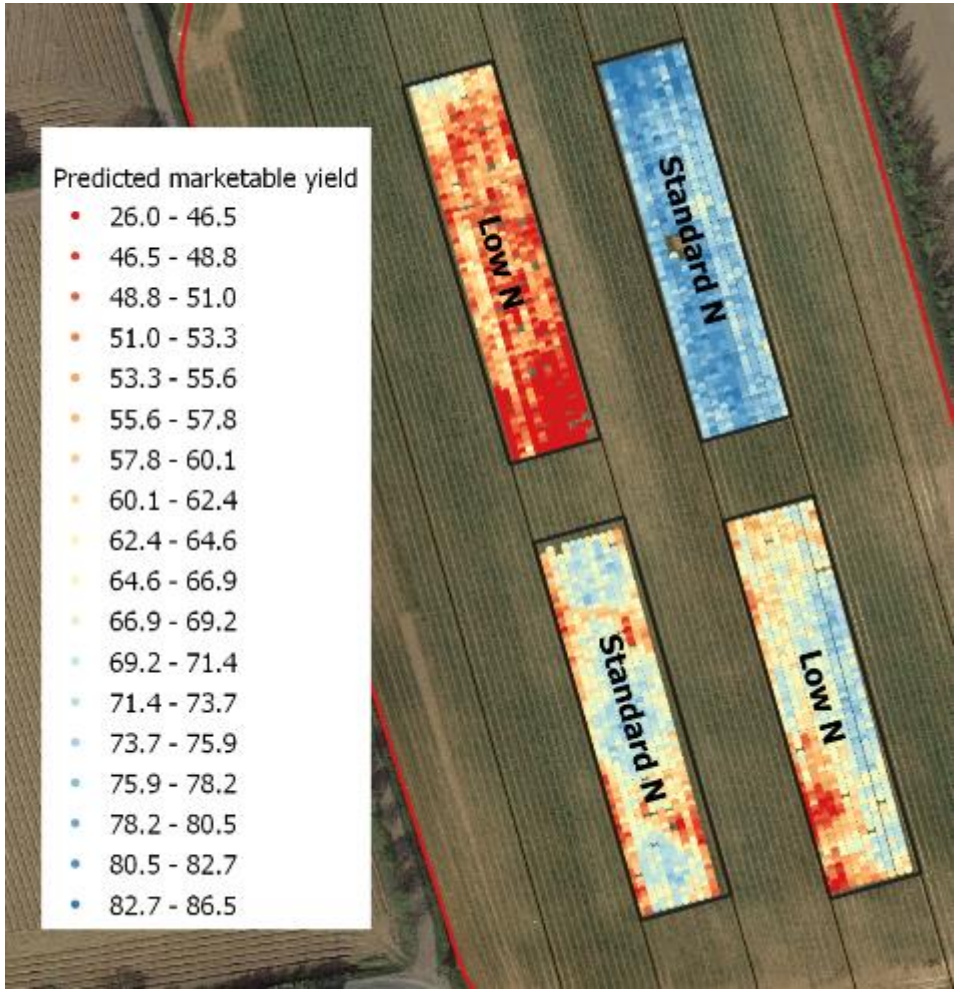
	1st flight (8 July)	2nd flight (12 Aug)
NDVI	0.89	0.91
MCARI2	0.75	0.82
Clgreen	0.90	0.87
Clrededge	0.87	0.84
MTCI	0.84	0.50
NDRE	0.89	0.86
REIP	0.89	0.48





Onions – trial results

- Predicted yield map created from NDVI (second drone flight), according to correlation with sample plot yields.
  - Average yield at standard N: 71.2 t.ha
  - Yield benefit of standard N rate over low rate: 12.9 t/ha ± 1.4 (95% confidence interval)
- Vegetation indices also analysed directly
  - All VIs from both flights significantly higher for standard N rate than low rate



Conclusions

- Crop reflectance data can correlate well with marketable yield
- Field scale experiments can be assessed accurately and efficiently using remote sensing data and Agronomics statistics
- Trials should be laid out with reference to underlying soil variation
- Treatments should be replicated where possible

Interreg
2 Seas Mers Zeeën
INNO-VEG
European Regional Development Fund

Questions?

Susie.Roques@adas.co.uk


van den borne
aardappelen

The company

VAN DEN BORNE AARDAPPELEN

- Arable farming , Sandy soil
- Reusel, Noord-Brabant - The Netherlands, 80% fields Belgium 20% fields The Netherlands
- 6 co-workers
- 180 fields, average size 3ha, average of 6 corners per field = 13 % overlap
- Precisiontechnology since 2006, Precision Farming since 2009
- Main crop potatoes, storage capacity of 32.000 tonnes

Precision Farming

VAN DEN BORNE AARDAPPELEN

What is the definition of precision Farming ?

Precision Farming

VAN DEN BORNE AARDAPPELEN

Accuracy of Precisionfarming ?

1% population farmer	5% population farmer	90% population farmer	100% population farmer
21e century Land consolidation	*After WOII Sicco Mansholt*	*750 BC until 500 AD Roman period*	

Precision farming cycle

VAN DEN BORNE AARDAPPELEN

WINTER

1 Mapping fields

2 Soilscan

3 Calculate tramlines

SPRING

4 Organic fertilizer

5 Soil cultivation

6 Variable planting

SUMMER

7 Crop sensing

8 UAV sensing

9 Crop spraying

10 Irrigation

11 Crop measuring

12 Variable fertilizing

AUTUMN

13 Harvesting

14 Storage

15 Organic fertilizer

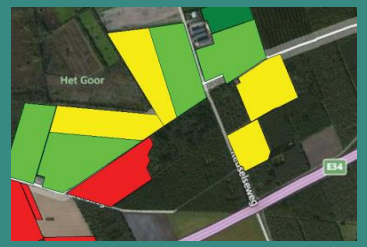
16 Cover crop

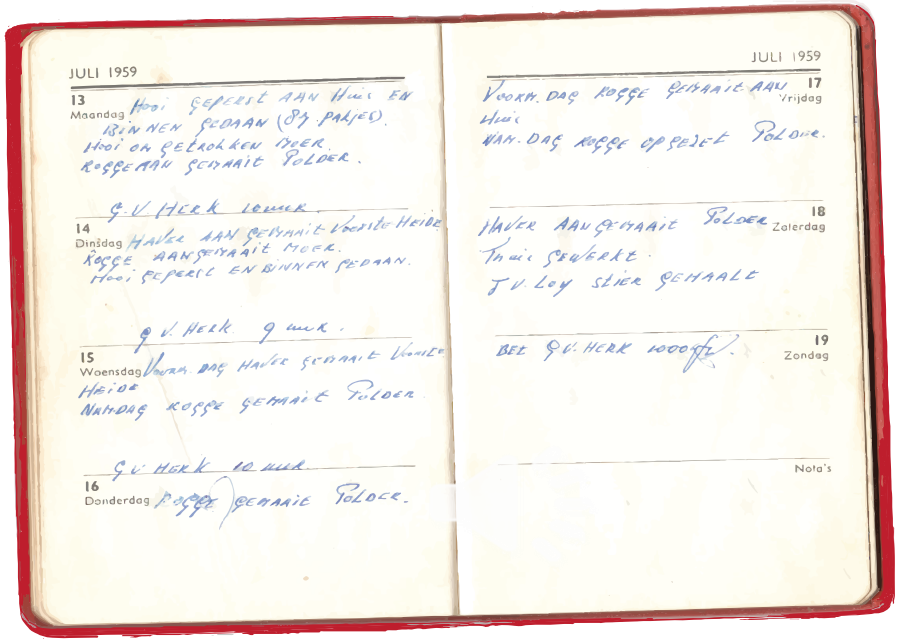
Mapping fields

VAN DEN BORNE AARDAPPELEN

1

Mapping fields





VARIO DOC

TASKDOC

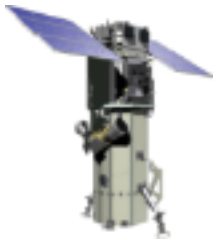
DACOM

Crop sensing

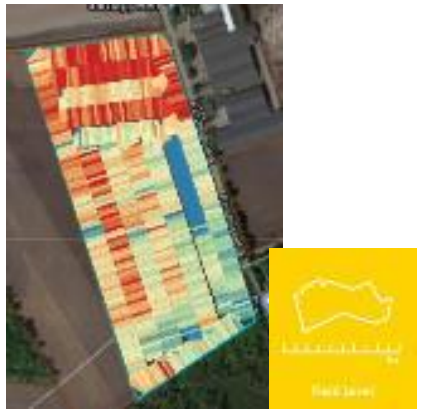
VAN DEN BORNE AARDAPPELEN

7

Crop sensing



Sensor data → Remote sensing → UAV sensing

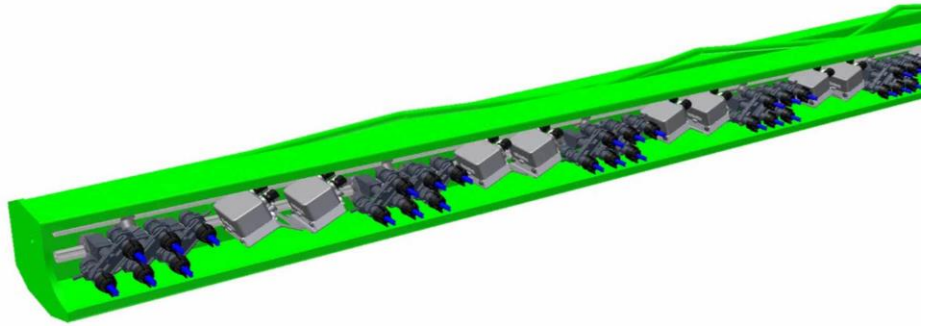


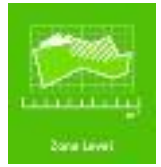
Crop sensing

VAN DEN BORNE AARDAPPELEN

7

Crop sensing



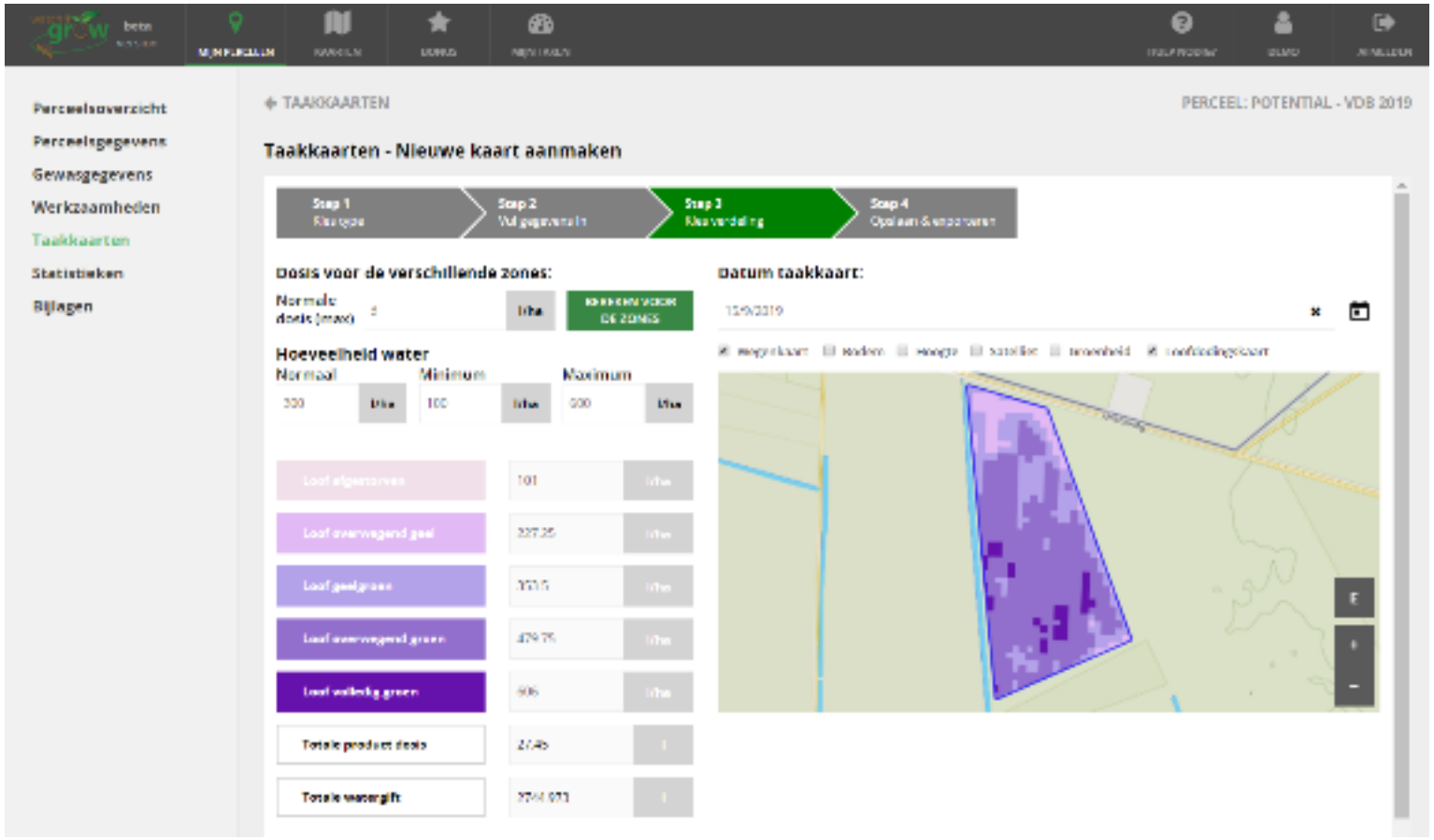


Crop sensing

VAN DEN BORNE AARDAPPELEN

7

Crop sensing



UAV Sensing

VAN DEN BORNE AARDAPPELEN

8

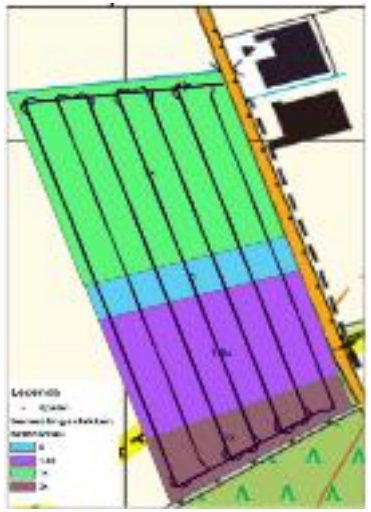
UAV sensing

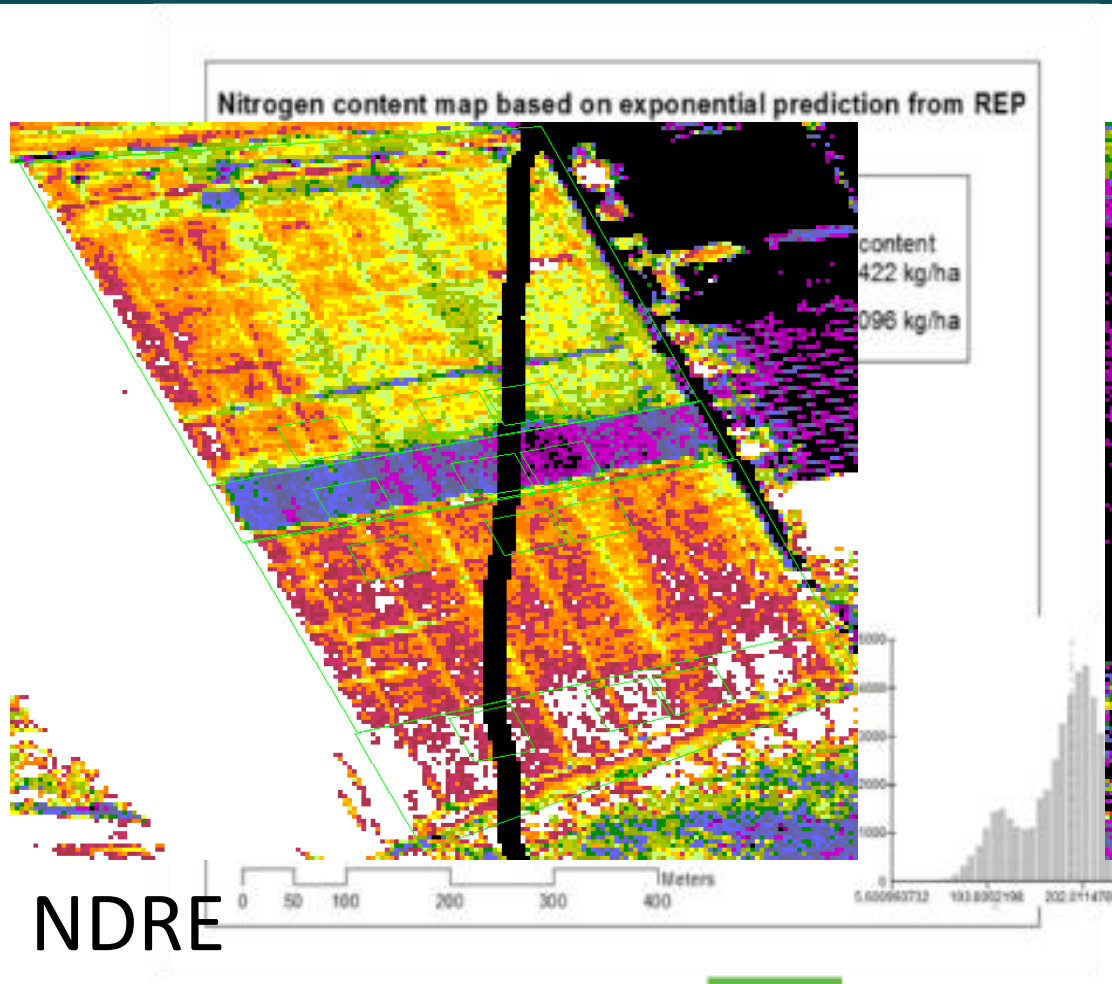
UAV Sensing

VAN DEN BORNE AARDAPPELEN

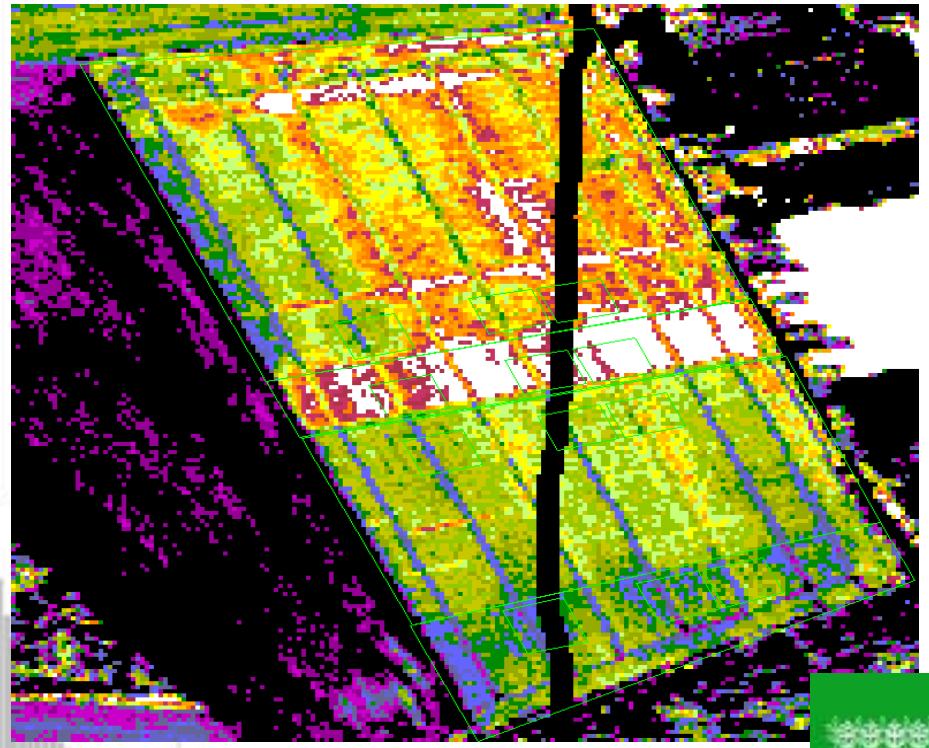
8

UAV sensing





NDRE



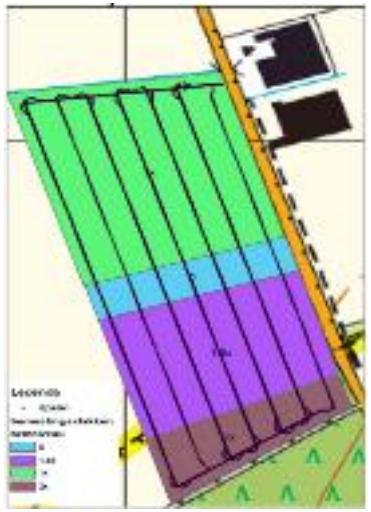
TCARI/OSAVI

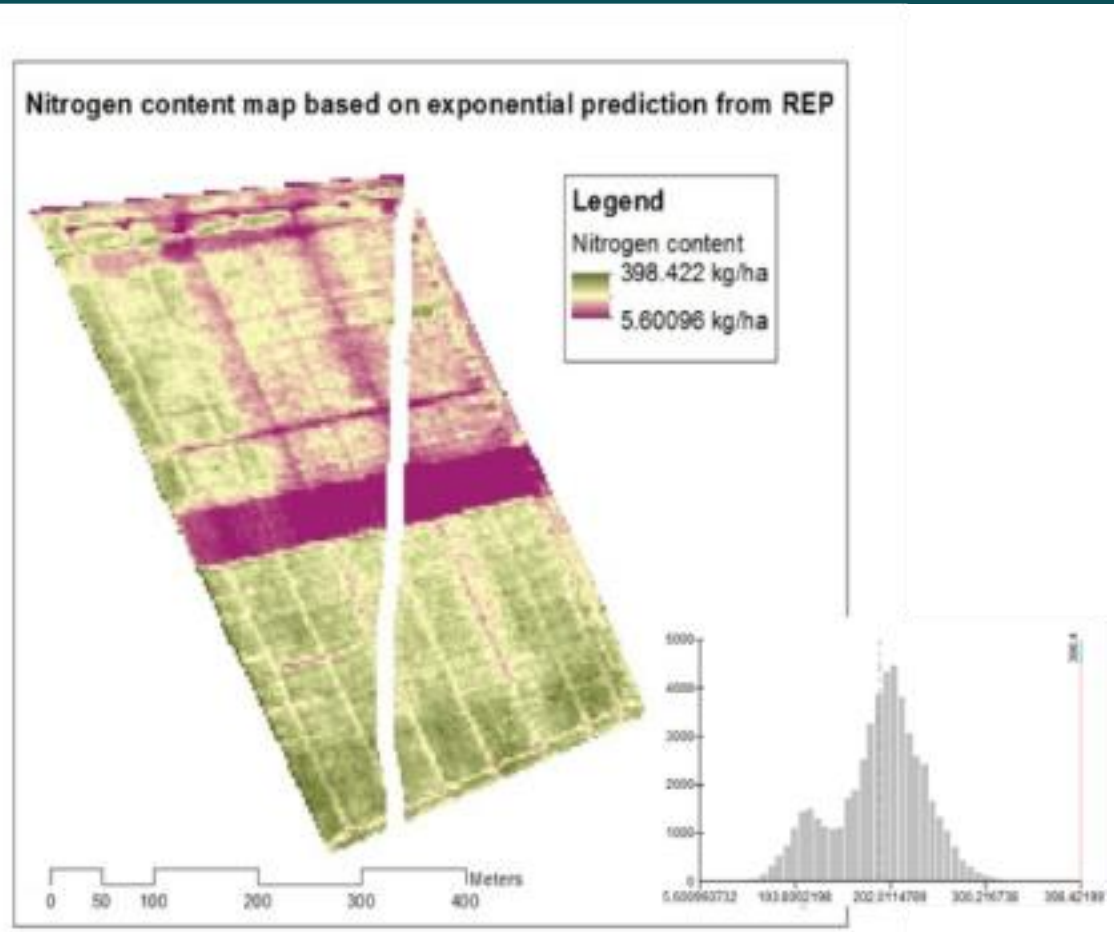
UAV Sensing

VAN DEN BORNE AARDAPPELEN

8

UAV sensing



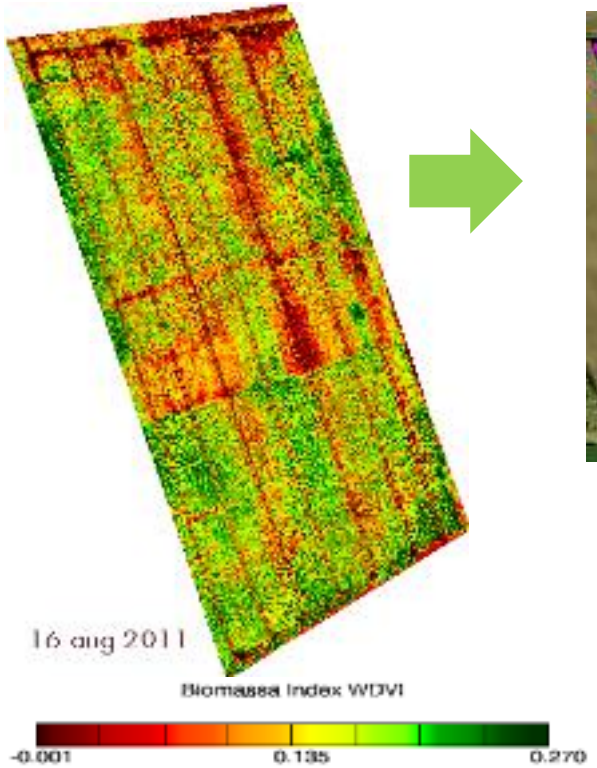


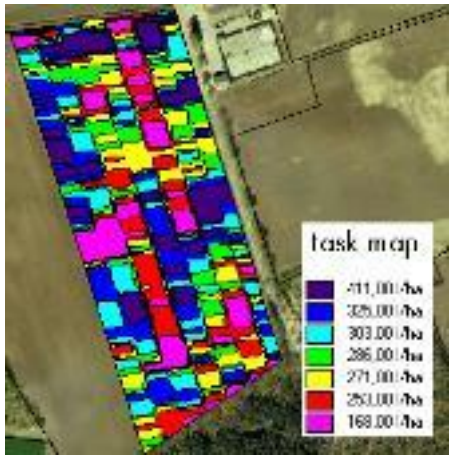
Crop spraying

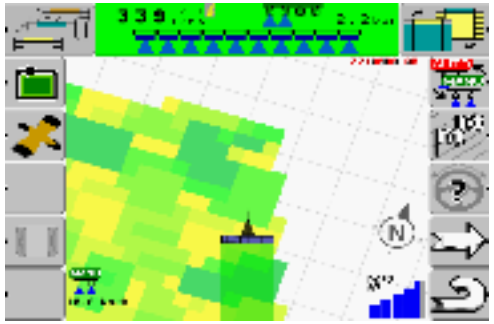
VAN DEN BORNE AARDAPPELEN

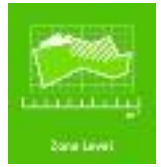
9

Crop spraying







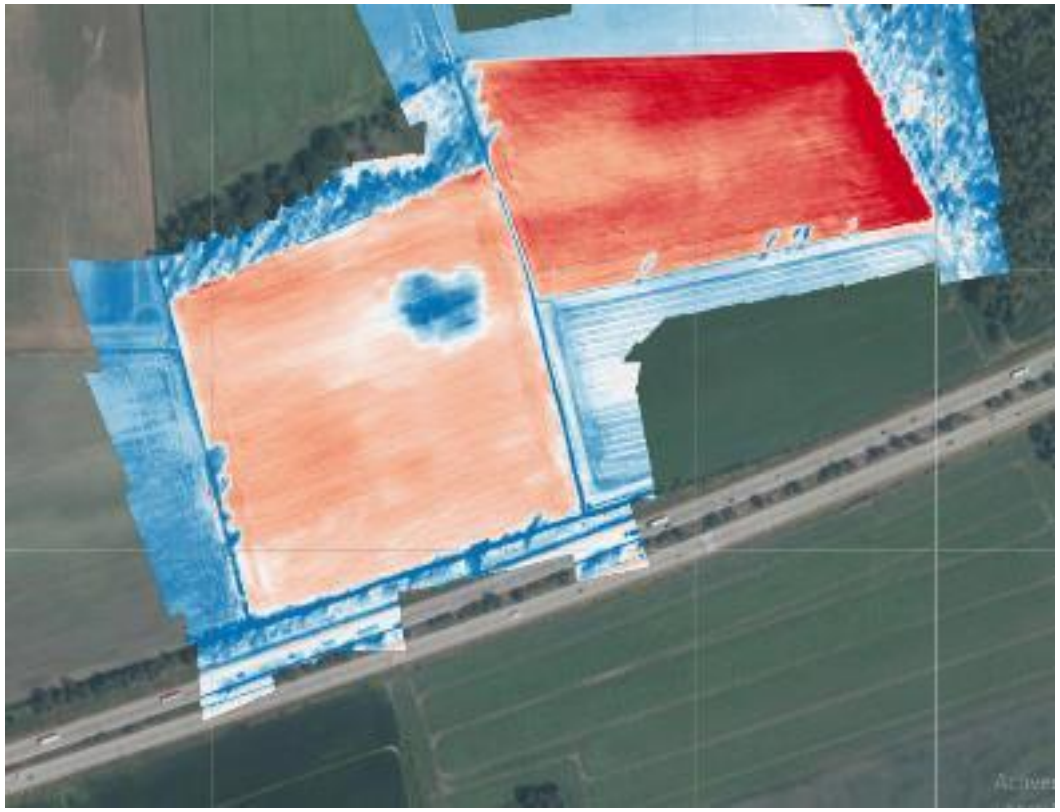


UAV Sensing

VAN DEN BORNE AARDAPPELEN

8

UAV sensing



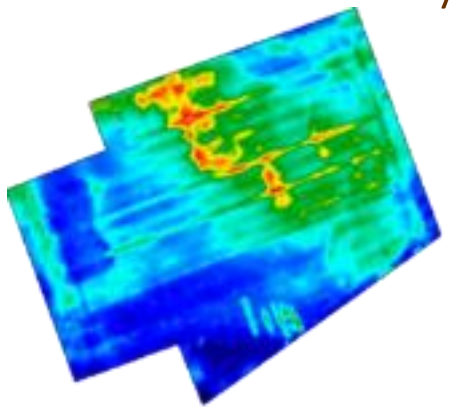
Irrigation

VAN DEN BORNE AARDAPPELEN

10

Irrigation

Soil conductivity



Soil moisture

Weather data

DACOM

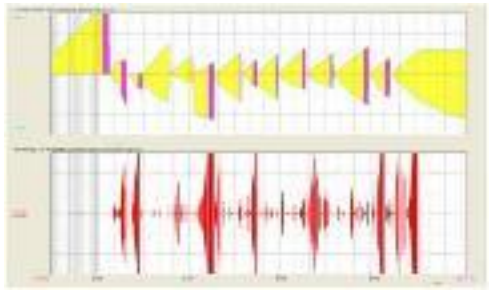
rain dancer

Crop spraying

VAN DEN BORNE AARDAPPELEN

9

Crop spraying



Application data

Weather circumstances

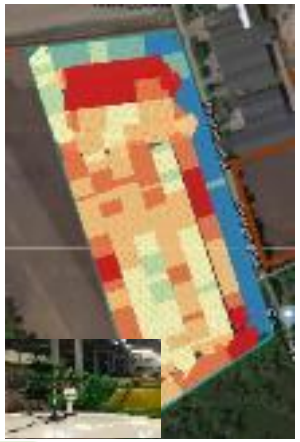
Sensor data

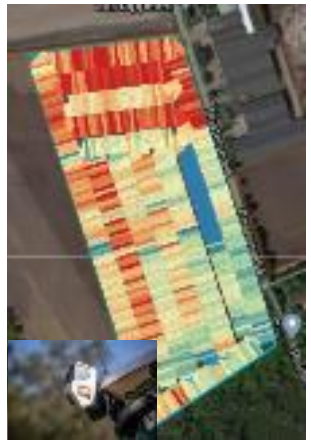
Remote sensing

Weather data

Advice

DACOM





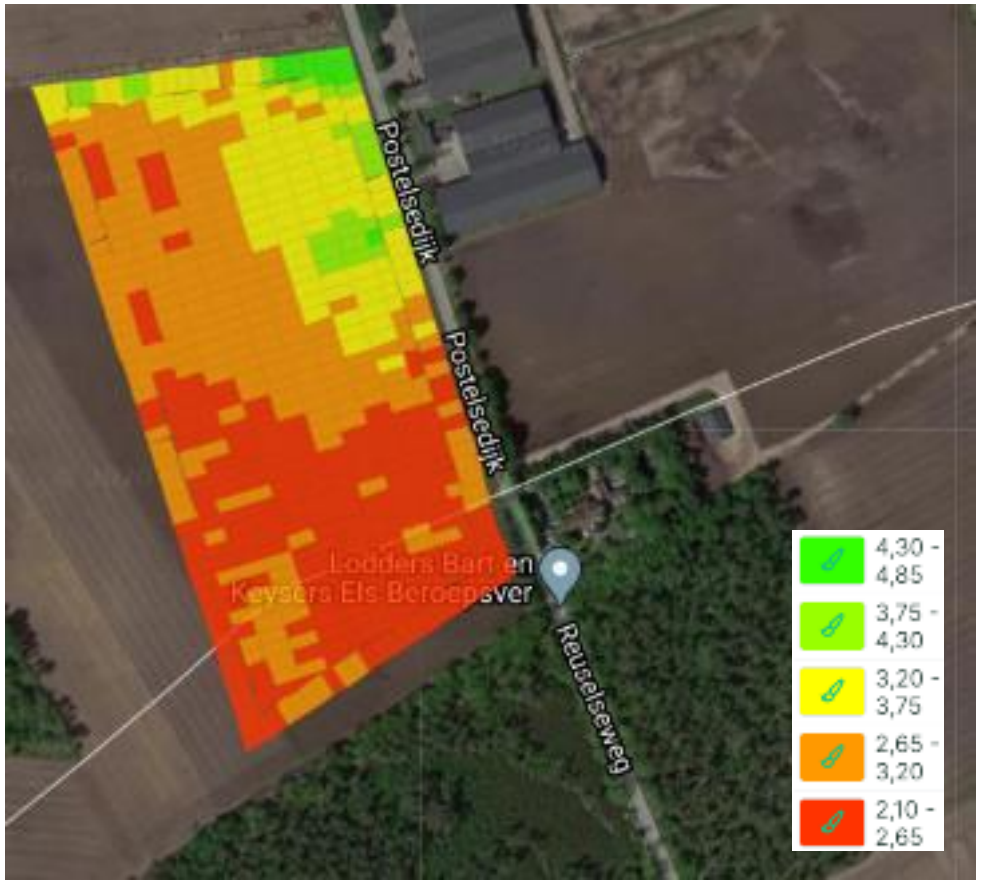
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Crop spraying

VAN DEN BORNE AARDAPPELEN

9

Crop spraying



Crop measuring

VAN DEN BORNE AARDAPPELEN

11

Crop measuring

Increase your growth

TTW

1 m' **rooien** (3 planten)

hoogte grond tot top stengel

aantal stengels

aantal etages

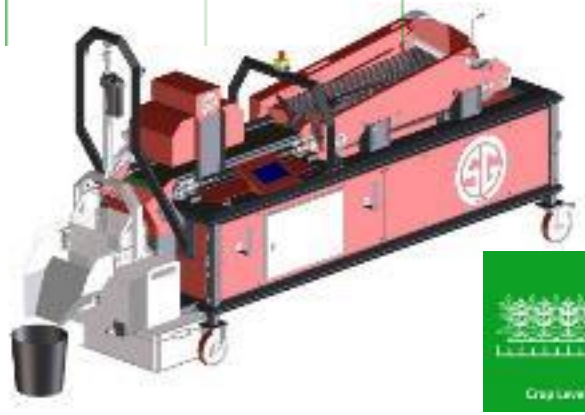
weeg stengels + loof van de gerooide planten

weeg **wortels**

sorteer+tel **knollen**

weeg knollen **per maat**

weeg **OWG** + **BWG** van hele partij



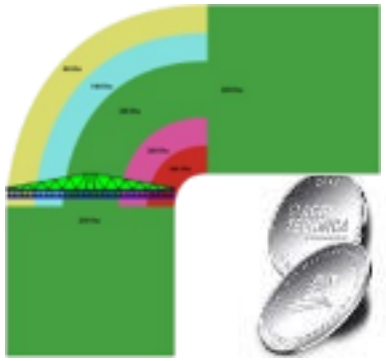
1 2 3 4 5 6 7 8 9 10 **11** 12 13 14 15 16

Variable fertilizing

VAN DEN BORNE AARDAPPELEN

12

Variable fertilizing



Precision Farming

VAN DEN BORNE AARDAPPELEN

Vlaamse overheid
vito vision on technology
Kverneland
FENDT
FME POWERED BY DUTCH TECHNOLOGY
Ministerie van Landbouw, Natuur en Voedselkwaliteit
INFORMATIE VLAANDEREN
LambWeston
CZAV
GRIMME
ARTS
CELLI
FOOD UP!
Fleuren BOOMKWEKERIJ
Delphy
TNO innovation for life
NXP
DACOM
DAMMANN
Praktijkcentrum Voor Precisie Landbouw
AVR
dewulf
TU/e Technische Universiteit Eindhoven University of Technology
Data Science School
GRIDS
dutch design foundation
SUIKER UNIE
DroneWerkers Loonwerkers van morgen
van den borne aardappelen
RAUCH
TILBURG UNIVERSITY
AGRICO
SESVANDERHAVE sugar beet seed
ZLTO
WAGENINGEN UR For quality of life
AUREA IMAGING geospatial solutions
has hogeschool
AERIALTRONICS
HZPC Growing with our potatoes
FARM FRITES
Helicon OPLEIDINGEN
VAN IPEREN INTERNATIONAL
ILVO
Countus
FrieslandCampina
LEMKEN
NGF 100 JAAR NEDERLANDSE GOLF FEDERATIE
CLUB PELIKAAN
imants 125 Years Quality Cultivation
BAYER

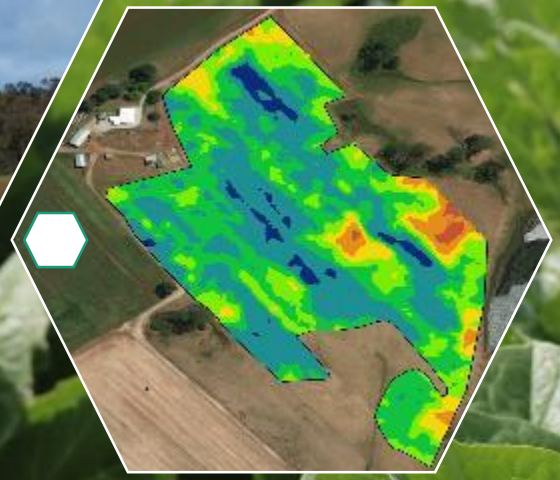
Precision Farming

VAN DEN BORNE AARDAPPELEN

Thanks for your attention!

Interested? Visit:
www.vandenborneaardappelen.com

/jacobvdborne /vandenborne /Van den borne aardappelen /Jacob van den borne



Validating precision ag tech for vegetables

Julie O'Halloran, Senior Development Horticulturist
Queensland Department of Agriculture and Fisheries

Precision systems technology in vegetable production

Collaboration with growers

Farm action plans

Soil sensing

Crop sensing

Variable rate

Precision drainage

Drone applications

Yield mapping

Yield prediction from satellite imagery

Queensland

South Australia

Tasmania

Western Australia

New South Wales

Carrots

Sweet corn

Brasscias

Beans

Lettuce

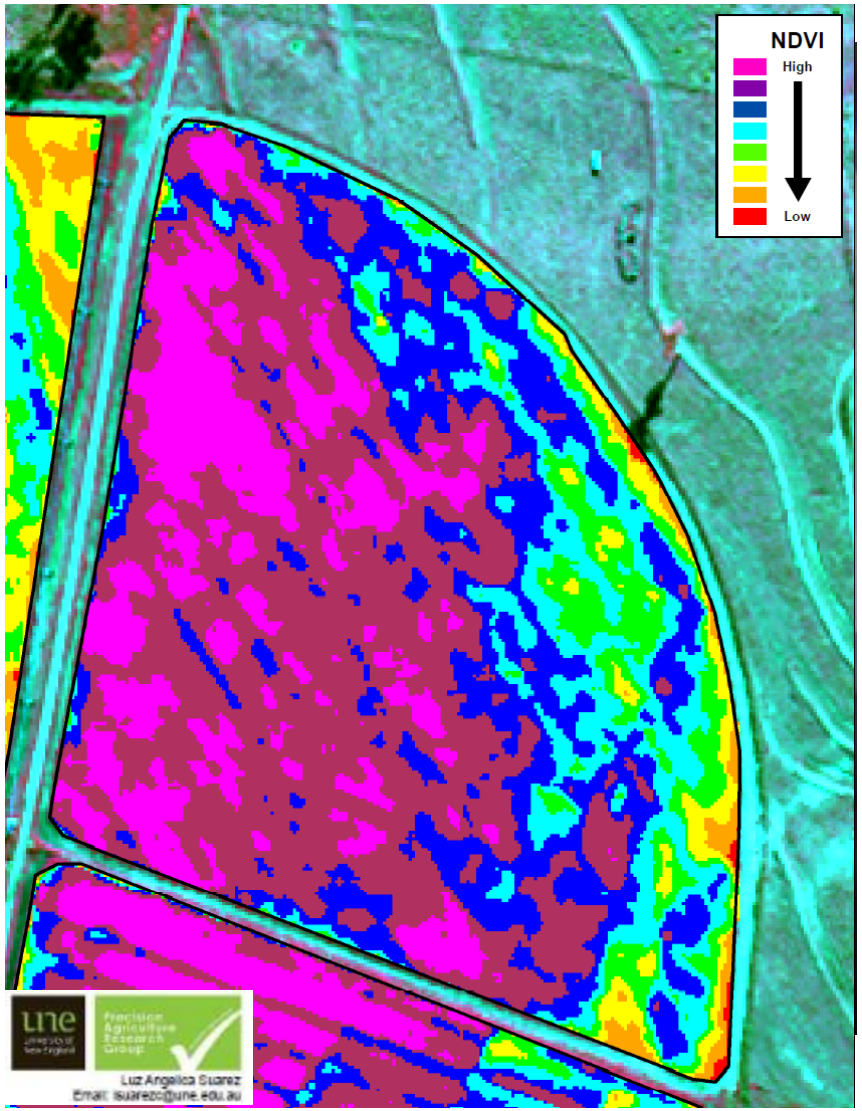
Chilli

Asian vegetables

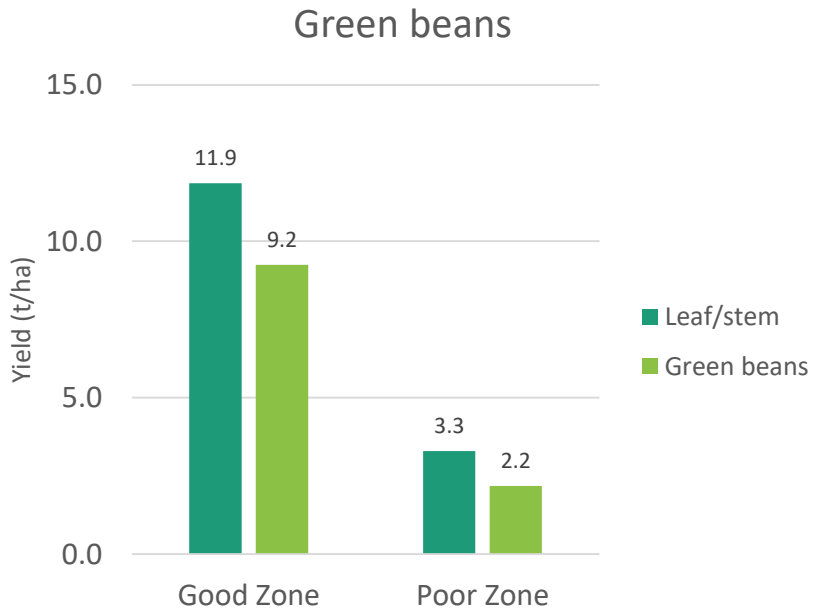
Collaboration with service providers and industry operators

Linkages with VegNET and SPAA for comms and extension

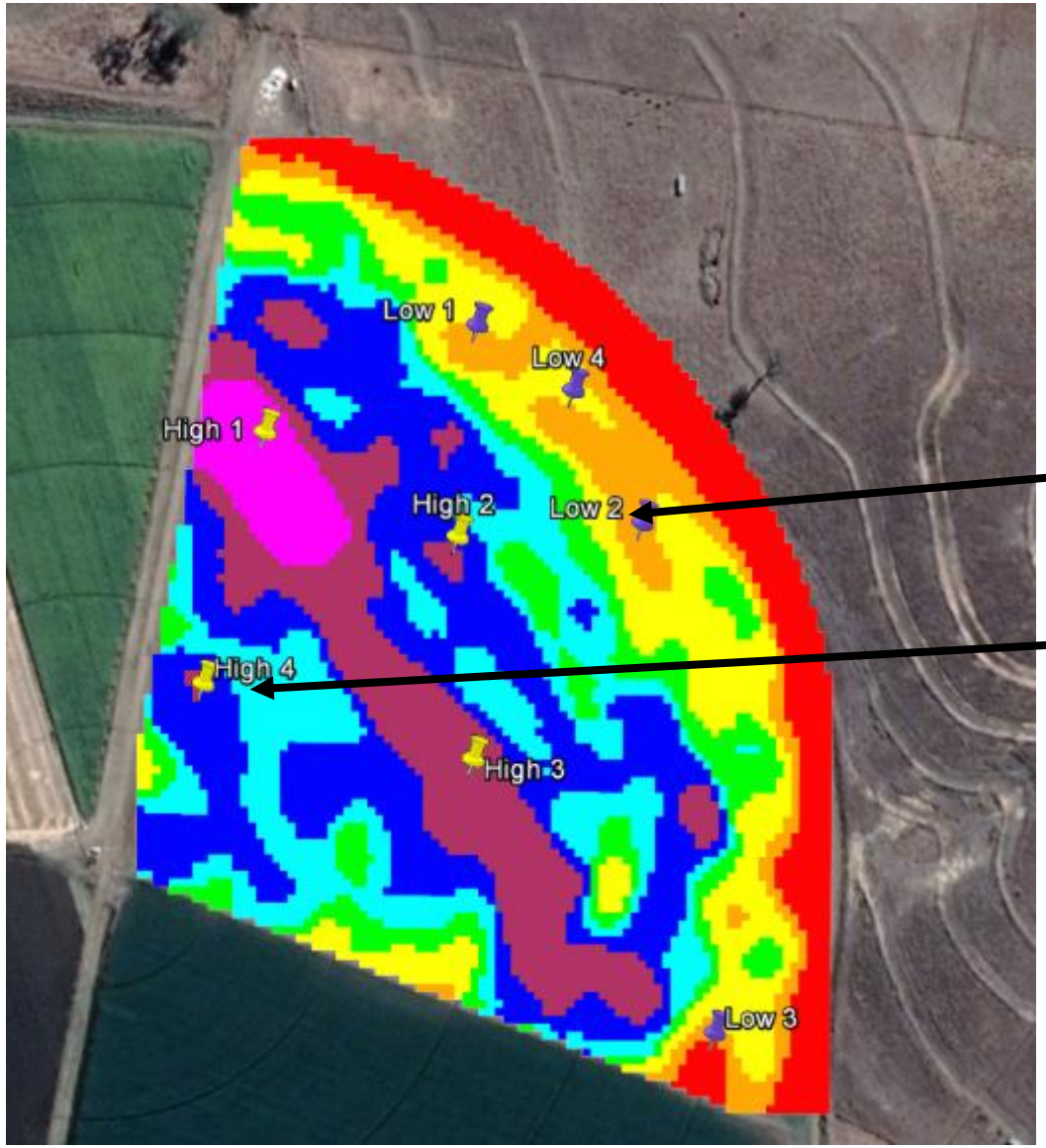
Spatial variability



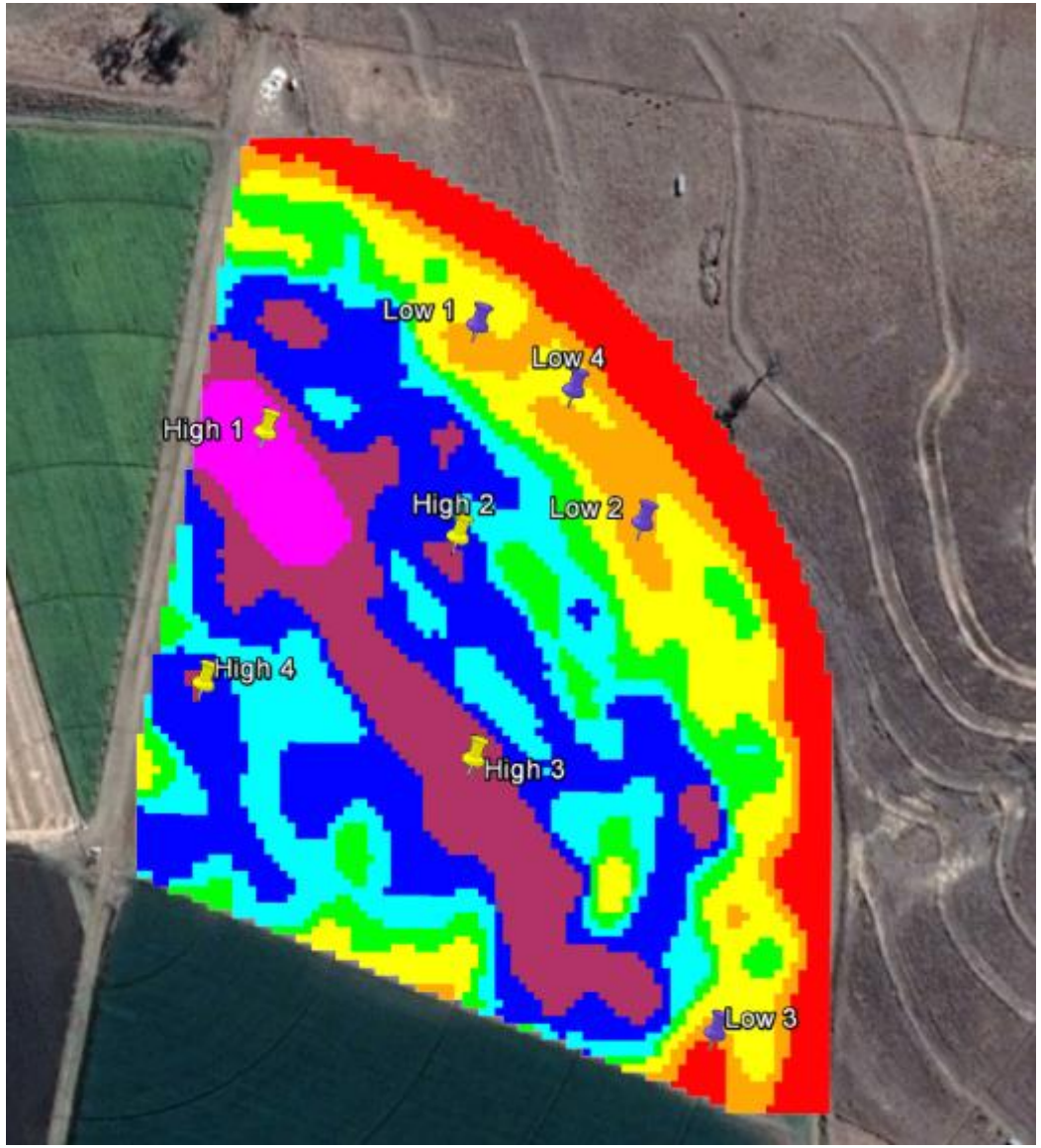
Visual differences in green bean growth at harvest in a good and poor crop growth zone.

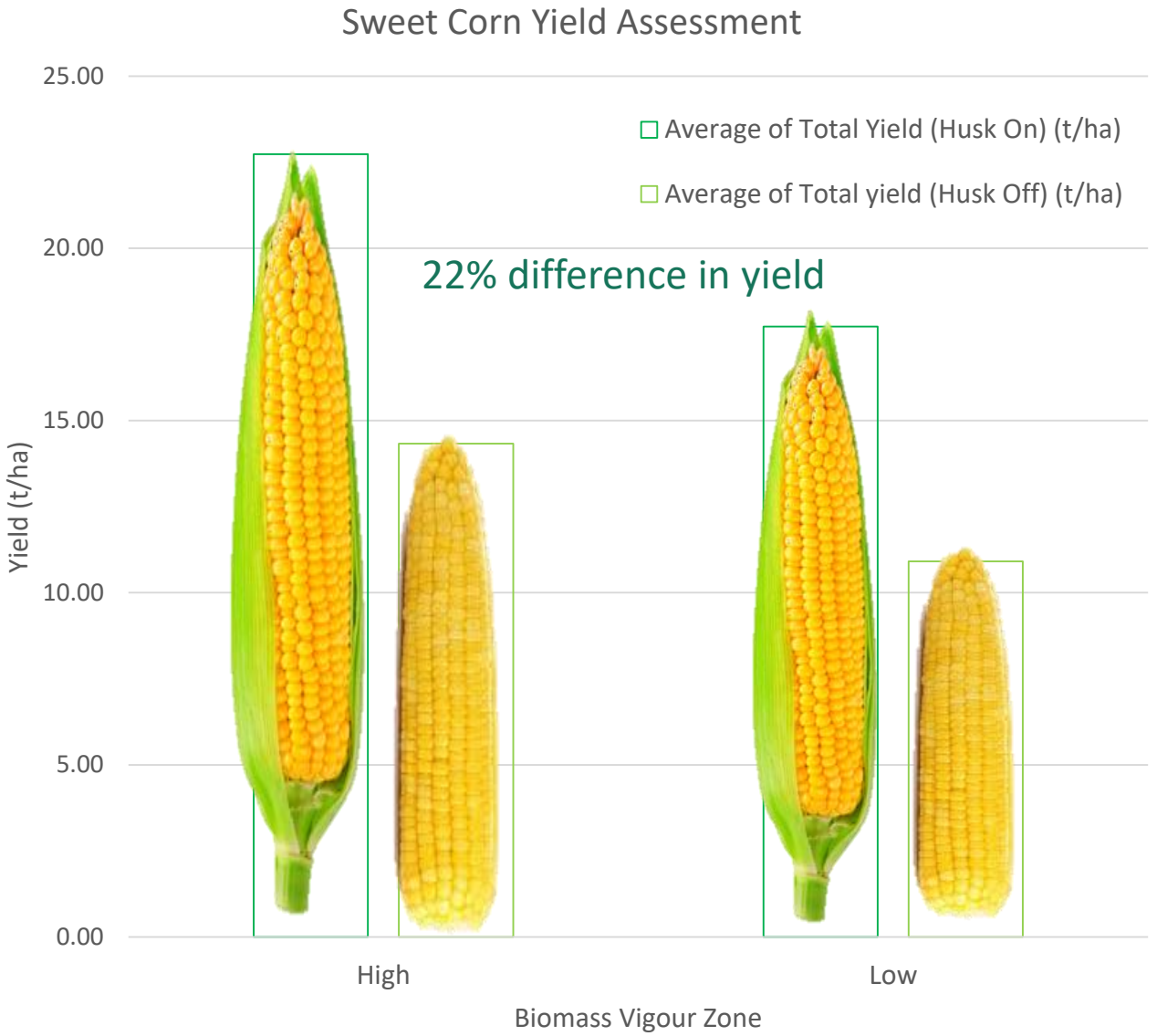


Similar spatial patterns over time



Similar spatial patterns over time

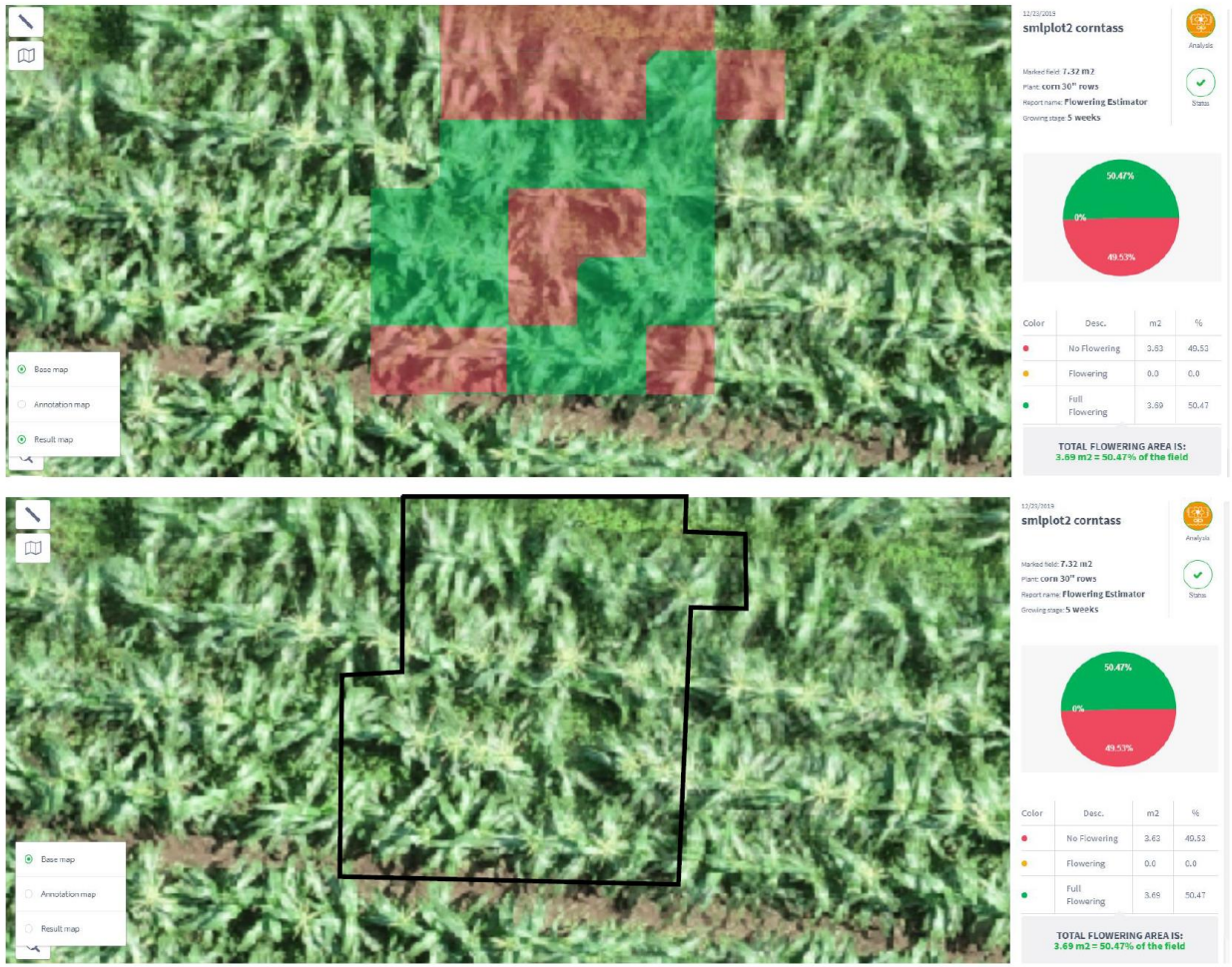




Yield monitoring in carrots

- Load-cell yield monitors retro-fitted to carrot harvesters
- Calibration a key factor in accurate data
- Exploring best output format for growers
- Useful for temporal and spatial variability monitoring

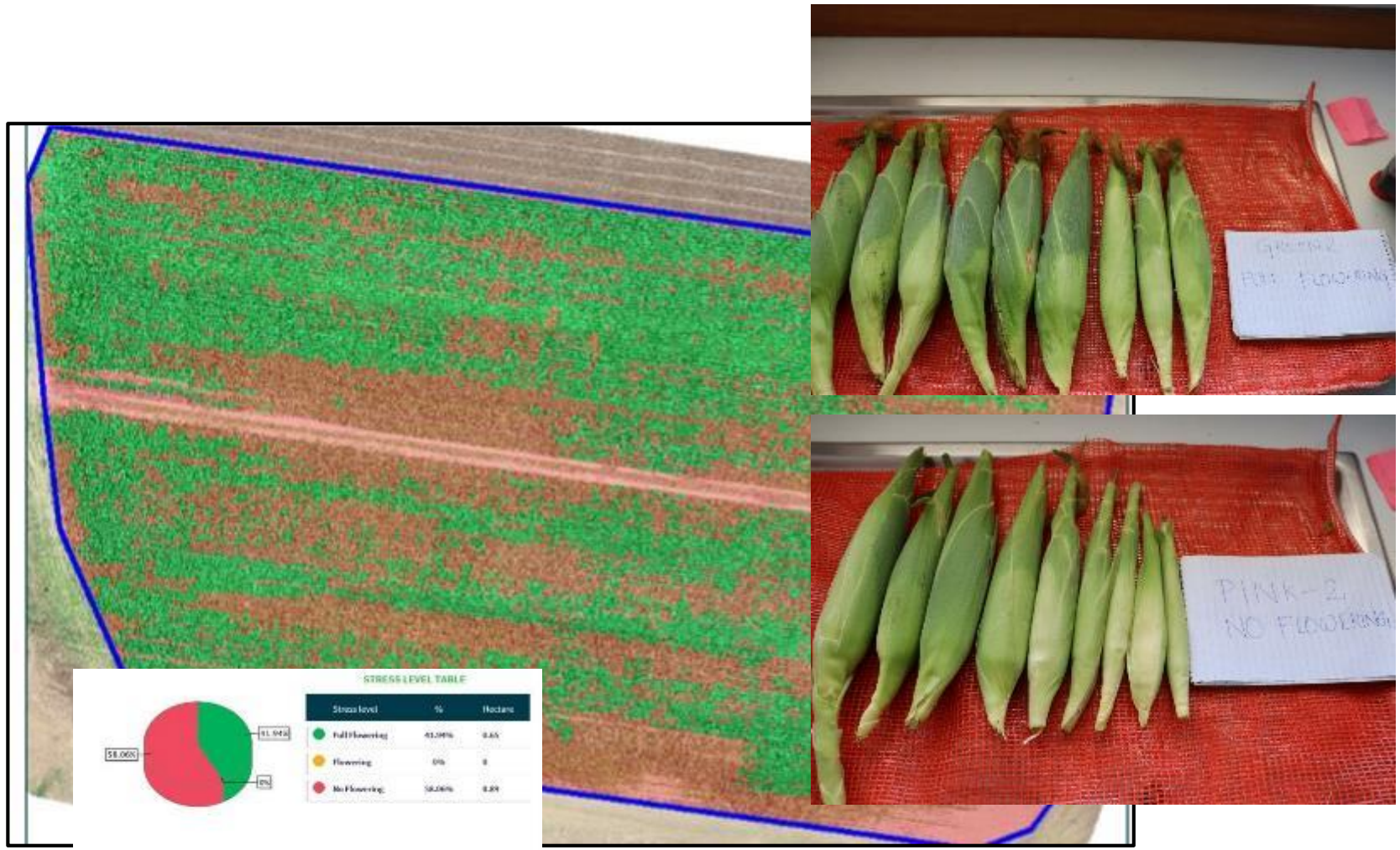
Flowering/ tasselling area



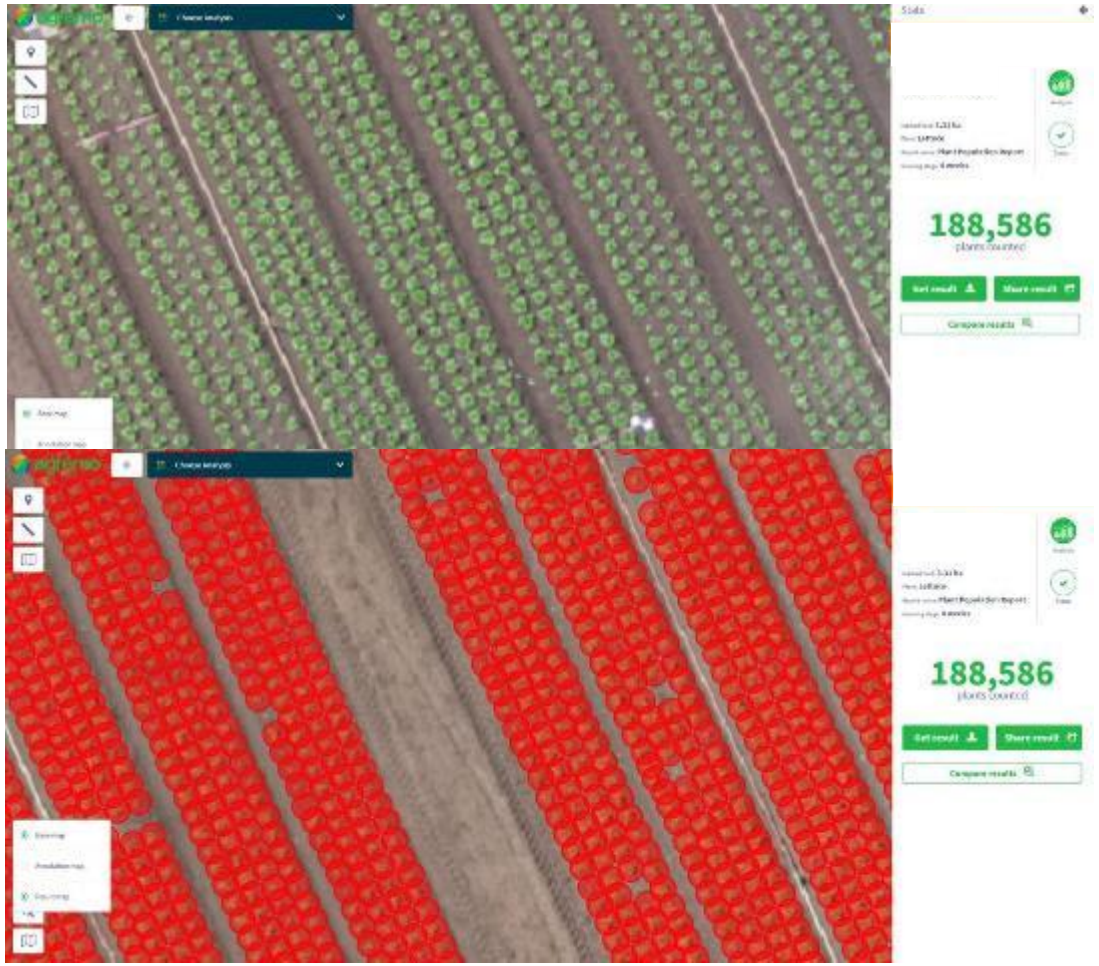
- Original objective to count flowers for yield estimation
- Agremo algorithm processed image to obtain flowering area
- Data can be used to plan spray schedule around tasselling

High Res RGB
0.5cm ground resolution

Flowering/ tasselling area



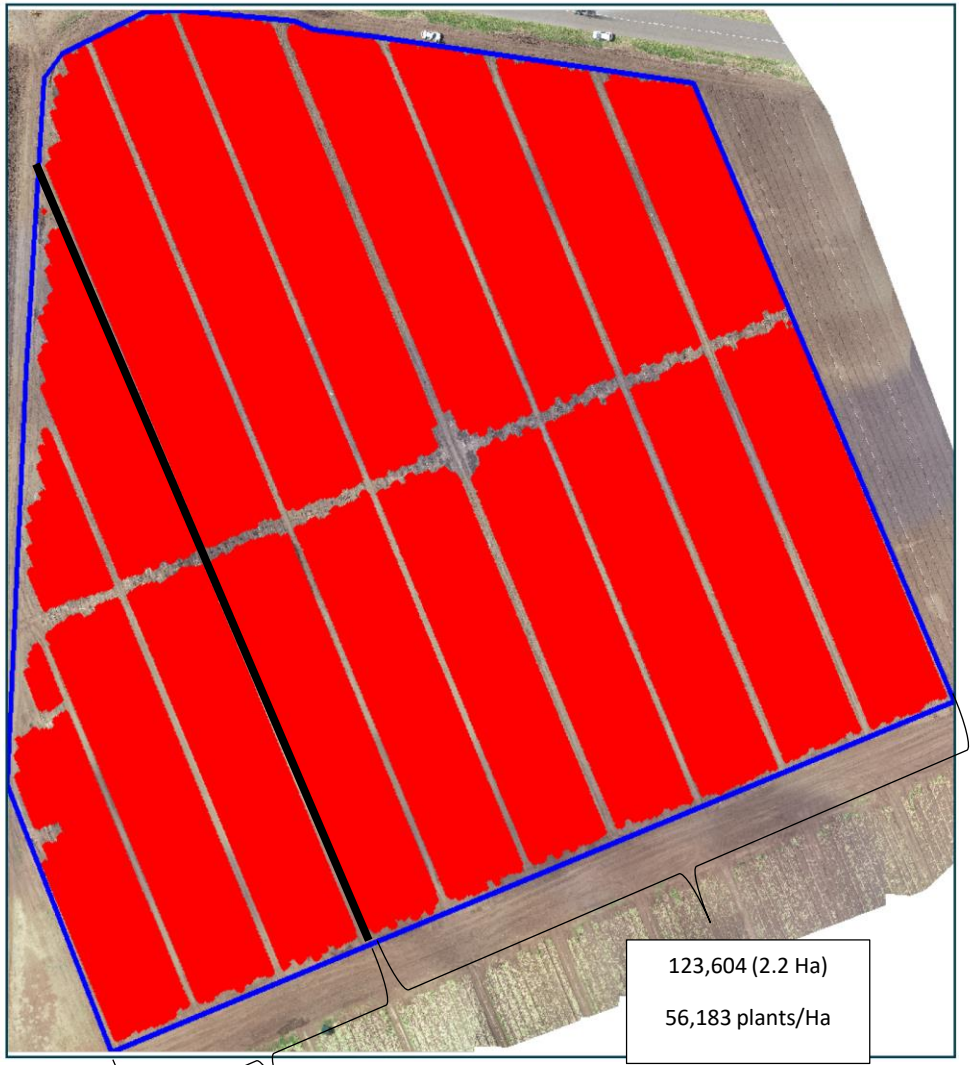
Plant counts



agremo

Nat

Survey Date: 11-04-2019



123,604 (2.2 Ha)

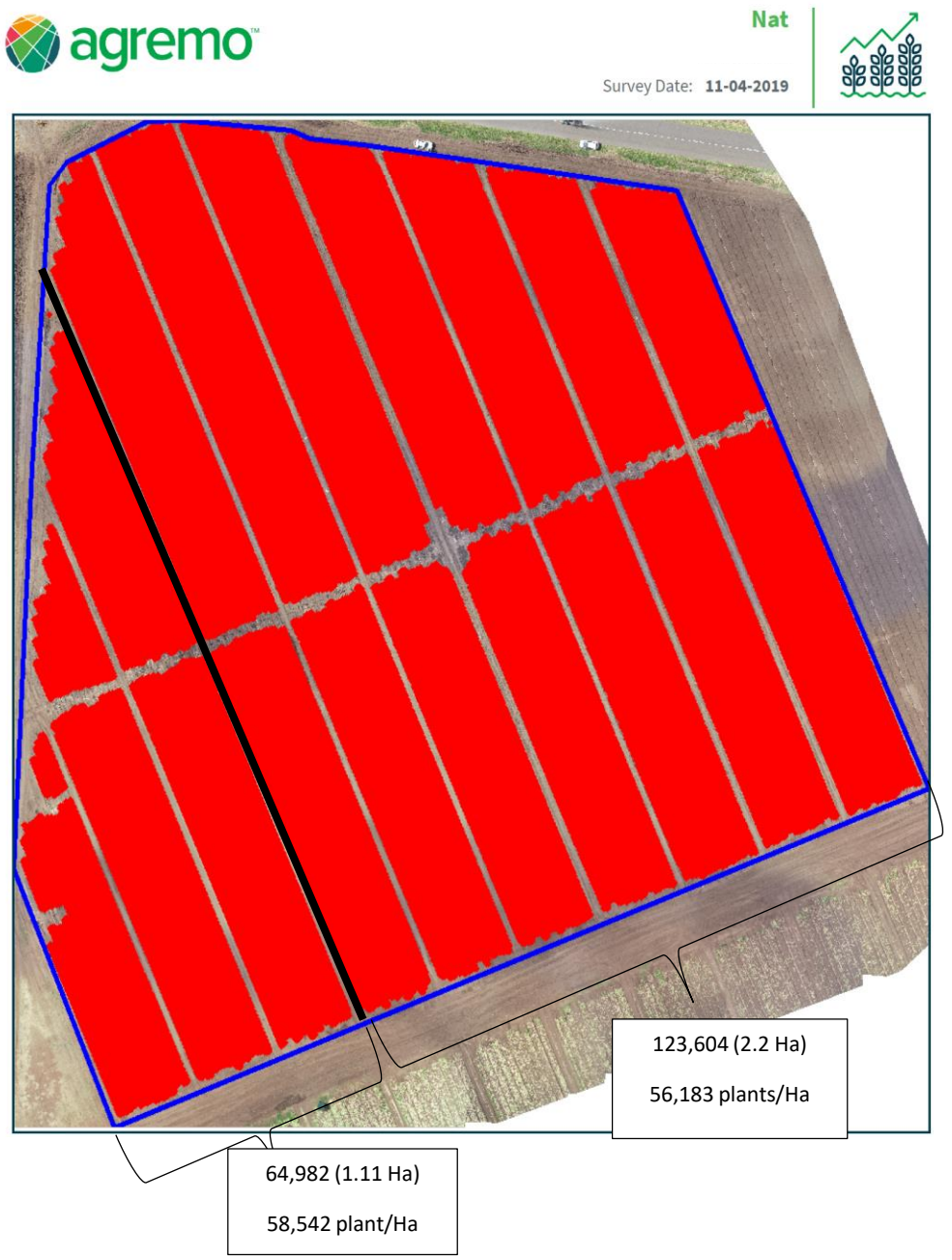
56,183 plants/Ha

64,982 (1.11 Ha)

58,542 plant/Ha

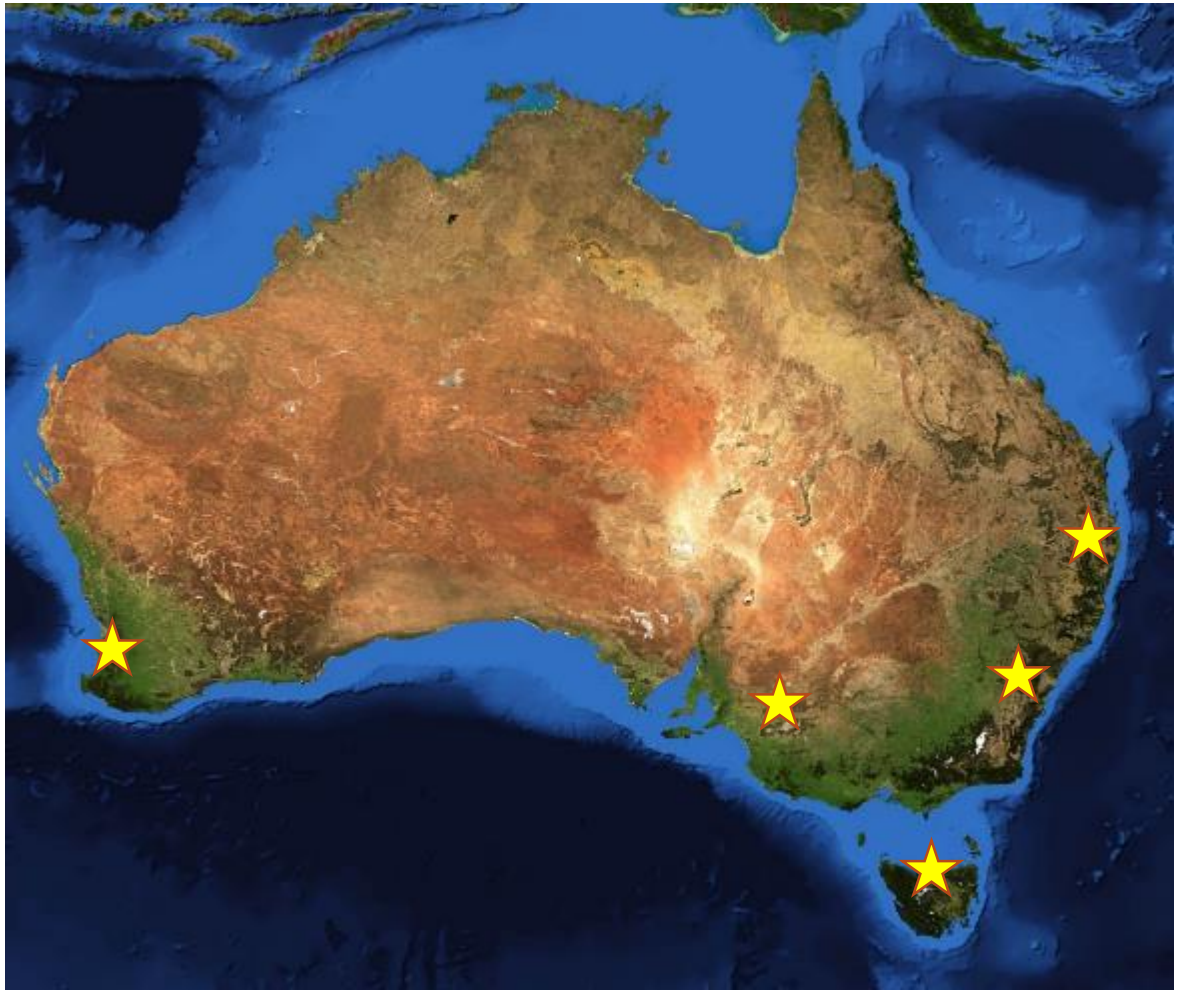
Plant counts

- Plant count algorithms appear to be 99% or greater accuracy compared with manual counts
- Useful for benchmarking potential yield early in growing period
- Compare with packout to measure ‘Field Recovery’ or possibly waste as plants left in the field
- Up to 40% discrepancy between planted and packed out product



Yield prediction from remote sensing imagery

- Is it possible to forecast crop yield from satellite imagery?
- How accurate can this approach be?

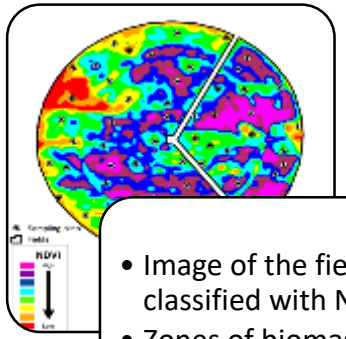


Yield prediction approach

Satellite Capture

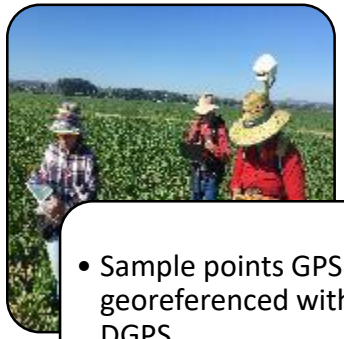
- High Resolution
  - World View 2 or 3.
- Low Resolution.
  - PlanetScope.
  - Sentinel-2.

Processing the image for field work



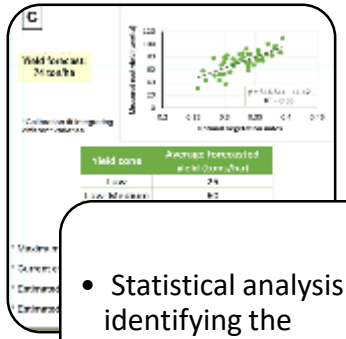
- Image of the field is classified with NDVI
- Zones of biomass vigour identified.
- Sampling sites/points located in the field to represent Low, Medium and High vigour zones.
- Replicated sample points created within each zone.

Field work



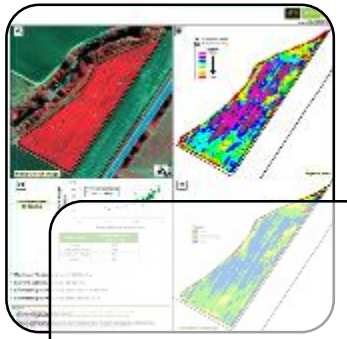
- Sample points GPS georeferenced with DGPS.
- Yield, soil and plant tissue samples collected from each sample site.
- Yield samples graded to a standardized protocol using supermarket specification.

Image Analysis



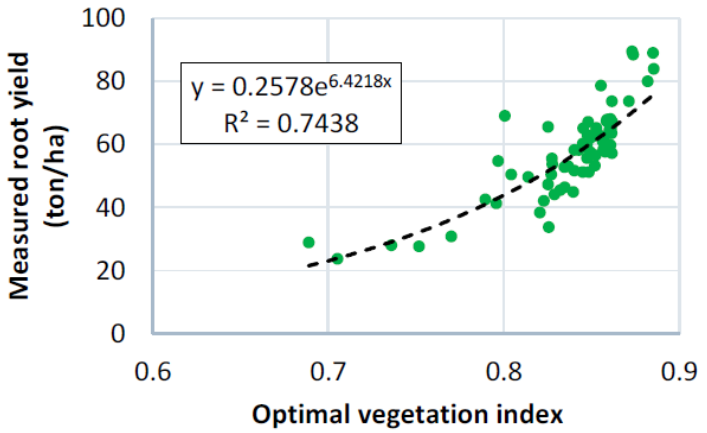
- Statistical analysis identifying the optimal regression fit and vegetation index (OPV) for yield forecasting..
- Transforming pixel values into yield
- Analysis of potential loss per performing zone.

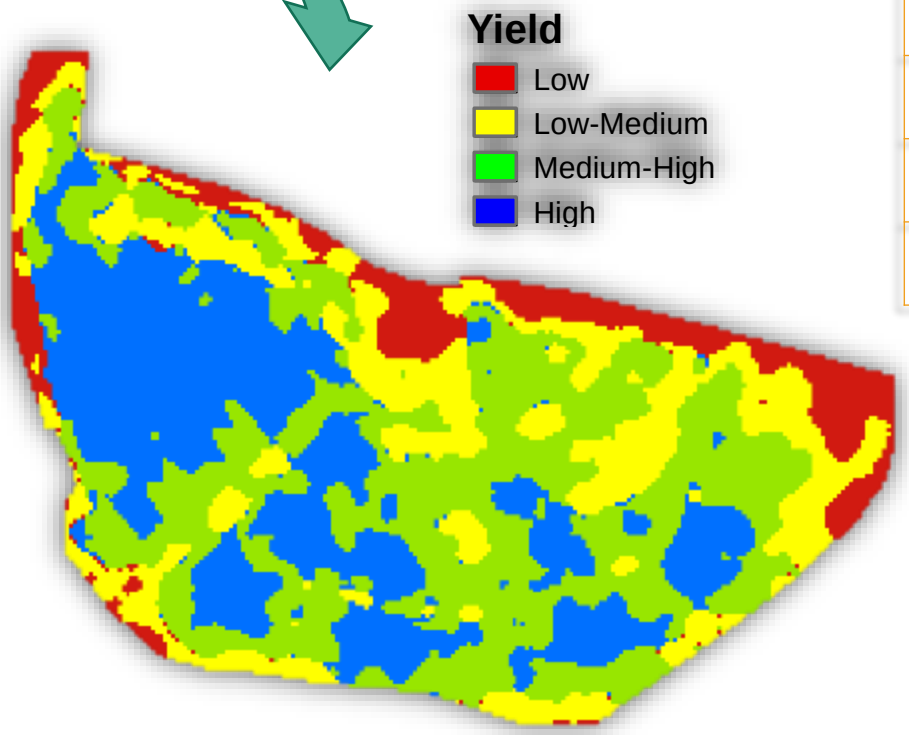
Forecasted Yield Map



Grower product

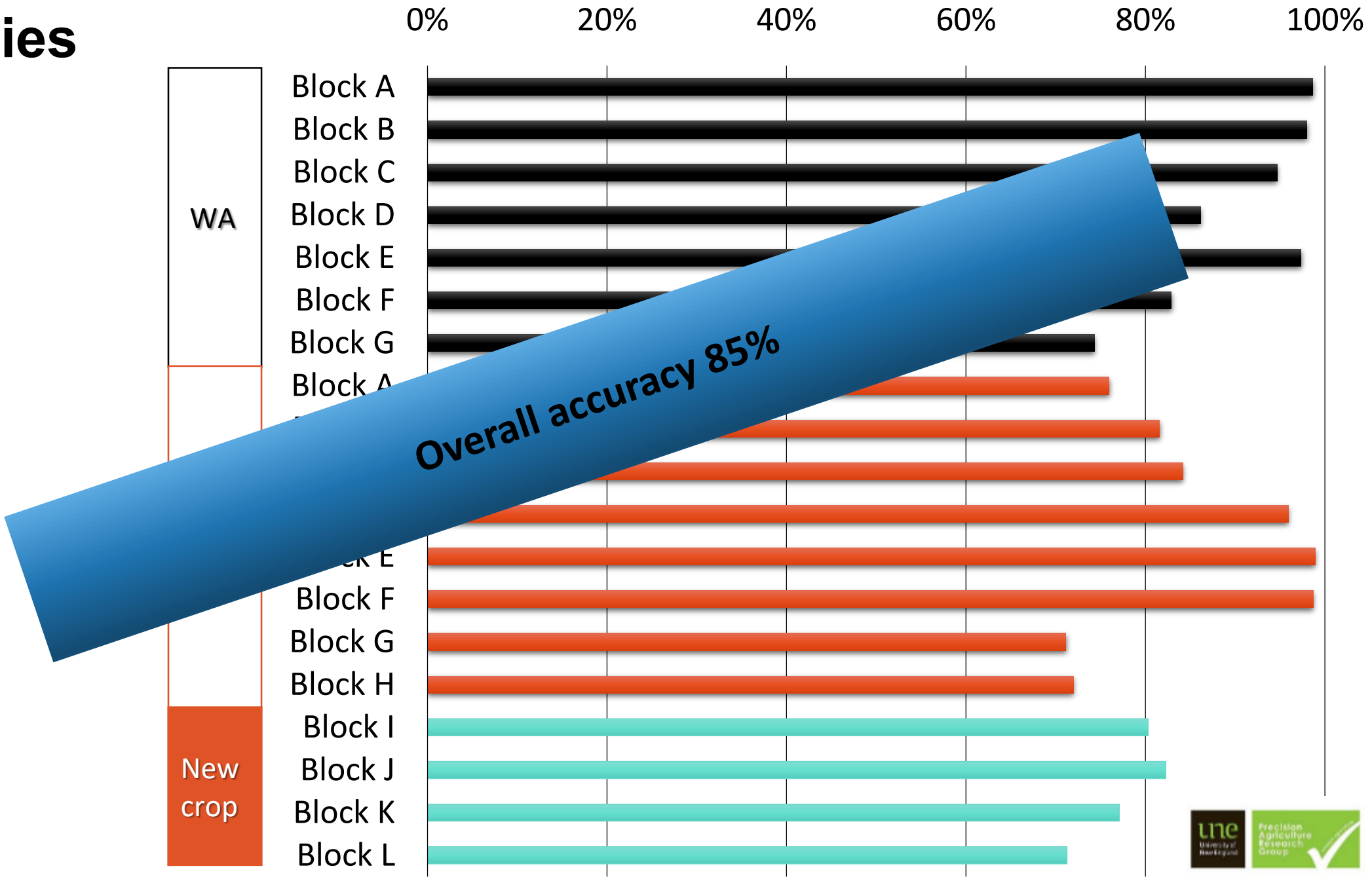
Image analysis





Yield class	Forecasted yield (t/ha)
Low	26
Low-Medium	46
Medium-High	55
High	62
Average	**56**

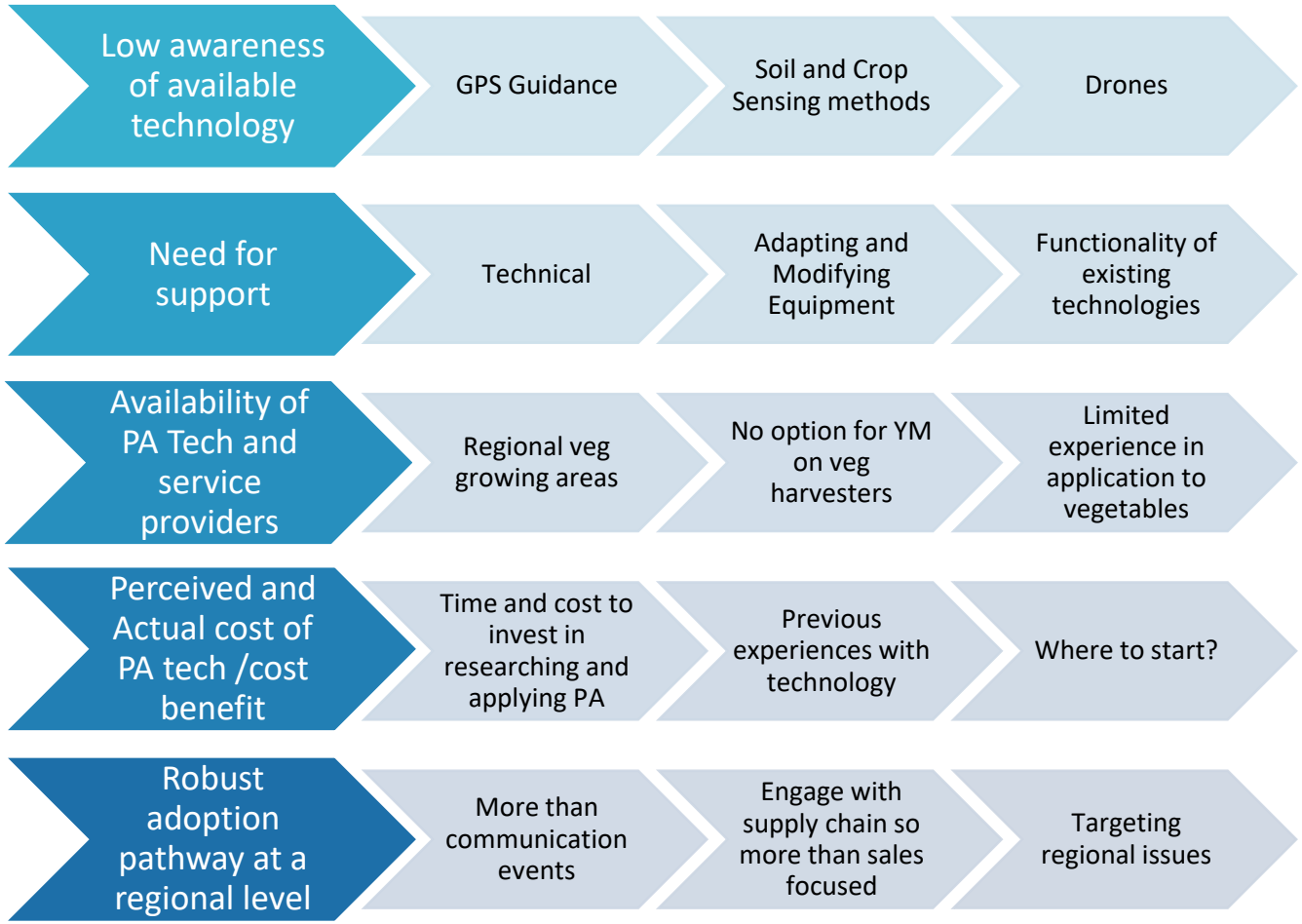
Accuracies



AARSC
Applied Agricultural Remote Sensing Centre

une
Precision Agriculture Research Group

Barriers to precision agriculture adoption in vegetables



With the current level of technology why do we still have issues achieving streamlined systems for industry and limits to functionality?

Resources

Videos available on You tube: Queensland Agriculture channel

Factsheets and case studies available on https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/agribusiness/agtech-vegetables

Key Messages

- All tech in these examples are commercially available (with the exception of yield prediction)
- PA implementation in vegetables should be problem or issue focused initially for maximum cost benefit
- There are low cost options to get started in PA
- Lots of resources are available on PA to get started
- **Always <u>GROUND TRUTH</u> the imagery!**

Acknowledgements

Acknowledgements
Primary Industries and Regions SA • Vegetables Australia • Tasmanian Institute of Agriculture • University of New England • Society for Precision Agriculture Australia • VegNet

Parilla • Fresh Select • Covino Farms • Harvest Moon • Kalfresh • Capel Farms • Kengoon Farming • Center West • Alandale Produce • Rieck Farming • Musolino and Sons • Samwell and Sons • Greenvale Pastoral • Austchilli• Mulgowie Farming Company• Armidale • Koala Farms •

For further information contact Julie O'Halloran

Julie.ohalloran@daf.qld.gov.au

Yield prediction work Angelica Suarez

lsuarezc@une.edu.au

Hort Innovation Strategic levy investment | VEGETABLE FUND

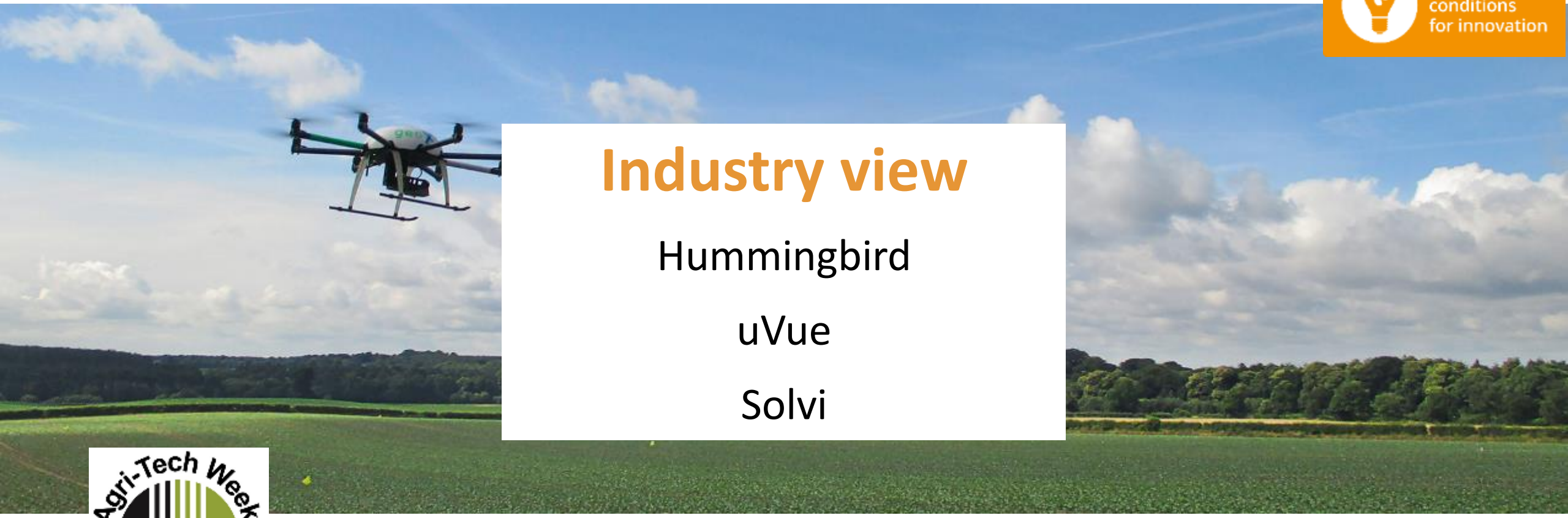
This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hummingbird Technologies

AGRIVUE

solvi

Framework conditions for innovation



Industry view

Hummingbird

uVue

Solvi

Agri-Tech Week 9th - 13th November 2020

@InnoVeg #INNOVEG #ATW20

HUMMINGBIRD TECHNOLOGIES

Solving problems - adding value

Awards

KPMG

Best Tech Startup

CognitionX
THE AI ADVICE PLATFORM

Best Global AI for Agriculture

FARMERS WEEKLY

AgriTech Innovator of the Year

UK Business Angels Association

One to Watch

Innovate UK
Knowledge Transfer Network

Multiple Grants

THE SUNDAY TIMES

Fast Track 100

We provide **advanced crop insights** to farmers using imagery analytics from drones, satellites and machine learning (ML)

No 1. Remote Sensing + Image Analytics Player Globally

Operating in **6 continents** and **10+ countries**

B2B relationships across all the 10+ countries

Specific solutions across **multiple crops**

Average ROI of between **15%** to **50%** across all geographies

62 in team: led by PHD level data scientists

15 Engineers with over 10 years' **experience**

90% customer retention with **50%** upsell across customer base

Multiple awards from industry leaders in science, agriculture, finance, business and government

BACKERS

esa
Imperial College London
BASF We create chemistry
TELUS
Beeswax Dyson Farming
SALIC
Downing Ventures

HUMMINGBIRD MISSION TO SOLVE 4 KEY PROBLEMS AND OUR DIGITAL SOLUTIONS

"Our mission, through sophisticated modelling and predictive analytics, is to measure sustainability, optimise food production and push the boundaries of science and technology"

REDUCE YIELD LOSSES

- Manage large holdings
- AI driven plant monitoring
- P&L benefit
- Predictive analytics

REDUCE INEFFICIENT INPUTS:

- Targeted treatment Lower chemicals, water and seed inputs where possible
- Prevent overspraying
- Manage resistance
- P&L saving

IMPROVE UNSUSTAINABLE PRACTICES:

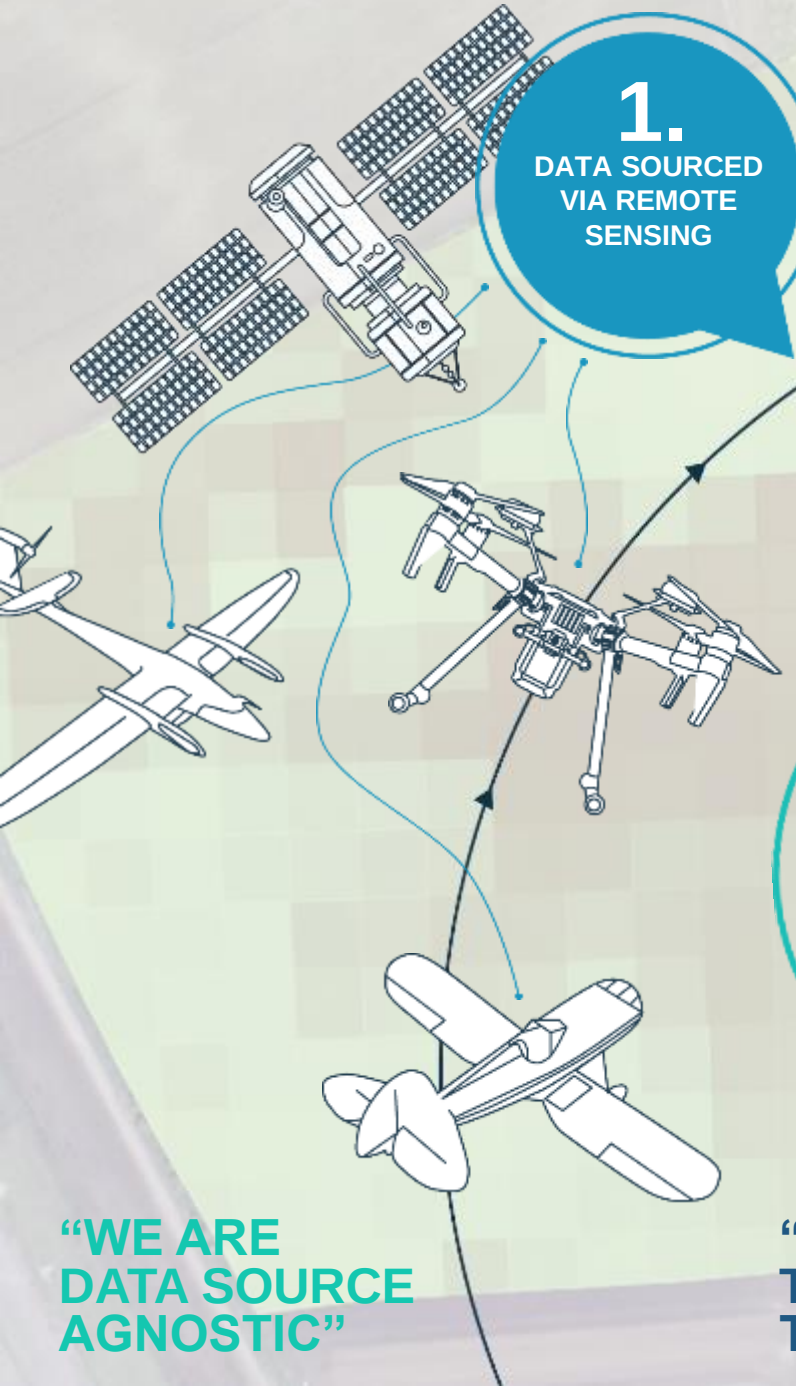
- Measure it (remote sensing)
- Monitor it (carbon reports)
- Facilitate it (VR maps)
- Report it (stakeholders)
- Avoid wastage (food/input)

IMPROVE POOR DECISION MAKING:

- Technology to save time
- Actionable insights
- Integrated data
- Earlier decisions
- Forward plan
- Better management

OUR PROCESS

1.
DATA SOURCED VIA REMOTE SENSING



2.
HUMMINGBIRD PLATFORM

Cloud based artificial intelligence platform where multiple layers of data are ingested and analysed

AI

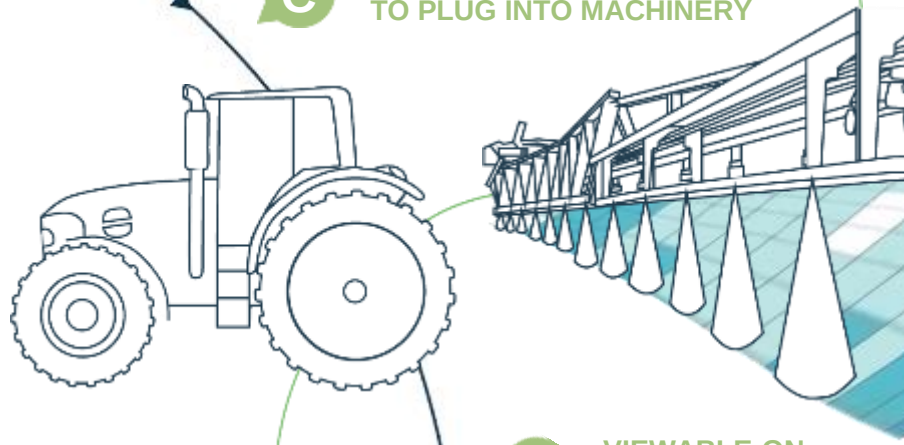
- DEEP LEARNING
- SOIL DATA
- WEATHER DATA
- HISTORIC YIELD

3.
Analysis and application maps are downloaded and available in multiple ways

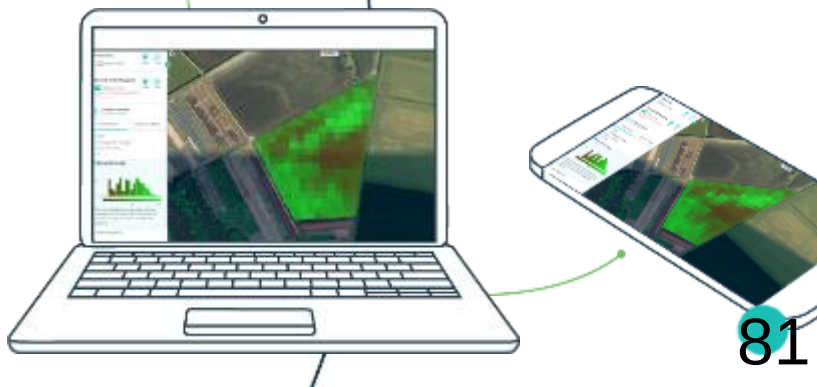
B VIA AN API INTEGRATION STRAIGHT TO FARM MGMT SOFTWARE OR MACHINERY

JOHN DEERE OPERATIONS CENTER

C VIA SHAPE FILE AND USB TO PLUG INTO MACHINERY

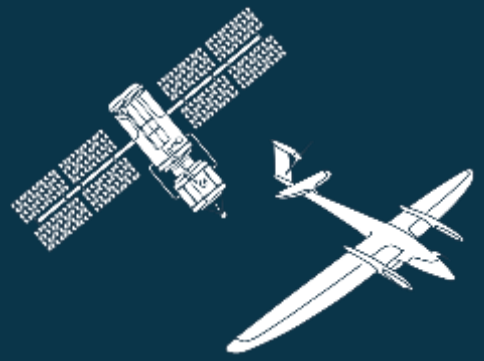


A VIEWABLE ON DESKTOP, APP & MOBILE



"WE ARE DATA SOURCE AGNOSTIC"

"AVERAGE TURNAROUND TIME IS <24 HOURS"



2020 CAPABILITIES

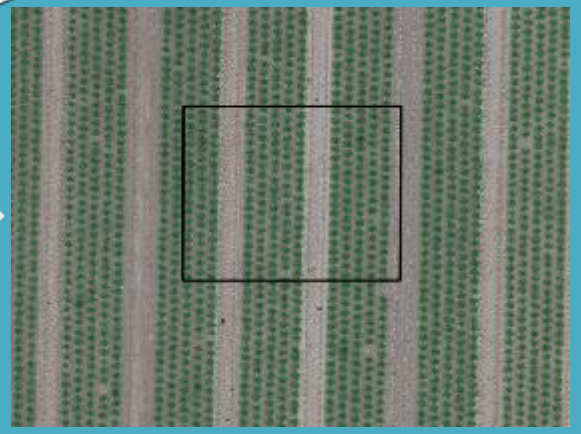
	WHEAT	BARLEY	OSR/ CANOLA	MAIZE	POTATO	SOYBEAN	SUGAR BEET	SUGAR CANE	SUN FLOWER	LETTUCE	COTTON	GRASSLAND	PEAS & BEANS
NDVI, VARIABILITY, BMARKING	●	●	●	●	●	●	●	●	●	●	●	●	●
SEEDING	●	●	●										
NUTRITION - VRN	●	●	●	●	●	●	●		●		●	●	
PLANT PROTECTION - PGR	●	●	●										
PLANT PROTECTION - HERBICIDE	●	●	●	●		●	●	●	●				
DESICCATION	●	●	●	●	●	●			●				●
PLANT PROTECTION - FUNGICIDE	●	●	●	●	●	●	●		●				
CANOPY COVERAGE			●		●	●	●		●				●
PLANT POPULATION					●		●		●				
PLANT COUNTING SIZING AND GRADING					●					●			
PATCH AND GAP DETECTION							●	●	●				
CROP TYPE CLASSIFICATION	●	●	●	PROJECT BASED									
YIELD PREDICTION, YIELD POTENTIAL	PROJECT BASED												

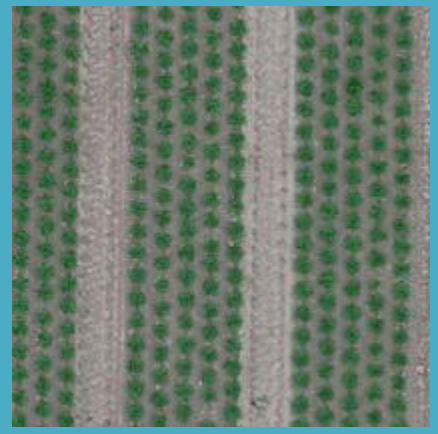
Hummingbird Technologies is a UK based business using state-of-the-art AI and high-resolution drone imagery to achieve analytics at an unprecedented scale for lettuce crops in data collection, training algorithms, knowledge share, and comparison with plant counts per plot.

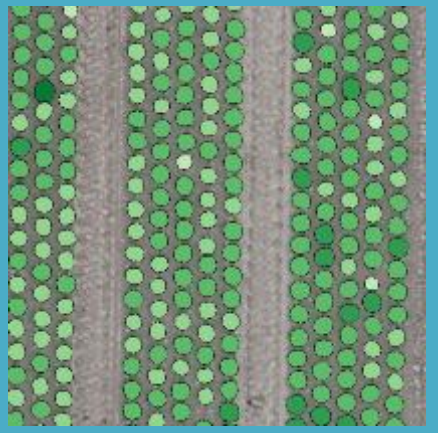
WHAT ARE THE MAIN OBJECTIVES FOR USING THIS TECHNOLOGY?

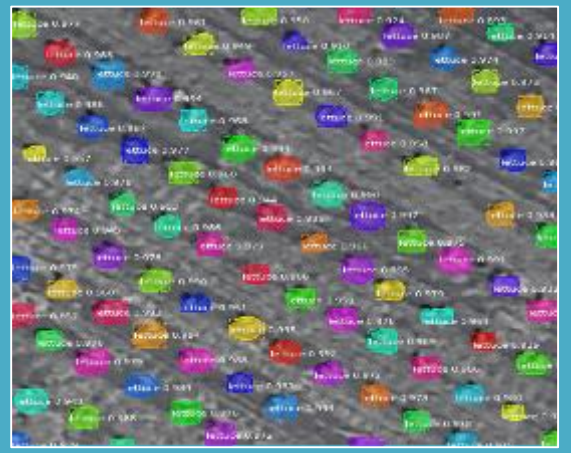
- Lettuce Plant Counting and Sizing
  - Traditional process is manual, time consuming, tedious and error-prone.
  - Technology solutions have failed to materialise into simple, accurate and reliable solutions.
- Unlock Management Decisions
  - Limited capacity to plan and forecast the harvesting numbers required to send to their customers.
  - Flat rate nitrogen sprayed across the fields ignores size differences, reducing efficiency & increasing cost
- Ability to create customised solutions for any problems specifically noted by the grower

HUMMINGBIRD AI SOLUTION









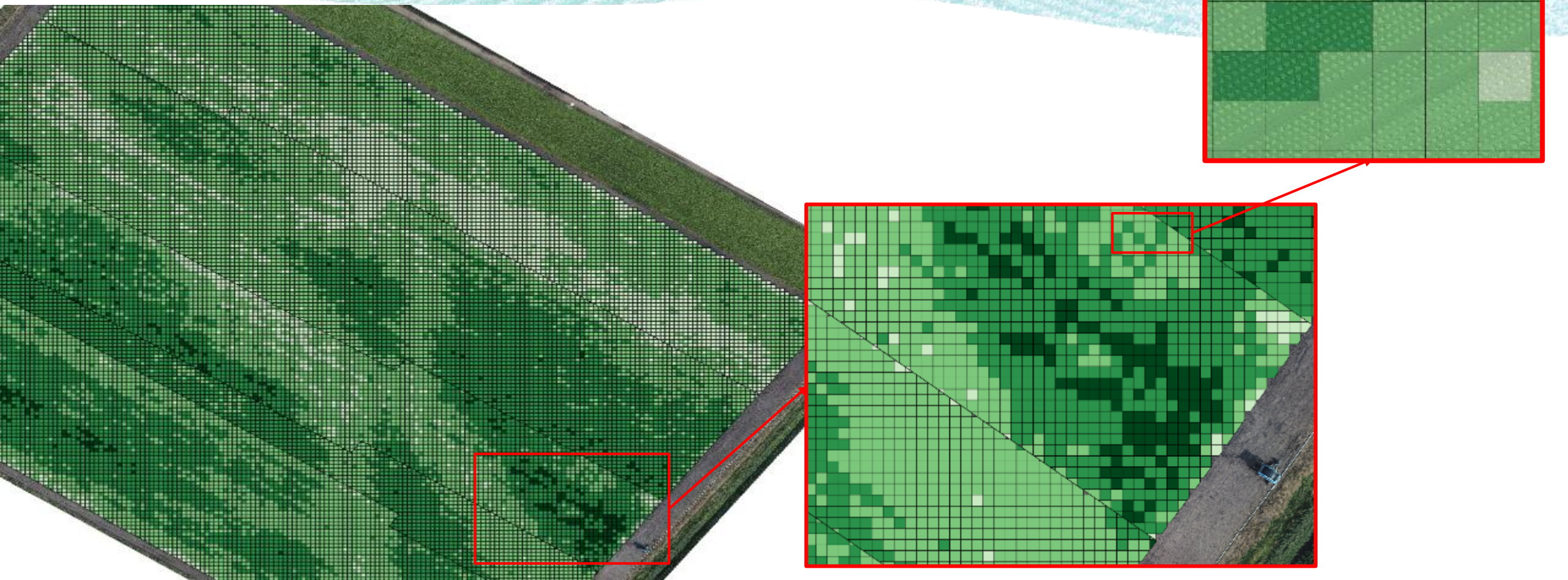
Collect and orthomosaic UAV imagery. Apply proprietary deep learning algorithm across data and deliver counting and sizing outputs.

Per Variety Plot Size Map

Darker cell colour corresponds to larger average size, lighter colour to smaller size.

Example application:

- **Cells are grouped in size bands for harvest scheduling.**
- **Bands are used to determine spot spray Nitrogen strategy (spray OR no-spray).**



BENEFITS TO THE GROWER

- High resolution RGB and NDVI imagery to direct field scouting and alert attention to certain areas
- Accurate capture of lettuce data throughout the season to assist fleecing / harvesting schedules.
- Precision farming enablement by identification of lower/higher growth areas.
    - Reduction in Nitrogen inputs by up to 30% through spot spraying.
    - Identification of disease through distribution of leaf colour/ greeness

- Sizing information can be used to allow the grower to homogenise / segment the crop per plot.
    - Sustainable farm management.
    - Limit waste.


GET IN
TOUCH
www.hummingbirdtech.com
uksales@hummingbirdtech.com
jeff@hummingbirdtech.com
UK - AUSTRALIA - BRAZIL - RUSSIA - UKRAINE - NZ - CANADA

Agri-Tech Week
9th - 13th November 2020

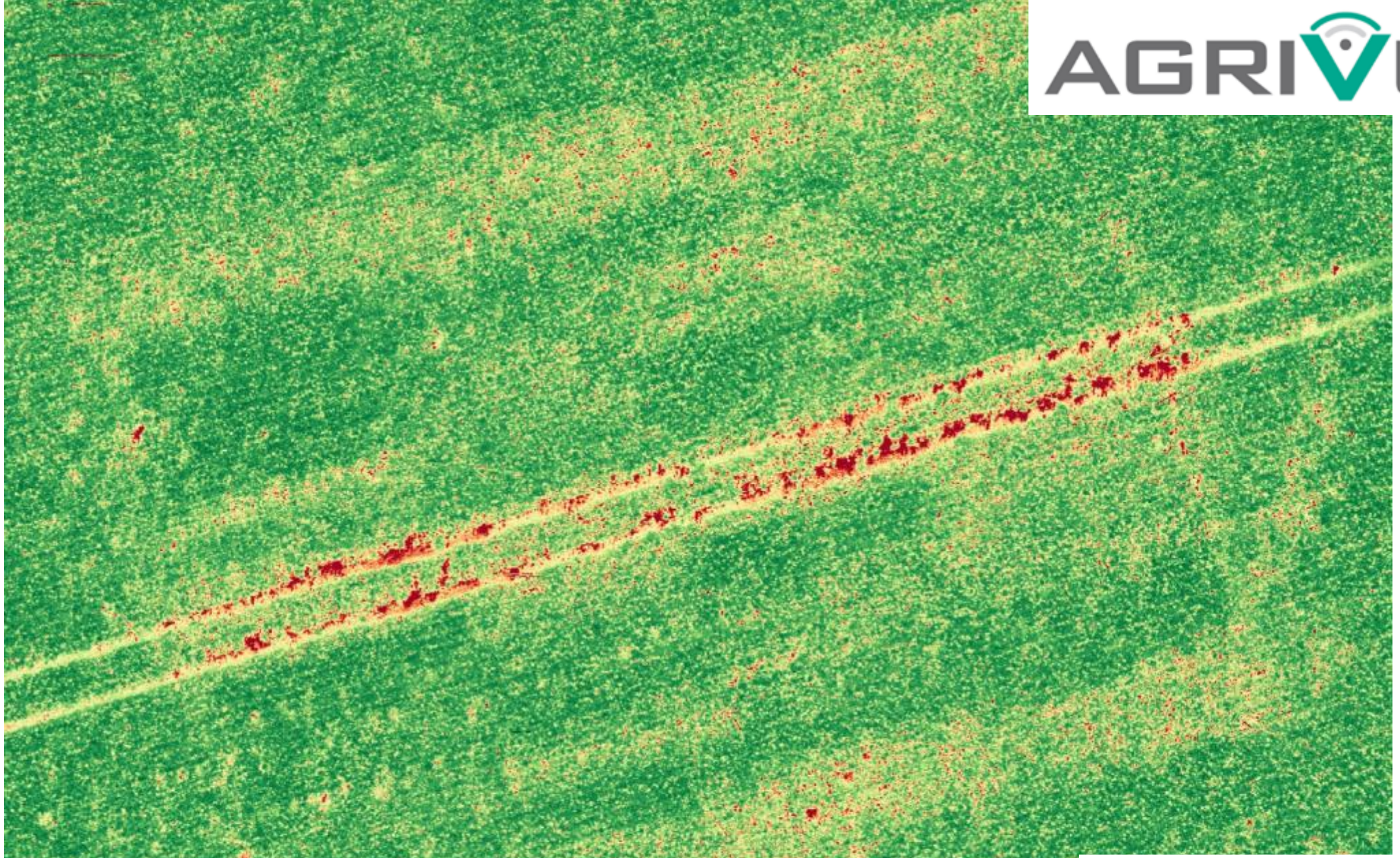
AGRIVUE

uVue drones

Russell Delaney

www.agrivue.co.uk

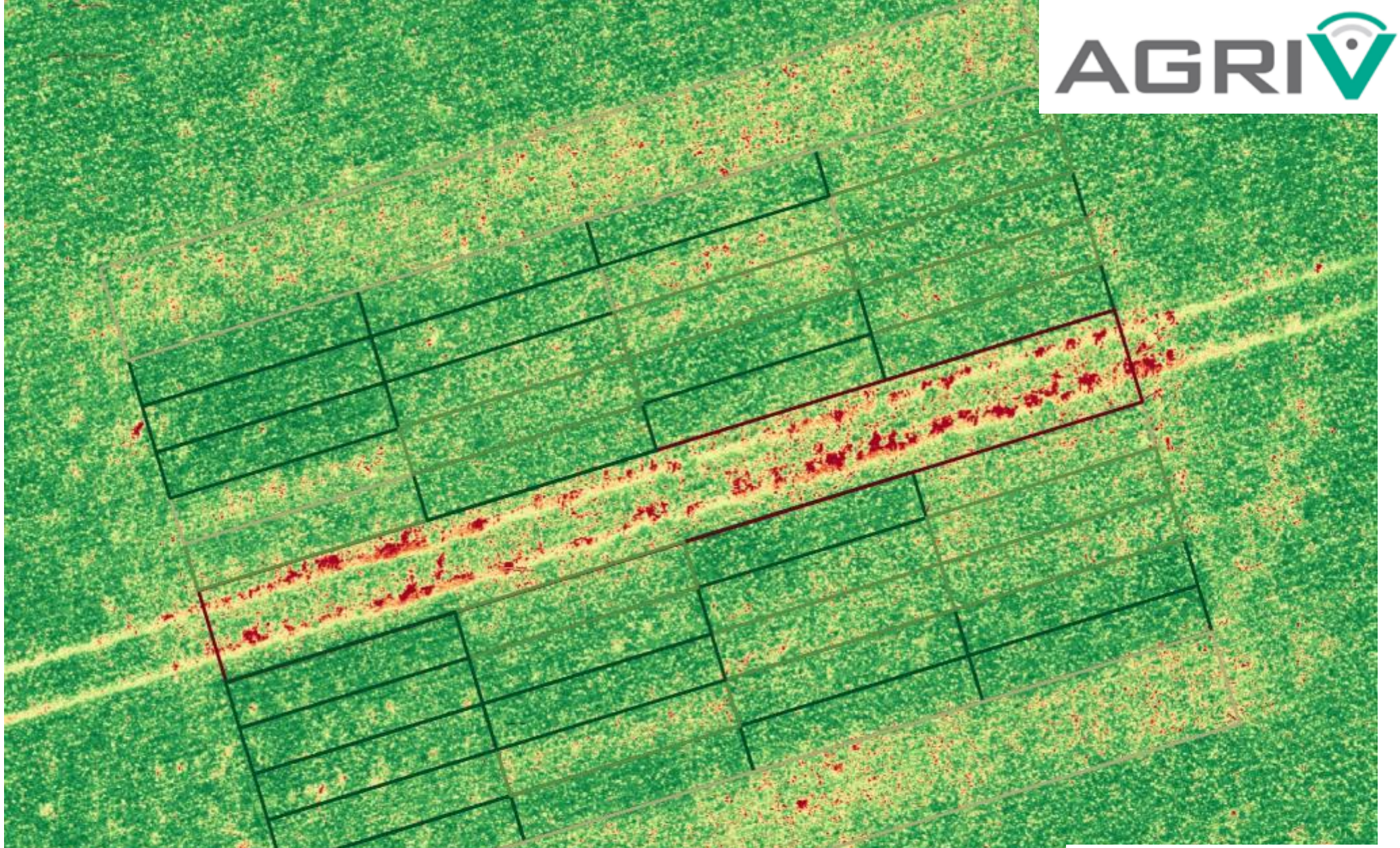
info@uvuedrones.co.uk



AGRIVUE

www.agrivue.co.uk

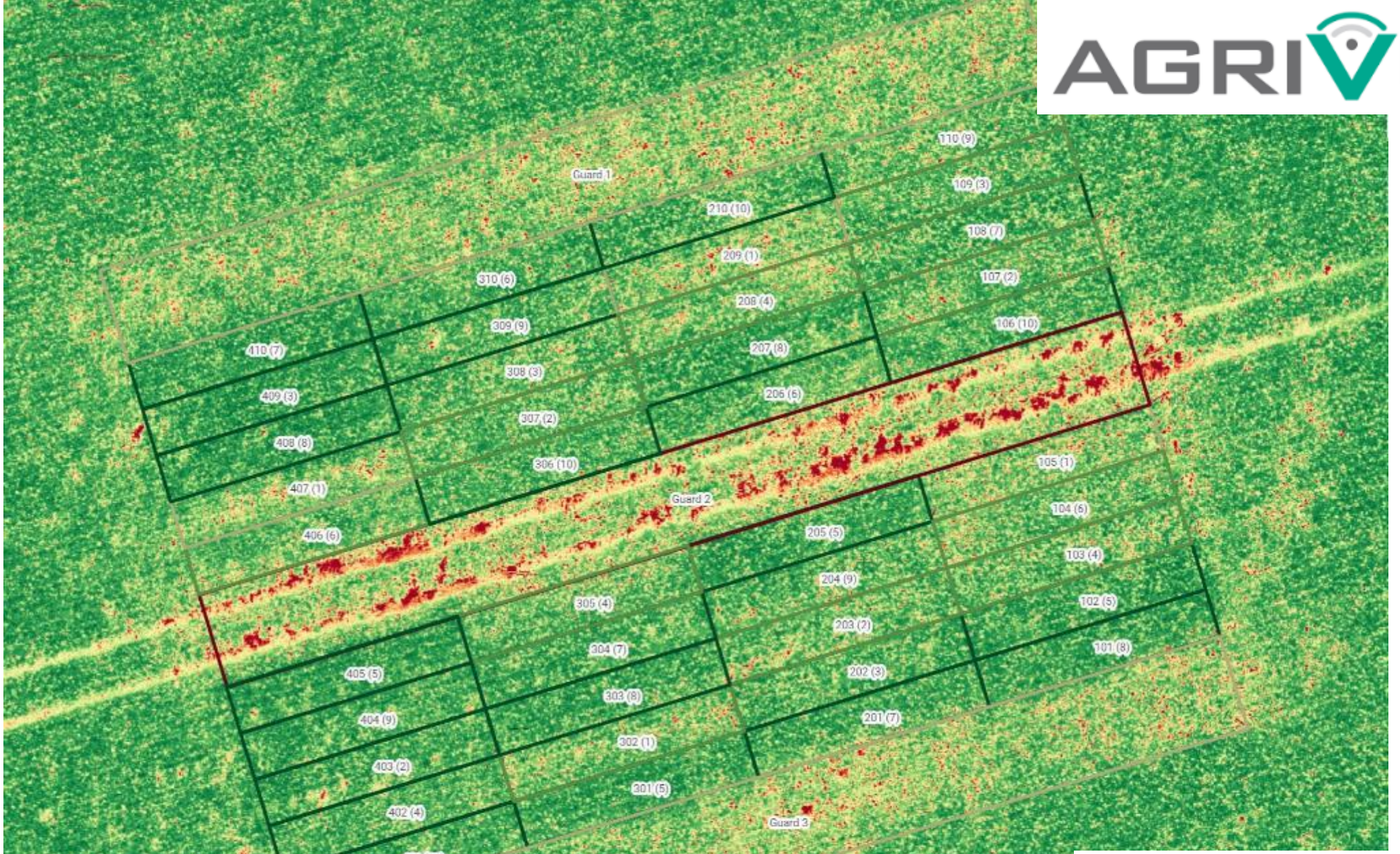
info@uvuedrones.co.uk



AGRIVUE

www.agrivue.co.uk

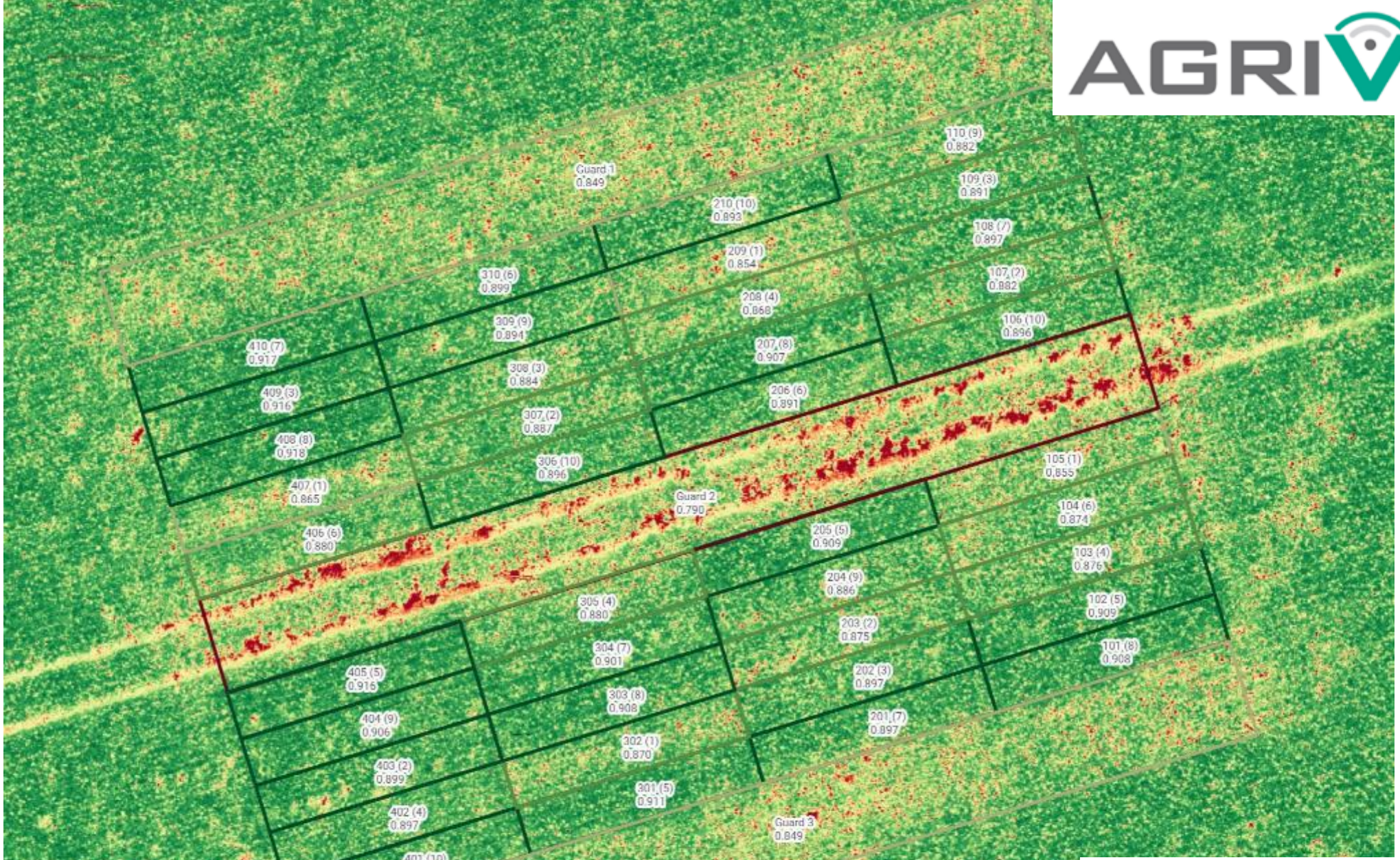
info@uvuedrones.co.uk



AGRIVUE

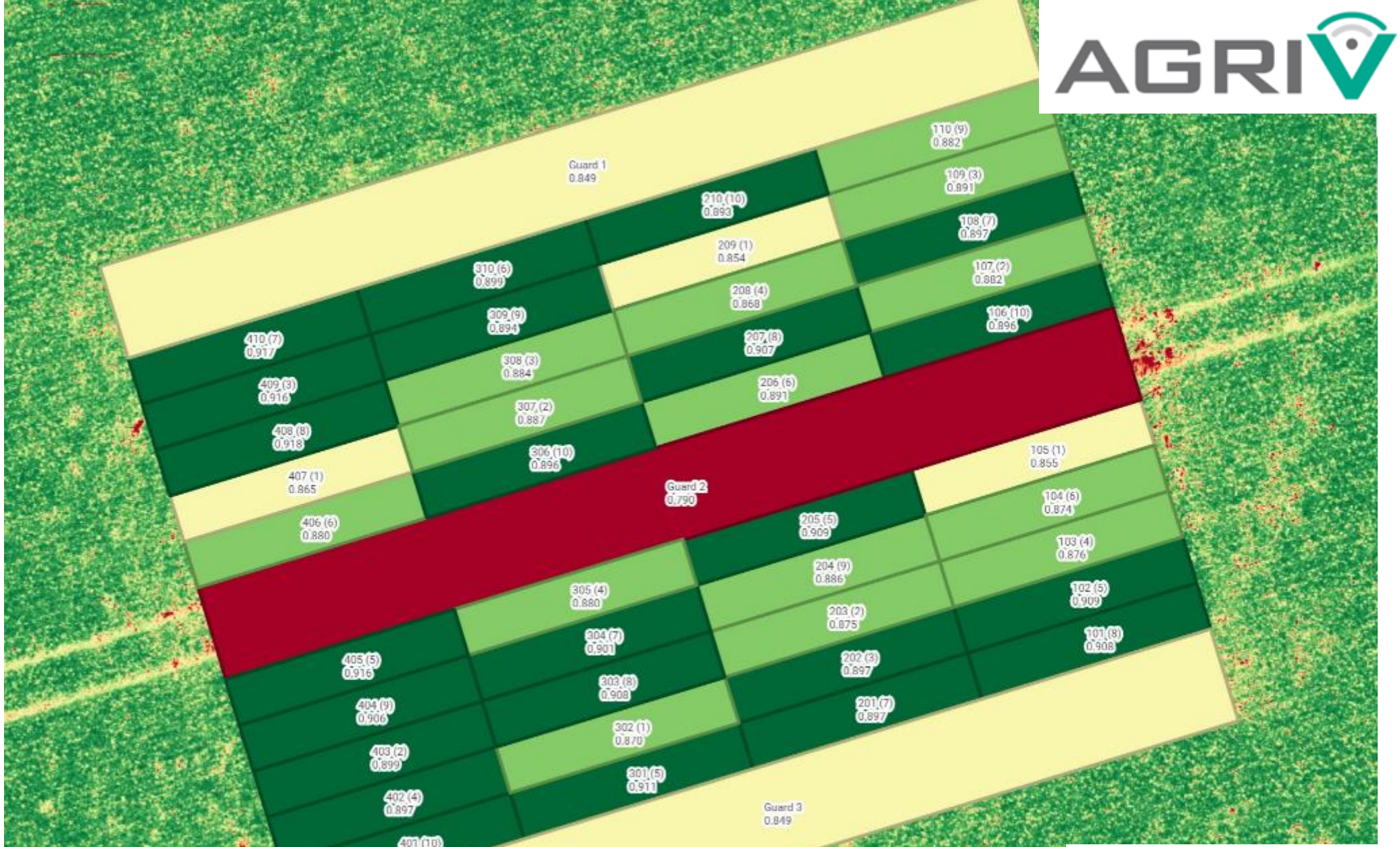
www.agrivue.co.uk

info@uvuedrones.co.uk



www.agrivue.co.uk

info@uvuedrones.co.uk



AGRIVUE

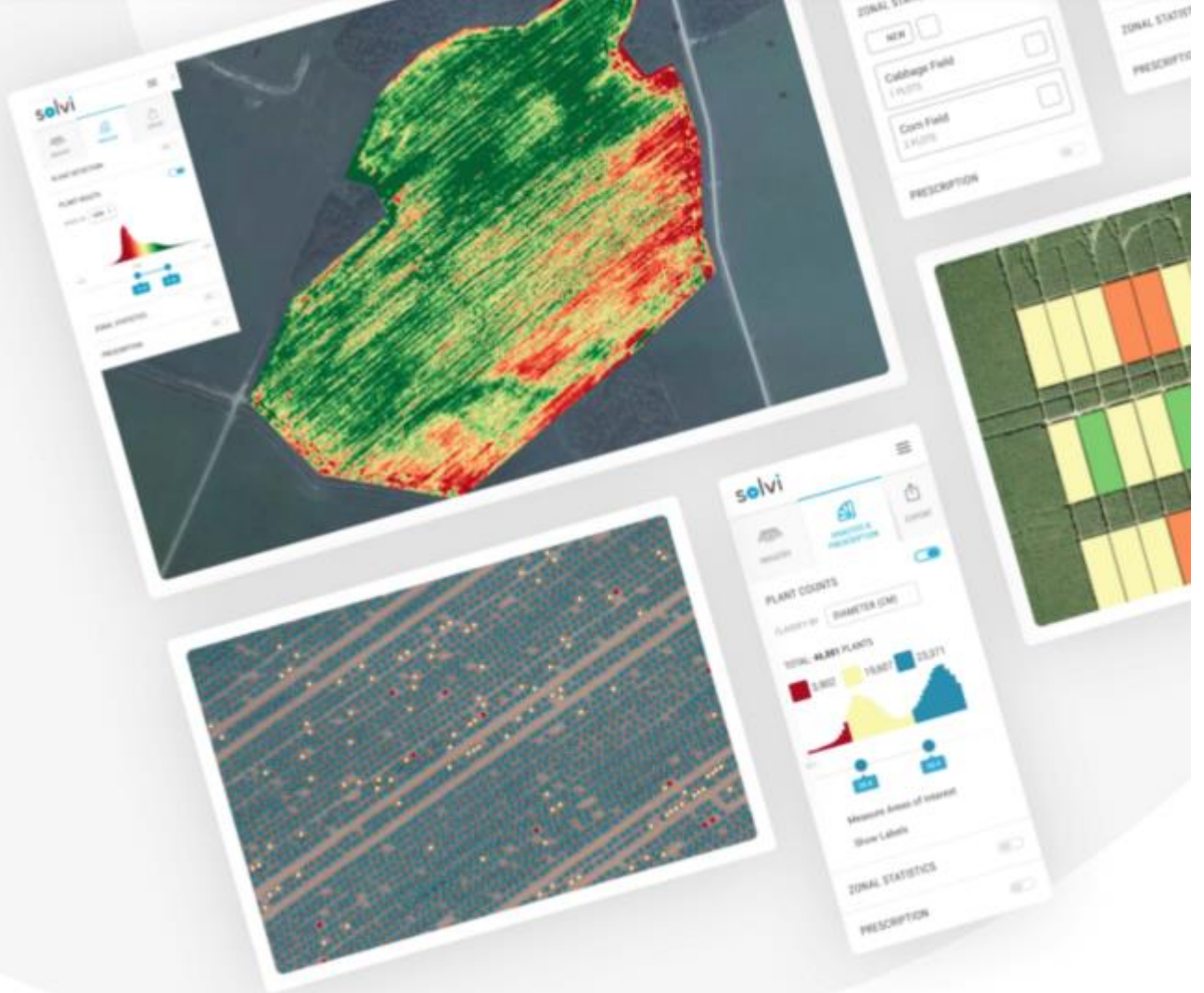
www.agrivue.co.uk

info@uvuedrones.co.uk

solvi

Get to know your crops with drone imagery

Solvi offers a complete solution for drone-based crop monitoring so you can make better decisions about your crops.



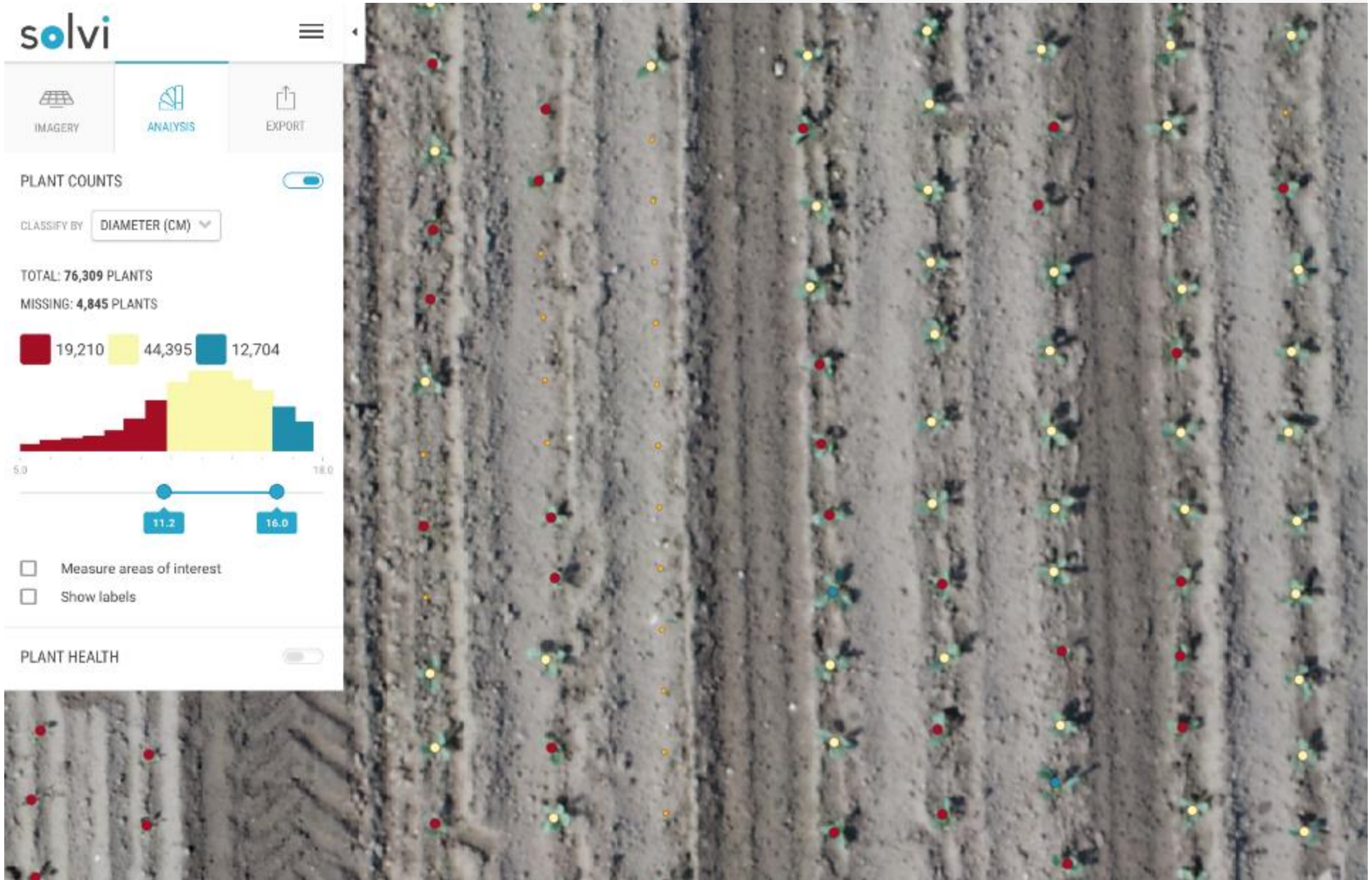
TRUSTED BY LEADING RESEACHERS, AGRONOMISTS AND ORGANIZATIONS

agrovista · TEKNOLOGISK INSTITUT · SEGES · DATAVÄXT · NBR Nordic Beet Research · SLU · SVEASKOG

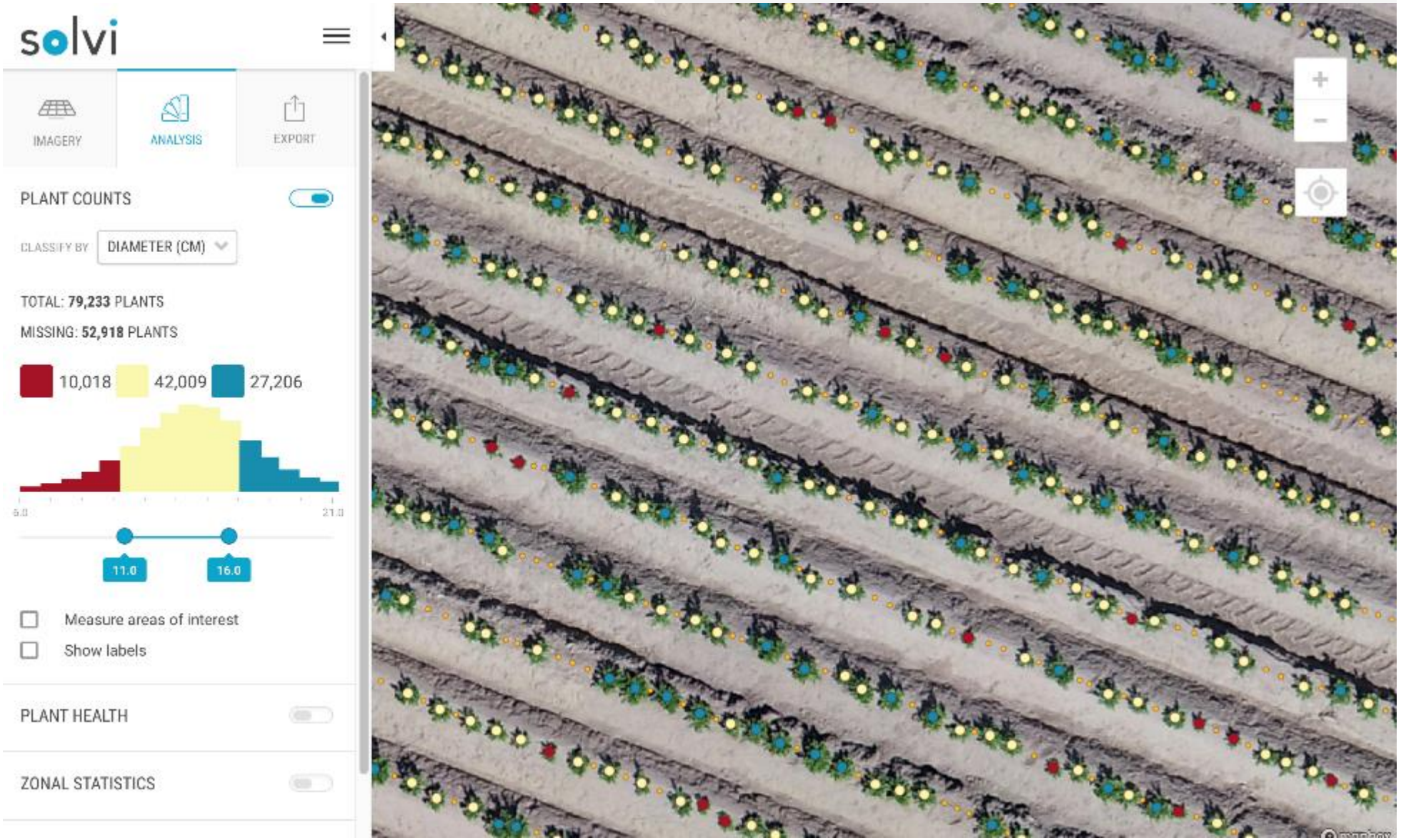
Drone imagery helps optimise crop production and improve yields

1. Crop establishment after planting

Crop establishment in vegetables

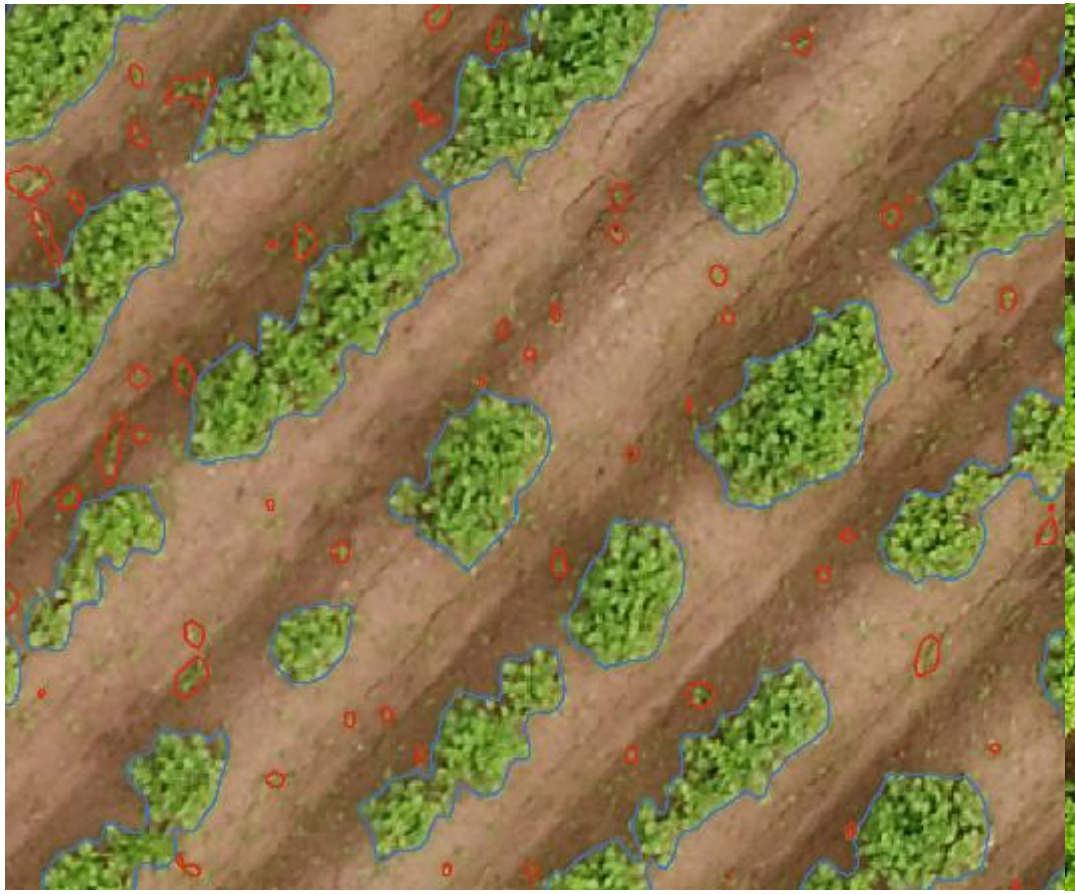


Crop establishment in potato

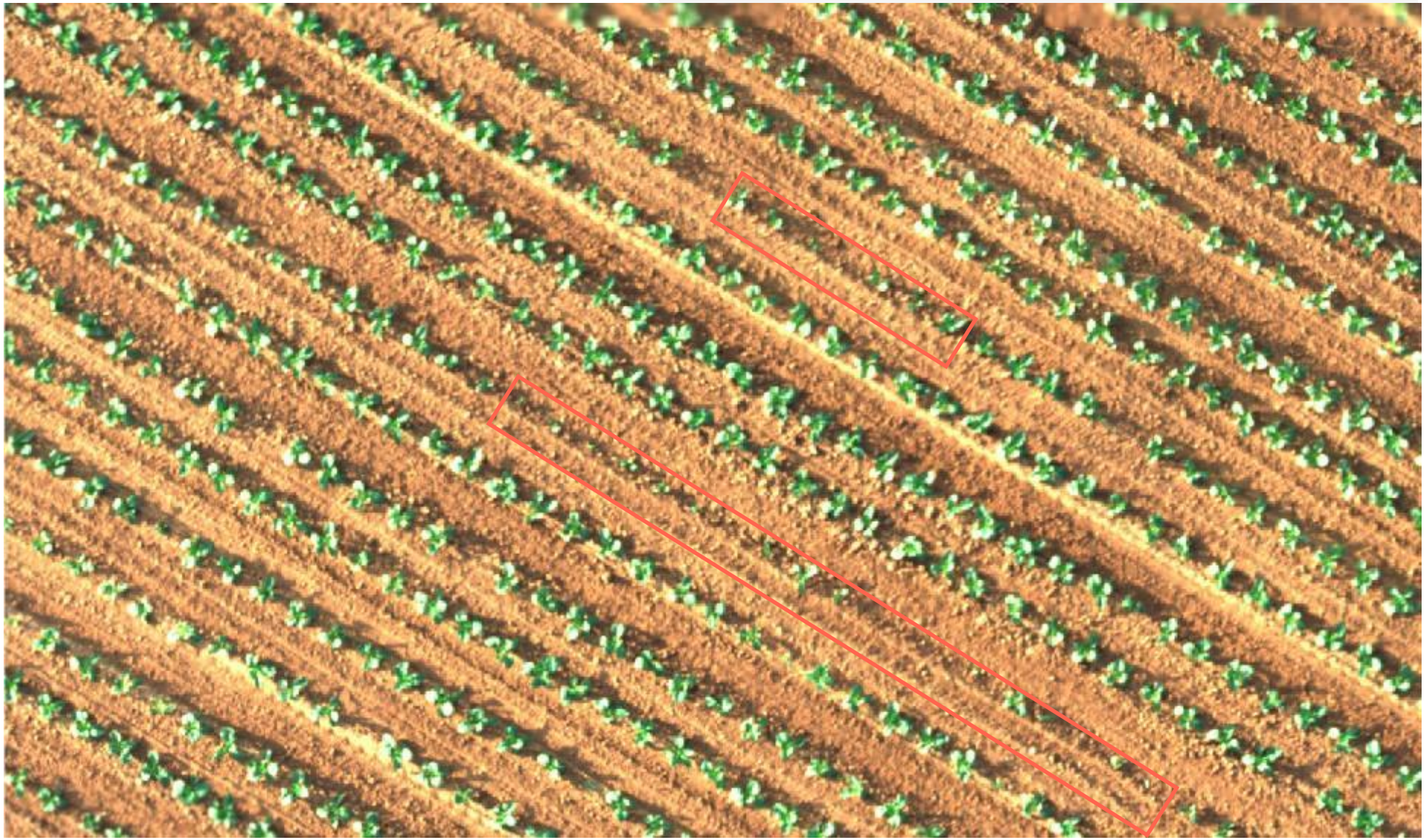


2. Monitoring and management of weeds, pests and diseases

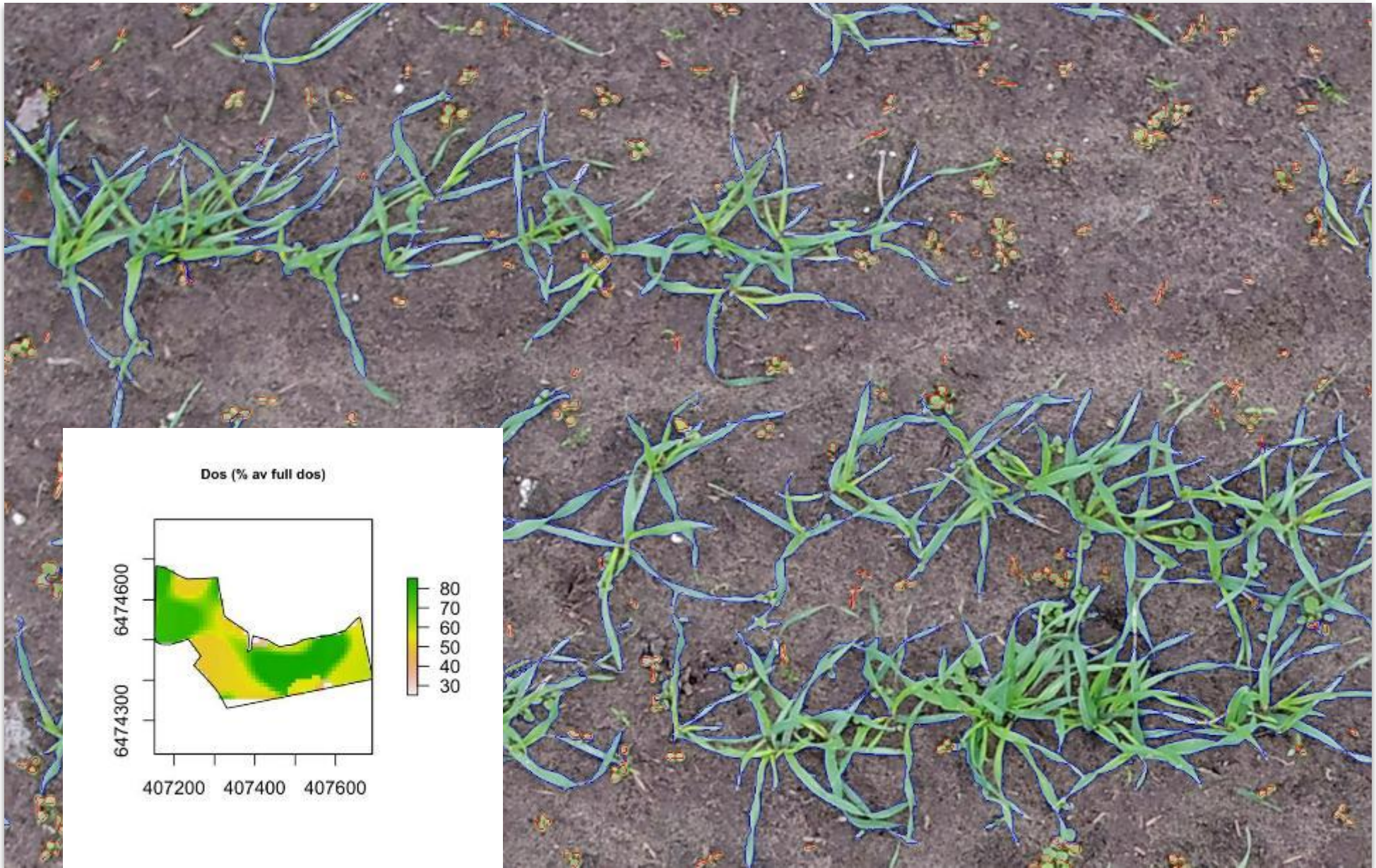
Evaluate weed management



Evaluate mechanical weed control



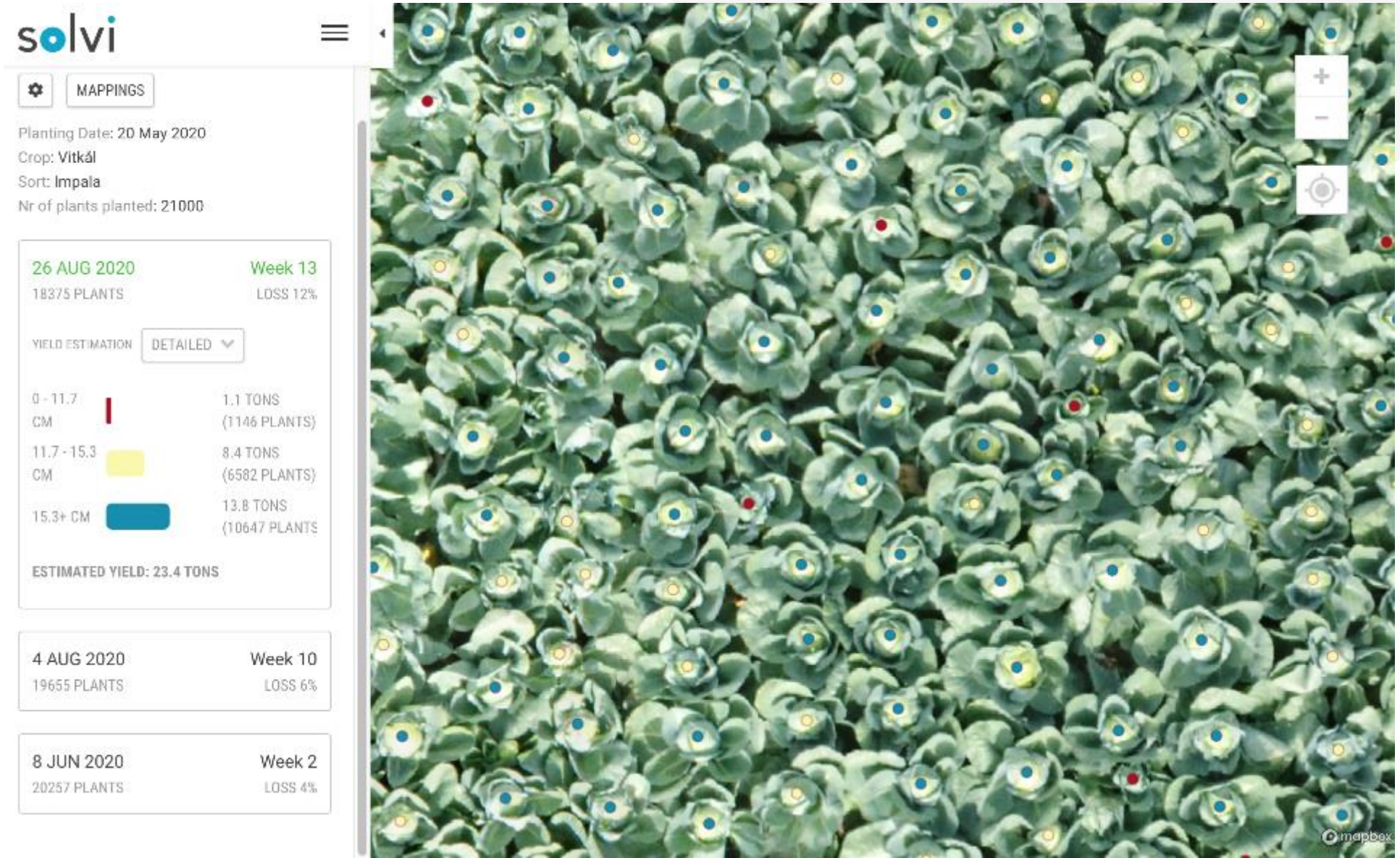
Variable rate weed-spraying



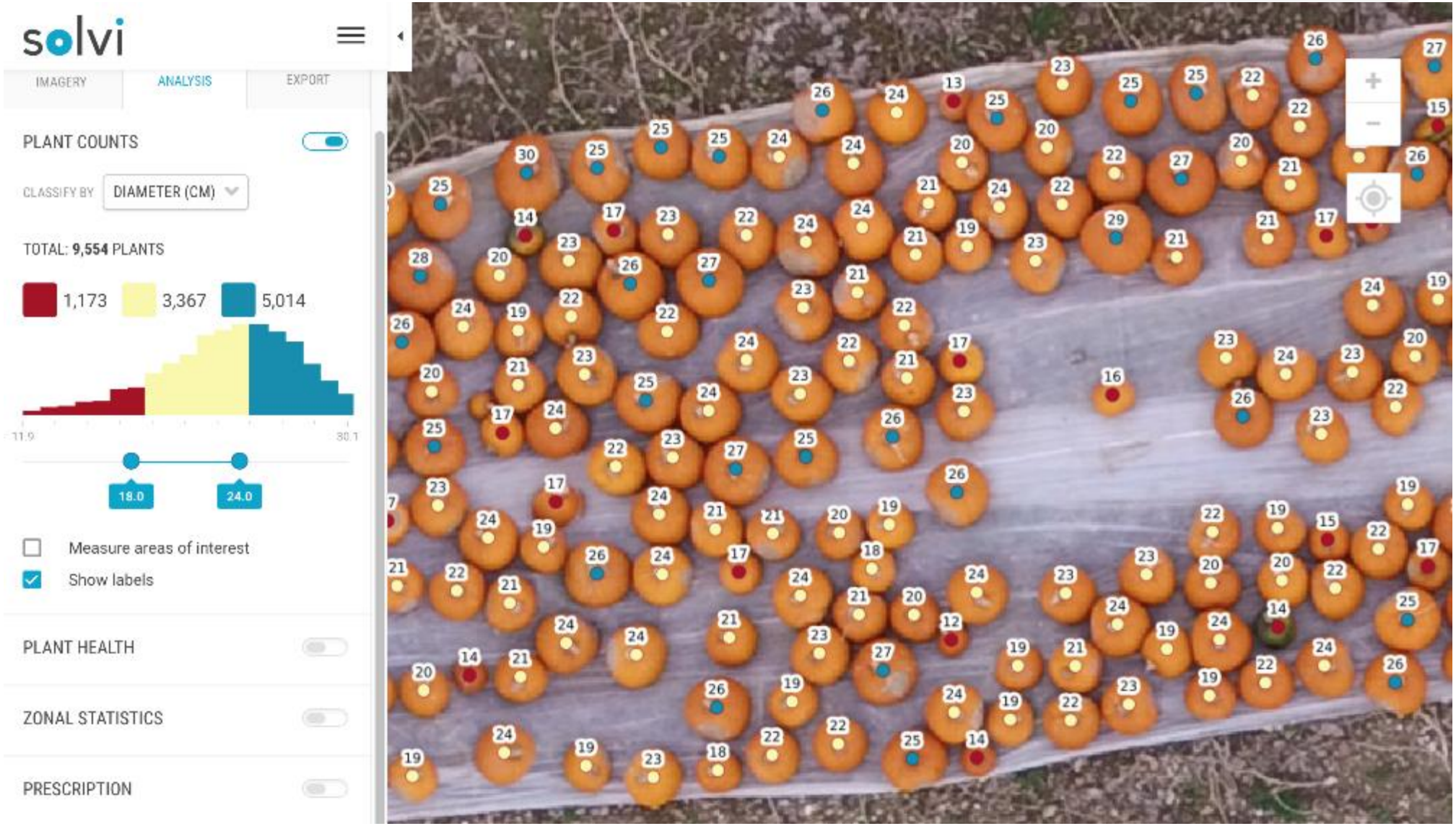
Pests and diseases

3. More accurate yield estimations

Yield Estimation, cabbage



Yield Estimation, pumpkins



solvi

1. Crop establishment after planting

2. Monitoring and management of weeds, pests and diseases

3. More accurate yield estimations

www.solvi.ag

Thank you!

Igor Tihonov
+46 704408004
igor@solvi.ag

Hummingbird Technologies

AGRIVUE

solvi

Framework conditions for innovation

Questions

Hummingbird

uVue

Solvi

Agri-Tech Week 9th - 13th November 2020

@InnoVeg #INNOVEG #ATW20

Questions & discussion

Remote sensing as a driver for innovation and profitability gains in agriculture? What do you think?

1. What are the biggest opportunities for remote sensing in agriculture in the next 5-10 years?

2. What are the main trends driving progress in the remote sensing sector?

3. What are the biggest challenges yet to be overcome?

https://www.inno-veg.org/en/Forum

Framework conditions for innovation

Thank You

Thanks for joining! Follow the project at

www.inno-veg.org

@InnoVeg #INNOVEG #ATW20