Big Data and 5G in Agriculture

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Agenda

Big Data and 5G in Agriculture	• Alexander Lehrmann, Sunrise UPC • Thomas Anken, Agroscope • Michael Feitknecht, fenaco
Innosuisse Research Project: Weed Detection using Drones and Agricultural Robots	• Thomas Anken, Agroscope • Dejan Seatovic, OST University of Applied Sciences
What Does the Future Hold?	• All

1. Big Data and 5G in Agriculture

Alexander Lehrmann (Sunrise UPC)
Thomas Anken (Agroscope)
Michael Feitknecht (fenaco)

Welcome to the 5G Joint Innovation Center…

… where pioneers assemble

Inspiration	**Experience 5G live**
Speak to experts	**New ideas**

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Survey: What are the Benefits of 5G?

A. Less energy consumption
B. Mobile broadband
C. Massive connectivity
D. Low latency
E. All of the above

The Evolution of Mobile Communications

1G	2G	3G	4G	5G
Mobile voice communication	Efficient voice communication for the mass market	Focus shifting to mobile data	Mobile broadband and its expansion	**A future-oriented platform**
1980s Analog voice	1990s Digital voice	2000s Wireless Internet	2010s Mobile broadband	**2020s** **Wireless Edge**

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5G is Shaking up Every Industry…

Driver of innovation – 5G for IoT

Logistics / 5G factory

5G technology

Networking anywhere

Smart farming

Telemedicine

Smart cities

5G and transport

Smart homes

Entertainment using 5G

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… and is Uniting Seemingly Conflicting Goals

90% less pesticides

Green 5G

30% more milk

People and the environment

Animal welfare

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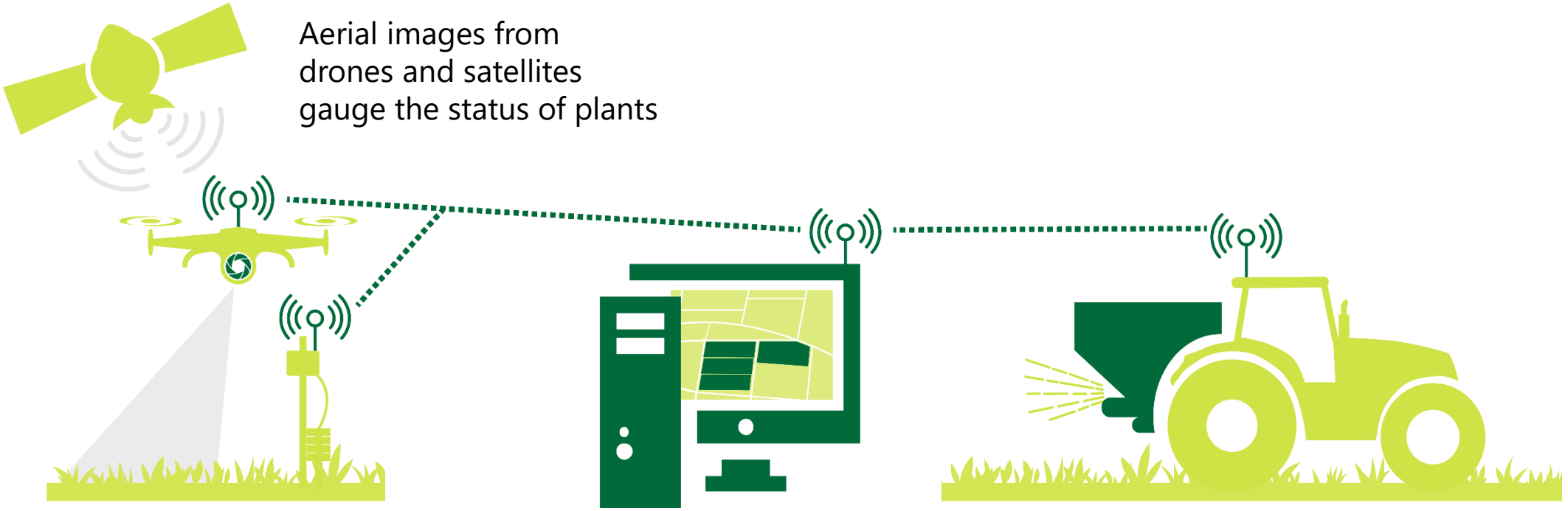
5G & IoT: Complementing «Farmer's Instinct» through Quantitative Methods



Aerial images from drones and satellites gauge the status of plants

Soil information

Creation of a fertilization map

Adjusted application in the fields

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IoT for Controlling Irrigation

Weather station

Soil moisture

Dendrometer
(stem diameter)

Flow meter

Water savings of 30% in Switzerland and Brazil

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Individual Plant-Specific Treatments

Camera detects lettuces

- Only lettuces are treated
- Pesticide usage reduced by up to 90%
- Future with 5G: Analyze camera images, check for diseases and send images to the producer

Joint project with
Steketee, Möri Aarberg
Schw. Zentralstelle für Gemüsebau, Koppigen
Agroscope Wädenswil & Tänikon

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Autonomous Vehicles: Low Latency and Good Connectivity

- Controlling and monitoring autonomous devices requires good connectivity
  → Significant parallels with commercial self-driving cars
- Tasks such as weed regulation in pastures and fields, landscape maintenance and sowing and harvesting work could in future be tackled by autonomous vehicles

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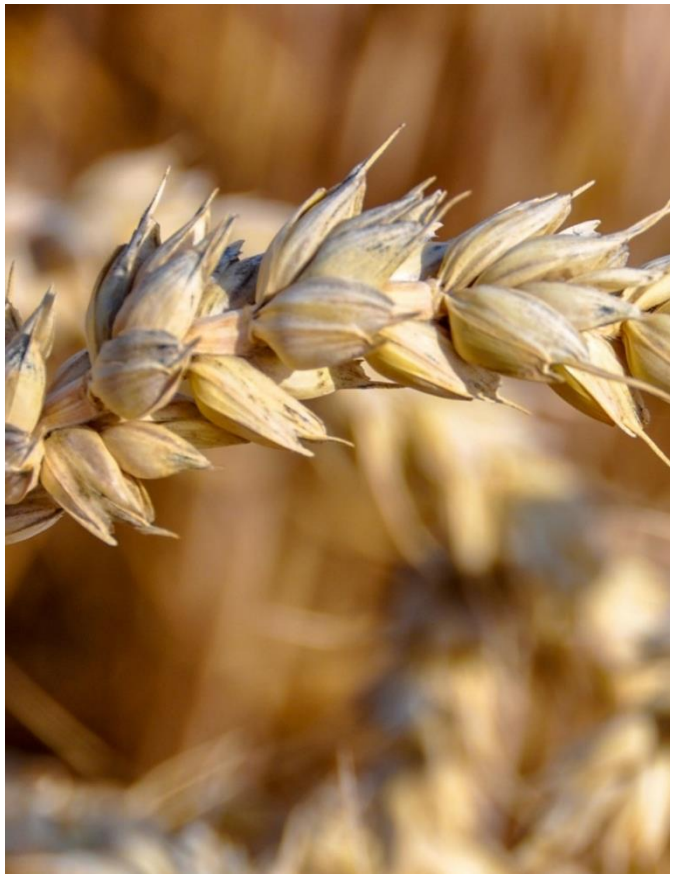
High Expectations for Agriculture



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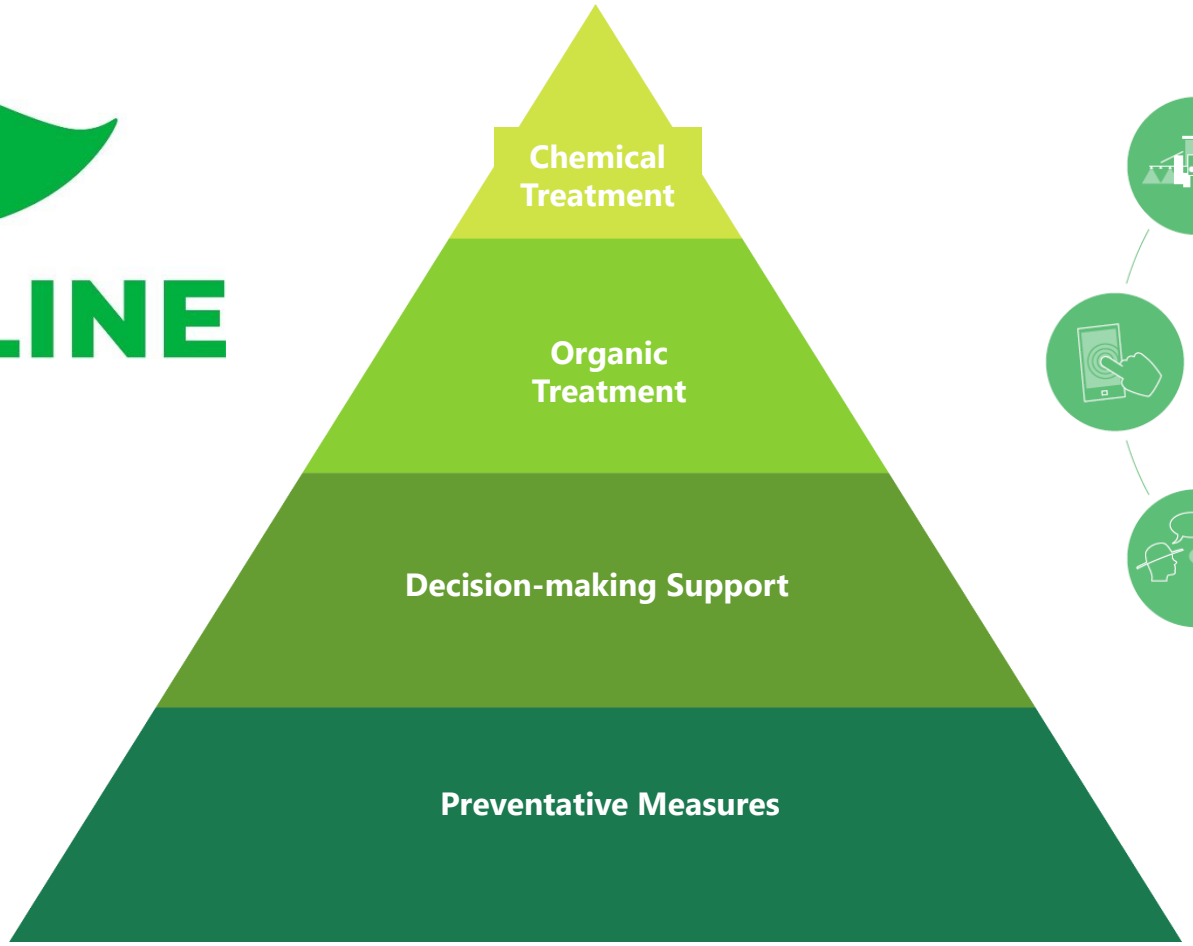
Integrated plant protection

AGROLINE



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Research Partnerships and Startups

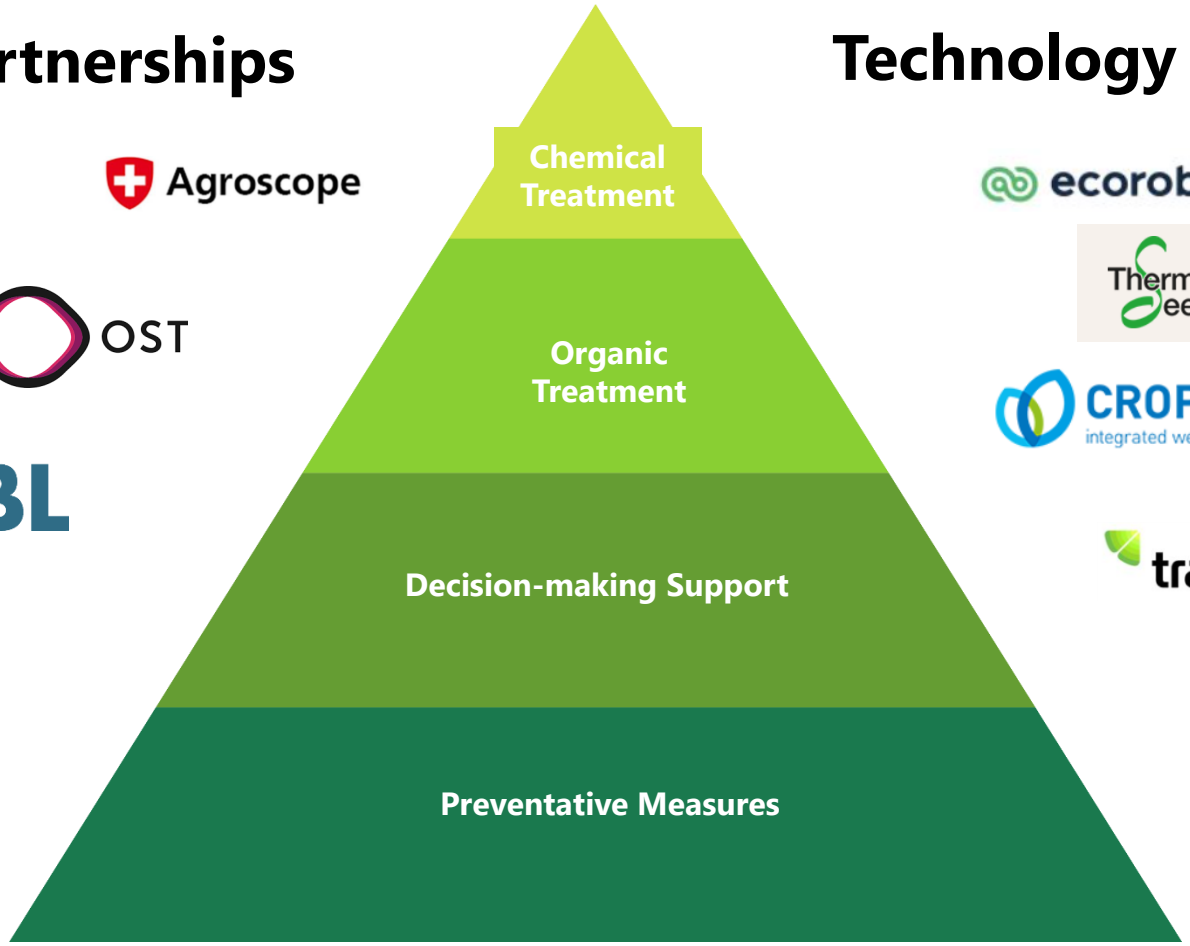
Research partnerships

Agroscope

OST

FiBL

ETH zürich



Technology

ecorobotix

Thermo Weed

serco landtechnik

CROP.ZONE integrated weed management

trapview

barto powered by 365FarmNet

ApiCenter

UFA SAMEN | SEMENCES

LANDOR

fenaco

Agroscope

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Plant Protection – Digital Solutions

- New solutions thanks to research and technology
- Combination of drones, robots and mechanical systems
- Goal: Reduce environmental risks, promote alternative plant protection

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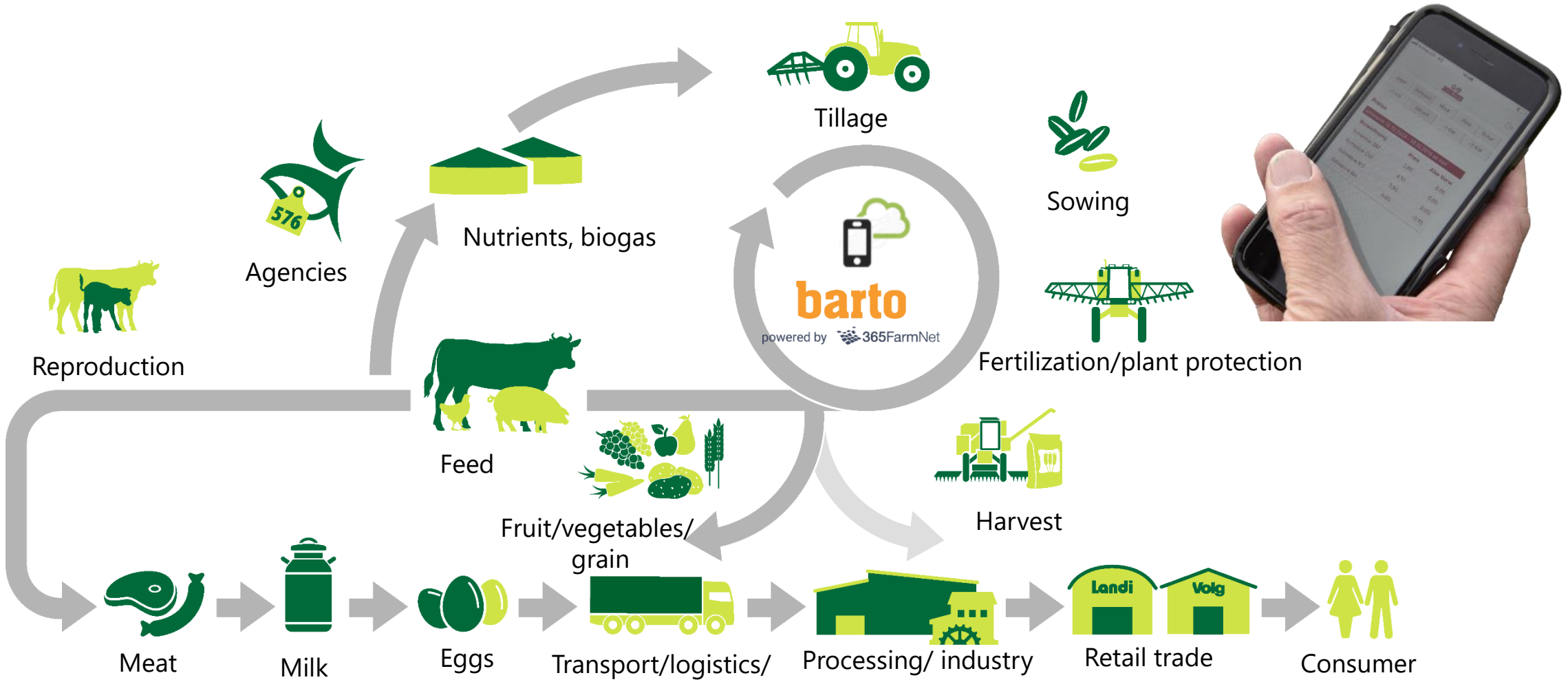
Optidrone

- Biodegradable «Optikugeln» («Optiballs») over corn fields
- Parasitic wasps lay their eggs in the eggs of the European corn borer
- Today, more than 15% of Swiss corn is protected via Optidrone

Digital Monitoring of Pests

- Pheromones are used to attract and identify pests
- Automatic counting and regular uploads to the cloud
- Precise and proactive pest control

barto, the digital farm manager



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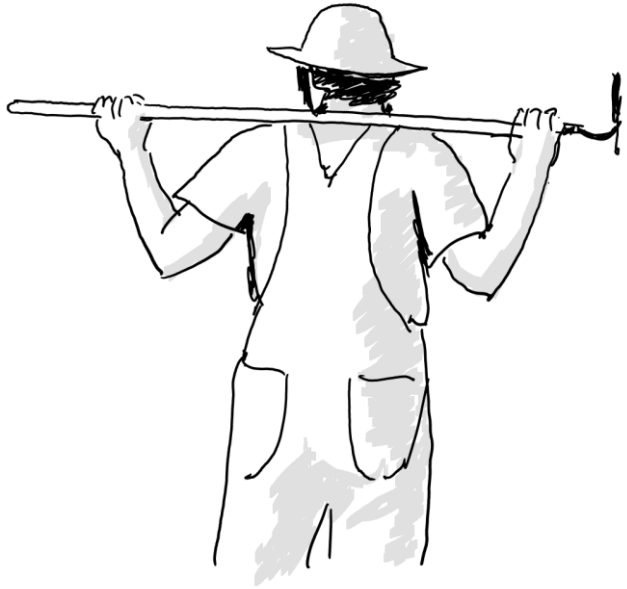
2. Innosuisse Project – Detect and Control Dock

Thomas Anken (Agroscope)
Dejan Seatovic (OST University of Applied Sciences)

The Dilemma Facing Farmers

How do I achieve the highest yield?



Bio/manual work:
Heavy workload, low yield –
but higher margins

Pesticides:
Simple application, certain results

Innosuisse Project: Detect and Control Dock

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Implementation partner for agricultural technology

Agroscope

Research partner for project management and system tests

OST

Main research partner for detection and localization of dock

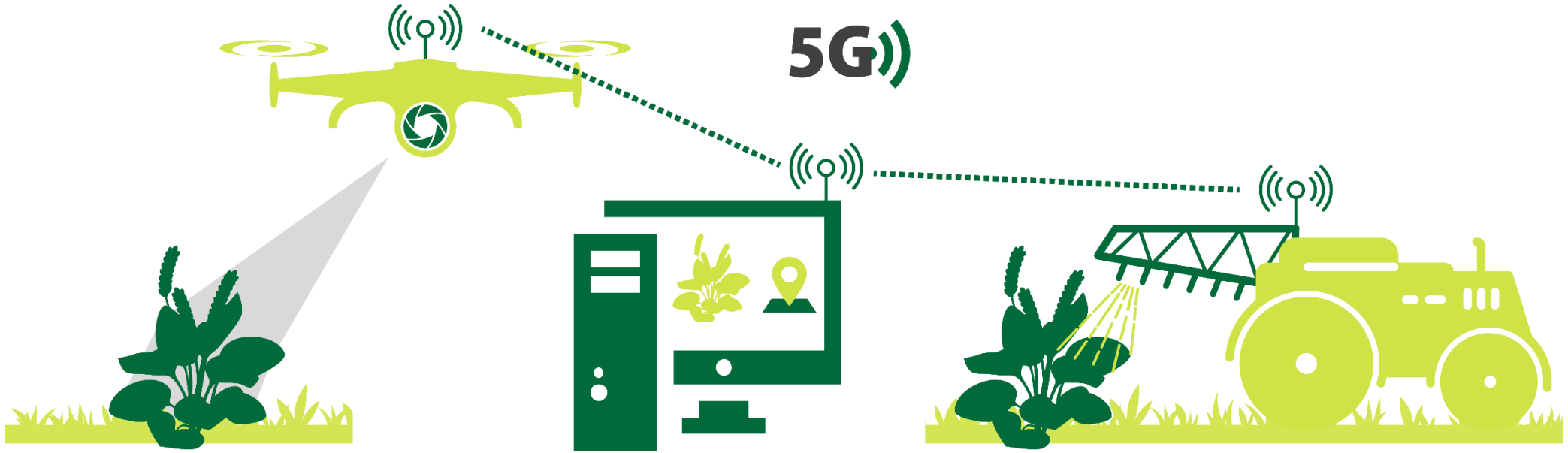
Sunrise upc

HUAWEI

Implementation partner for communication infrastructure

Project Proposal

Workflow Overview



Raw data → Orthophoto → Plant detection → Plant localization → Mission file

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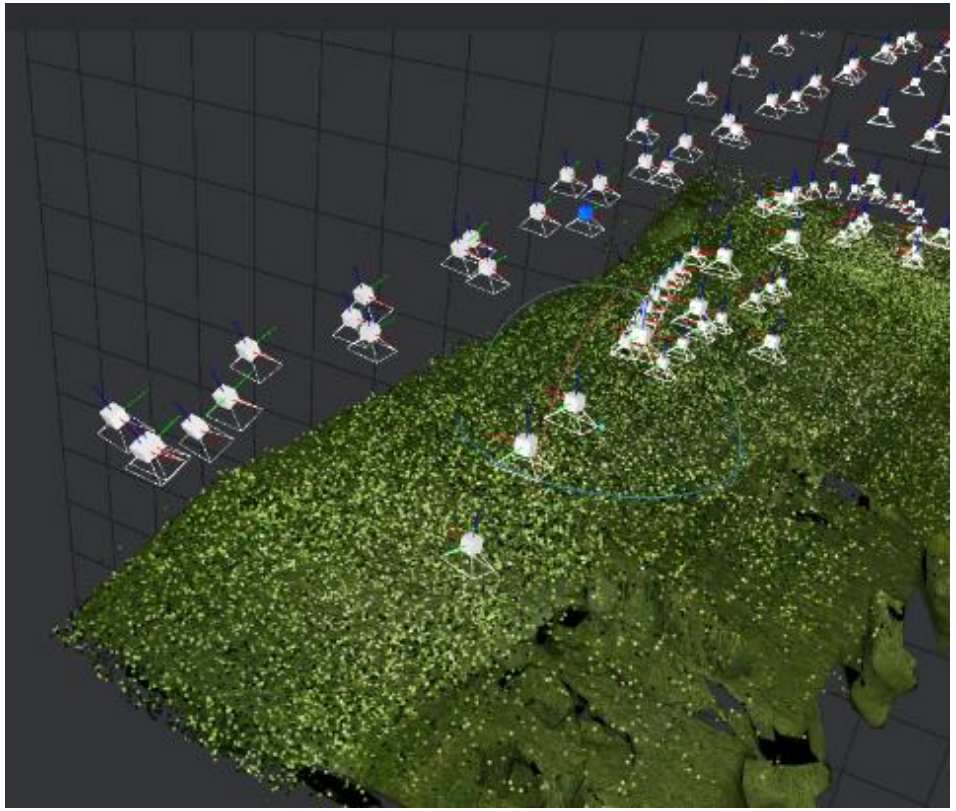
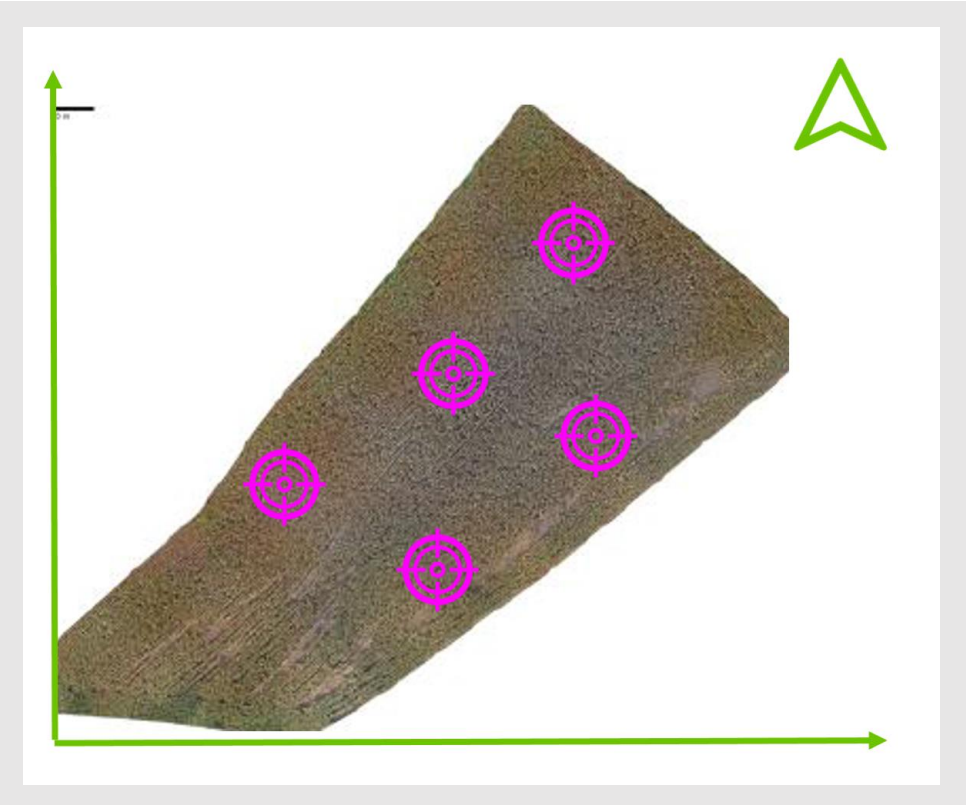
Taking the Images and Creating a Map



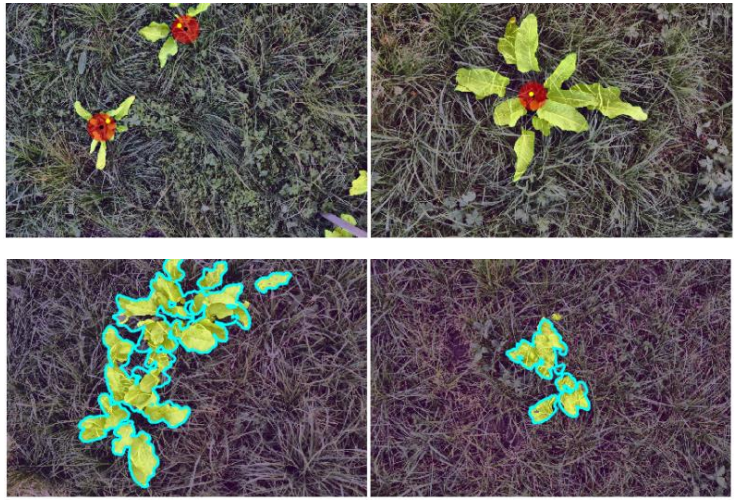


The Map

Dock Segmentation via Neural Network

Collected data

- 113 images – 1.7 GB
- <2 mm/pixel required for labeling



Detection

- Algorithm based on U-Net
- True positive 80% (119/143)
- False positive 50%

High spatial resolution required

- Min. 3 mm/pixel

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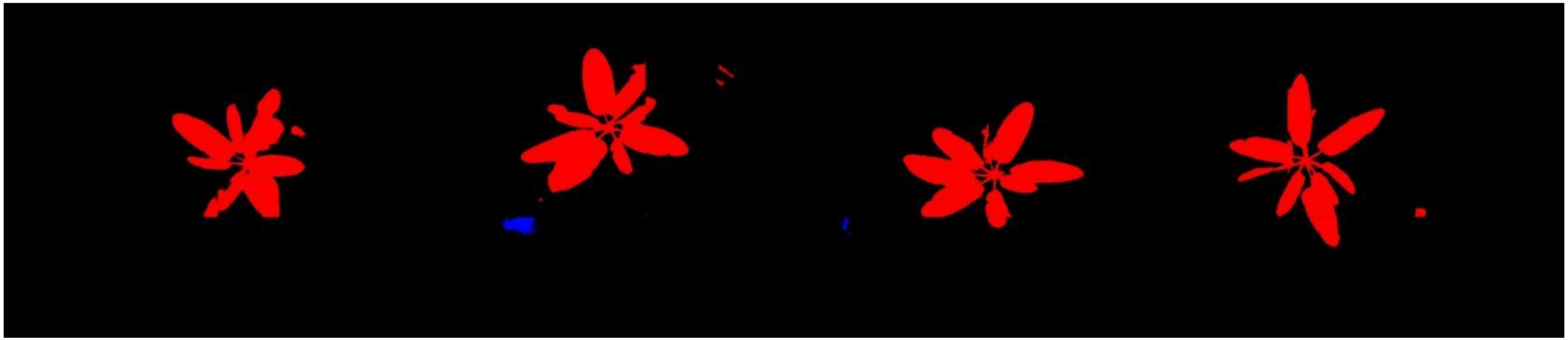
Detected Docks



Root Localization

Image quality is essential

3. What Does the Future Hold

Michael Feitknecht (fenaco)
Thomas Anken (Agroscope)
Dejan Seatovic (OST University of Applied Sciences)
Alexander Lehrmann (Sunrise UPC)

New Offers in the Field of Plant Protection

- Accurate advice
- Expansion to cover other weeds
- Complete documentation
- Invasive species

Benefits to Farmers

Better advice regarding plant protection

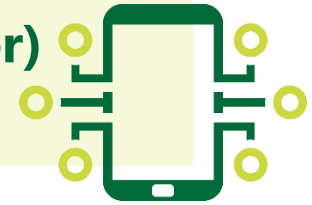
Reduced usage of pesticides

Issues detected early

Scaling to cover additional weeds

Simplified administration

Integration of additional data (e.g., weather)



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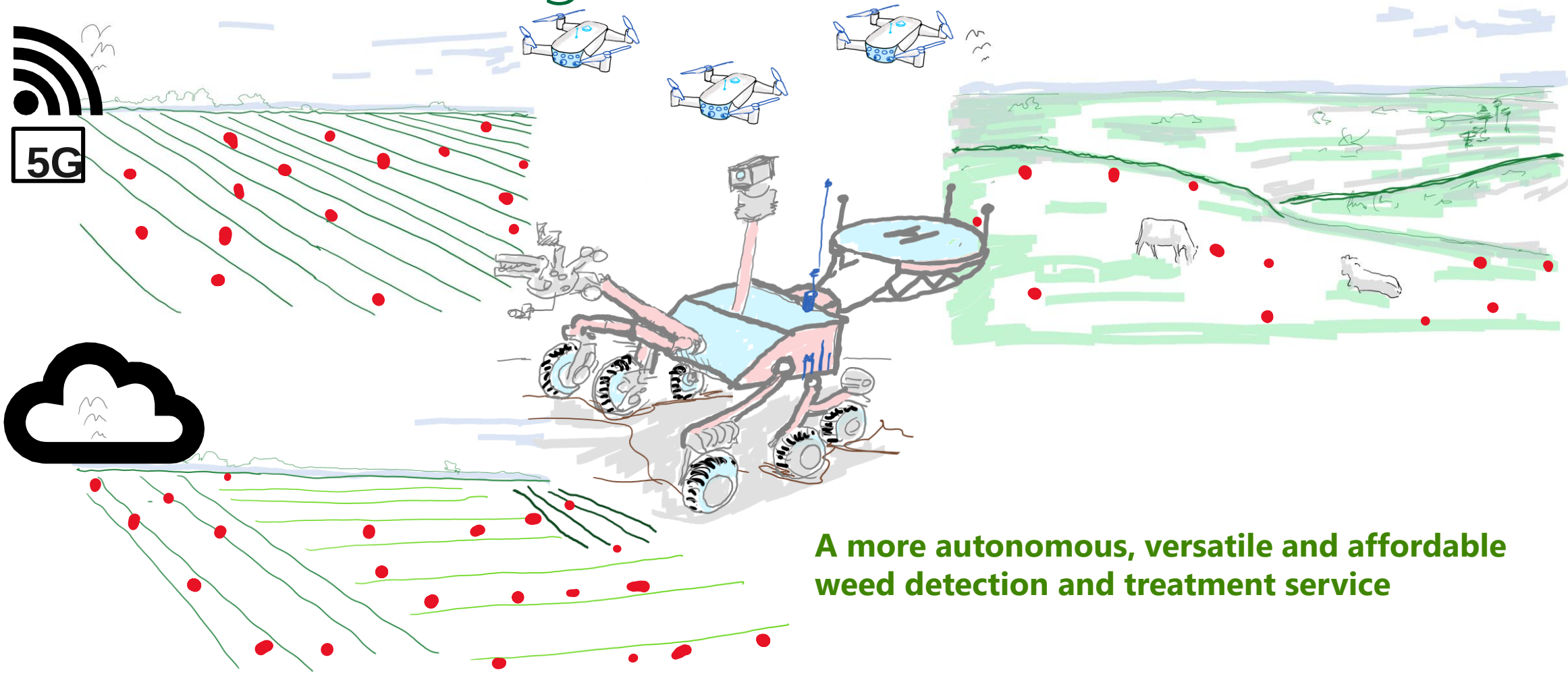
The Vision for Agriculture



A more autonomous, versatile and affordable weed detection and treatment service

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Data-based Agriculture

Complex challenges –
digital solutions

Combination of sensors,
data transfer
and data processing

Basis for more efficient
and **sustainable production** in
agriculture

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Thank You for Listening