Cooperation with the UN, here from meeting with UNOOSA in Vienna 2024


Investment hunting
on
Norwegian Embassy
2024

Swedish
The embassy in
Washington


Kunskapsnav
Digitalisering
Knowledge hub for
agricultural digitalization
Jordbruks
verket


Busse
Res gratis! Free ride!
Boka på ridethefuture.se
EASY MILE
RAU 85N
Kick-off
23 October


Goals for the digitalization hub

The knowledge hub's goal is to increase knowledge, strengthen cooperation regarding digitization with relevant actors and for more farmers to see the possibility of using digital equipment. This is with the aim of strengthening the competitiveness of Sweden's primary producers.
The goal of increasing knowledge must be aimed at everyone, regardless of previous knowledge level (digital maturity and use).

By fulfilling the knowledge hub's objectives, the effect is expected to be a stronger agrarian knowledge system that contributes to efficient, profitable and sustainable primary production and a competitive food chain


2 Million Euro, first 3 years


Gård & Djurhälsan
LIVANG LANTBRUKSKONSULT AB
LUDVIG & CO
VÄXA
SLU
LANTBRUKARNAS RIKSFÖRBUND
DeLaval
VÄDERSTAD
AI SWEDEN
Sweden Secure Tech Hub
IOT WORLD
LINKÖPING SCIENCE PARK
RI. SE
Hushållnings sällskapet
Agtech Sweden
LINKÖPINGS UNIVERSITET
Medfinansieras av Europeiska unionen
Jordbruksverket


Professors
Sofia Nyström
Per Andersson


Environmental monitoring

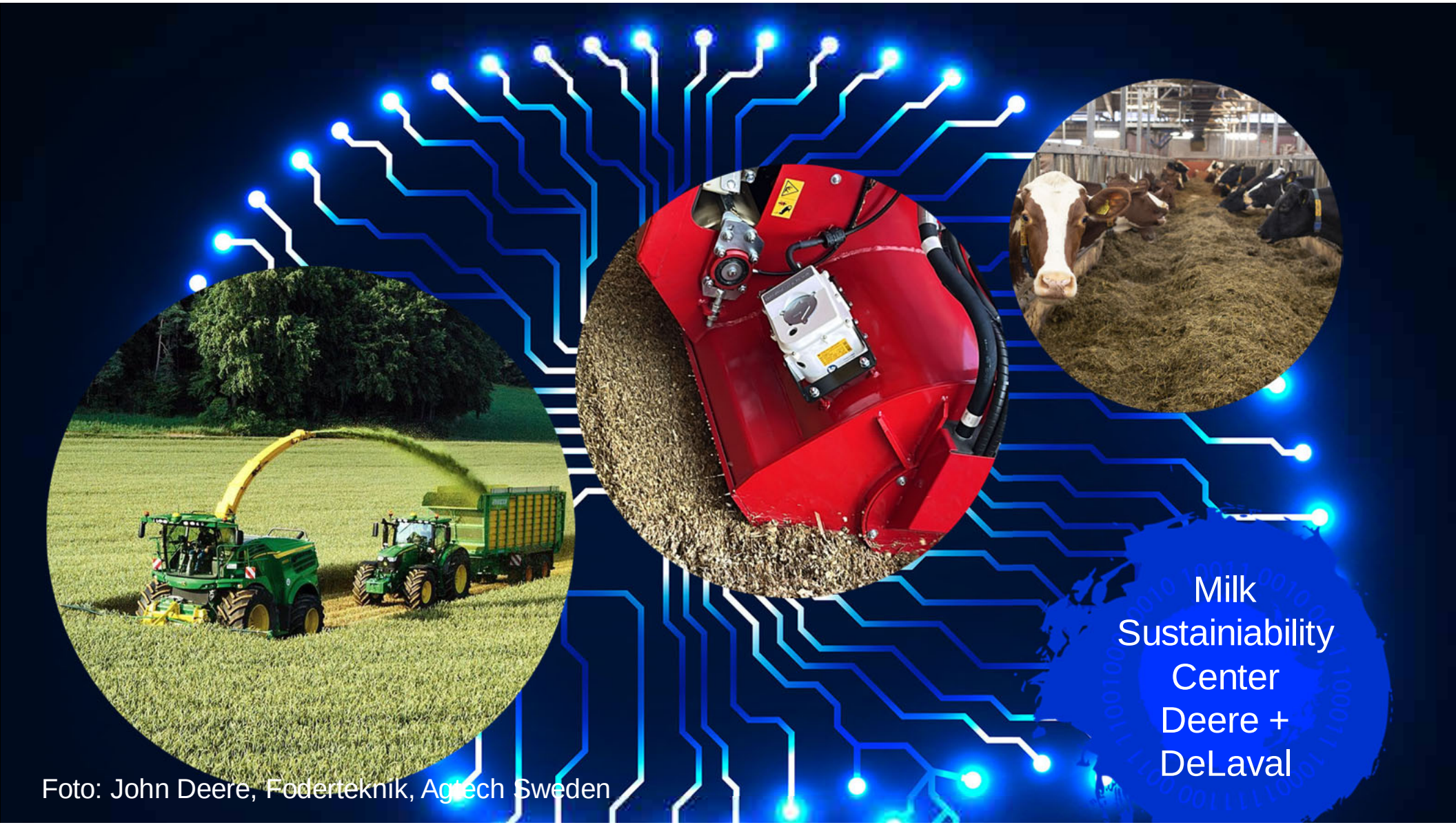


Foto: John Deere, Foderteknik, Agtech Sweden

Gårdslaboratorium för jordanalyser

Namn på produkt eller koncept: Radicle Agronomics
Företag eller annan aktör: Precision Planting LLC
Kategori: Växtodling, digitalt stöd för jordprovtagning

Beskrivning
Radicle Agronomics är ett automatiskt system för jordprovtagning och analys av jordprover. Jorden hämtas upp manuellt av person körandes på t.ex. en fyrhjuling och placeras i runda plastbehållare försedda med RFID-tag genom en speciell utrustning monterad på fyrhjulingen. Behållarna förses med koordinater automatiskt. Inga etiketter eller hantering av provtagningspåsar eller pappersboxar behövs. I ett mobilt jordlaboratorium på bara 3x3 meter, som har namnet Radicle Lab, slutförs sedan analyserna, helt automatiskt. Förutom P, K och pH klarar labbet även magnesium, kalcium, katjonbyteskapacitet (CEC) och basmättnadsnivå (base saturation level). Kväve däremot ingår inte. Den molnbaserade programvaran integrerar provtagning, kartläggning och analys i en enda plattform. Målgruppen uppges vara agronomer som vill leverera bättre rekommendationer för näringshantering liksom slutanvändare, lantbrukare. Kapaciteten är 200 prov per dag. Affärsmodellen är en kombination av leasing ($13 000 USD per år) och kostnad per prov ($5,50). Konceptet testades 2022 och presenterades på Agritechnica 2023. Ännu finns ingen i Sverige som testat konceptet. Kvaliteten på analyserna är ännu okända men företaget säger att de har metoder för kalibrering och påtalar att kvalitet också handlar om att ta många prov och gärna oftare än vad fallet brukar vara med vanlig jordprovtagning. Precision Planting har sitt säte i Tremont, Illinois, USA.

Det mobila laboratoriet som kallas Radicle Lab. Foto: Per Frankelius.

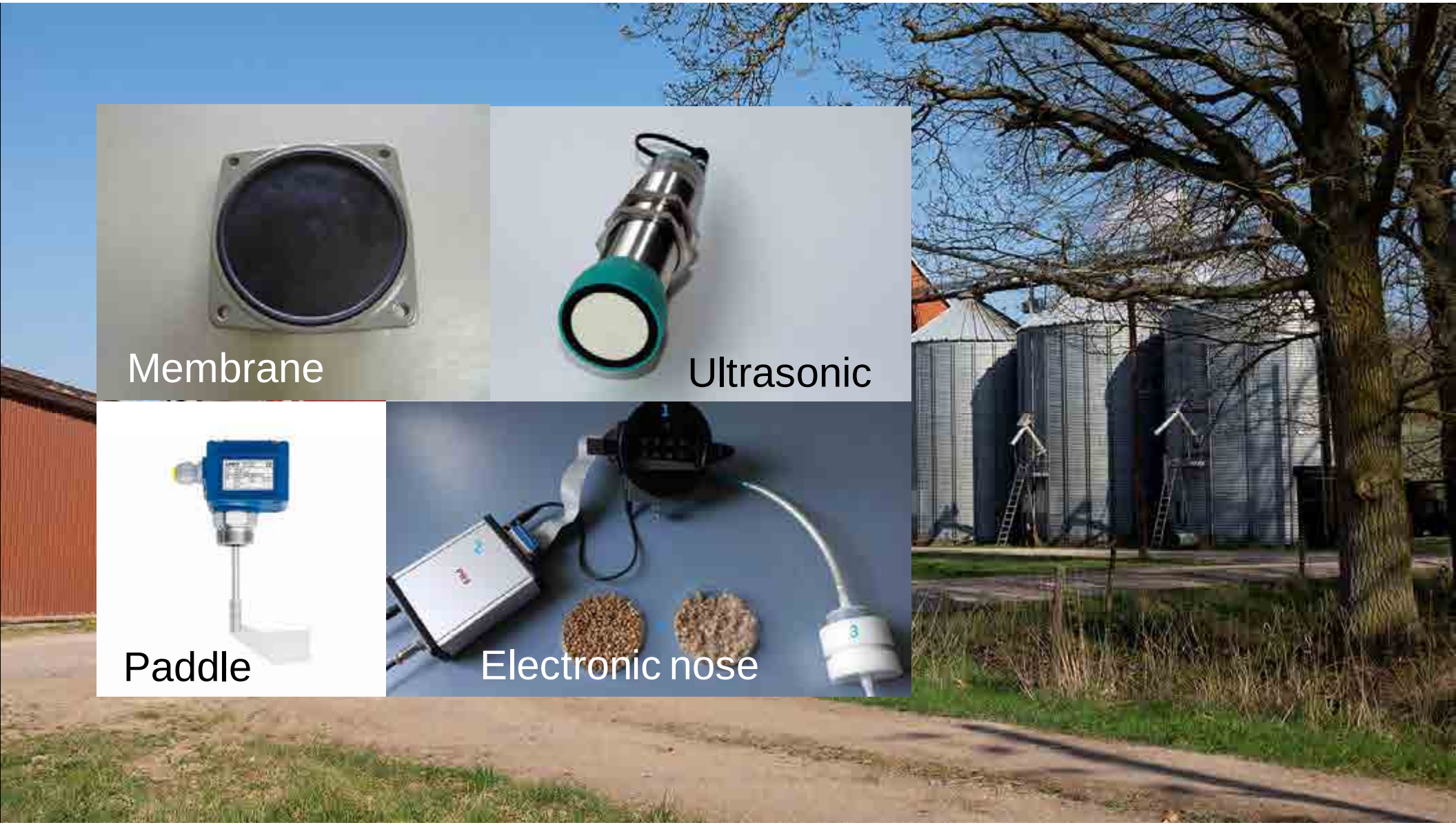
Källor
https://www.precisionplanting.com/radicle-agronomics-by-precision-planting
Observatör
Per Frankelius, Linköpings universitet, per.frankelius@liu.se

Need analysis

(ethnographies through for example farm visits)

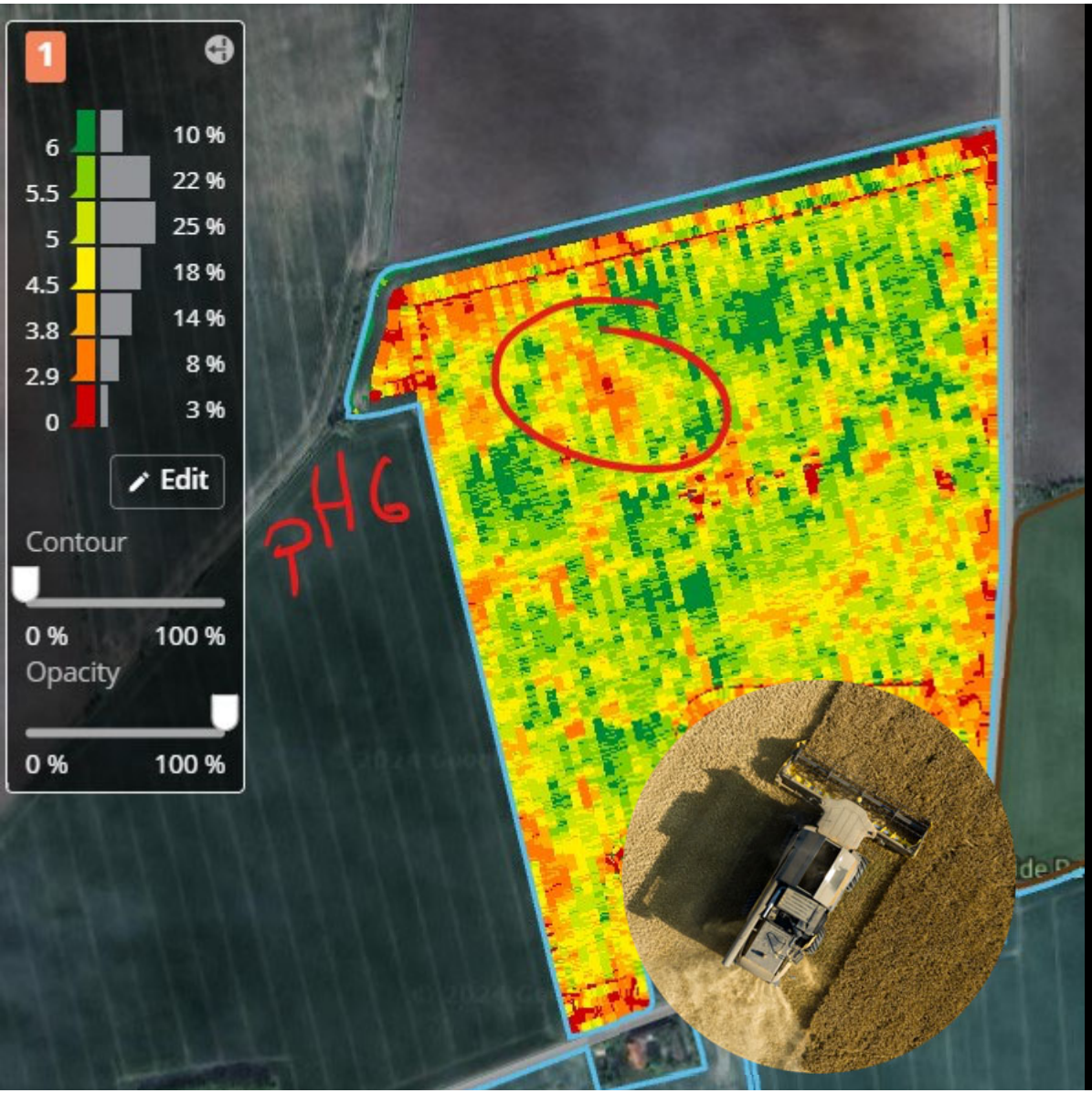

JOHN DEERE
7720
400 KG


Test and evaluation of new technology


Membrane
Ultrasonic
Paddle
Electronic nose

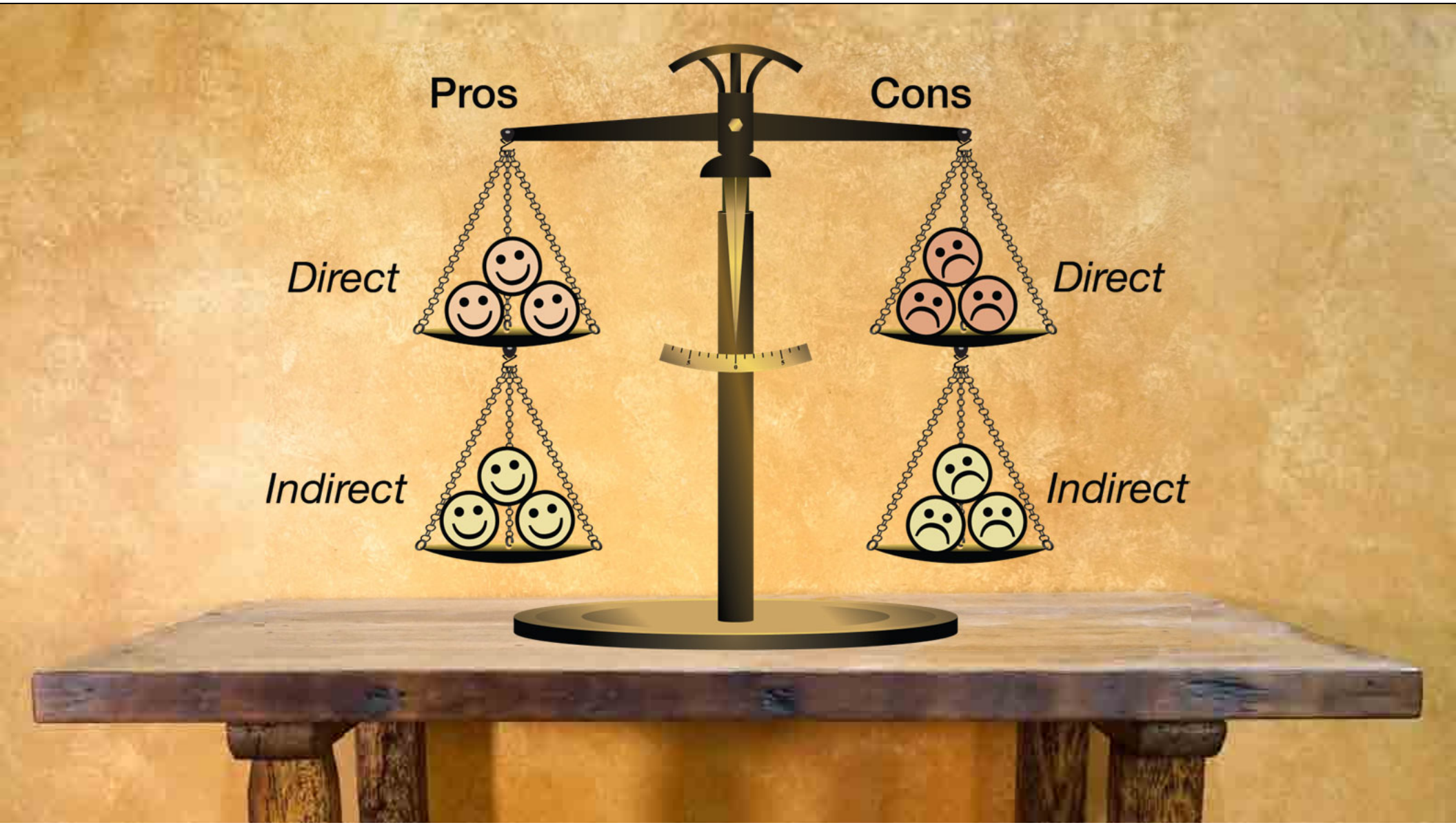

nedap
SmartTag


User reports



”En inte helt oväntad fördel är att kunna titta på punkter med lågt pH och se om det verkligen är så illa att ha pH 6 på en ensam punkt och resten är pH 6,5-7. Vi vet teoretiskt att det är så men när det också syns direkt i skördekartan att ja, här var det mätbar skördesänkning

Mårten Svensson, Sjöstorps Bygård, Lund


Pros
Cons
Direct
Direct
Indirect
Indirect

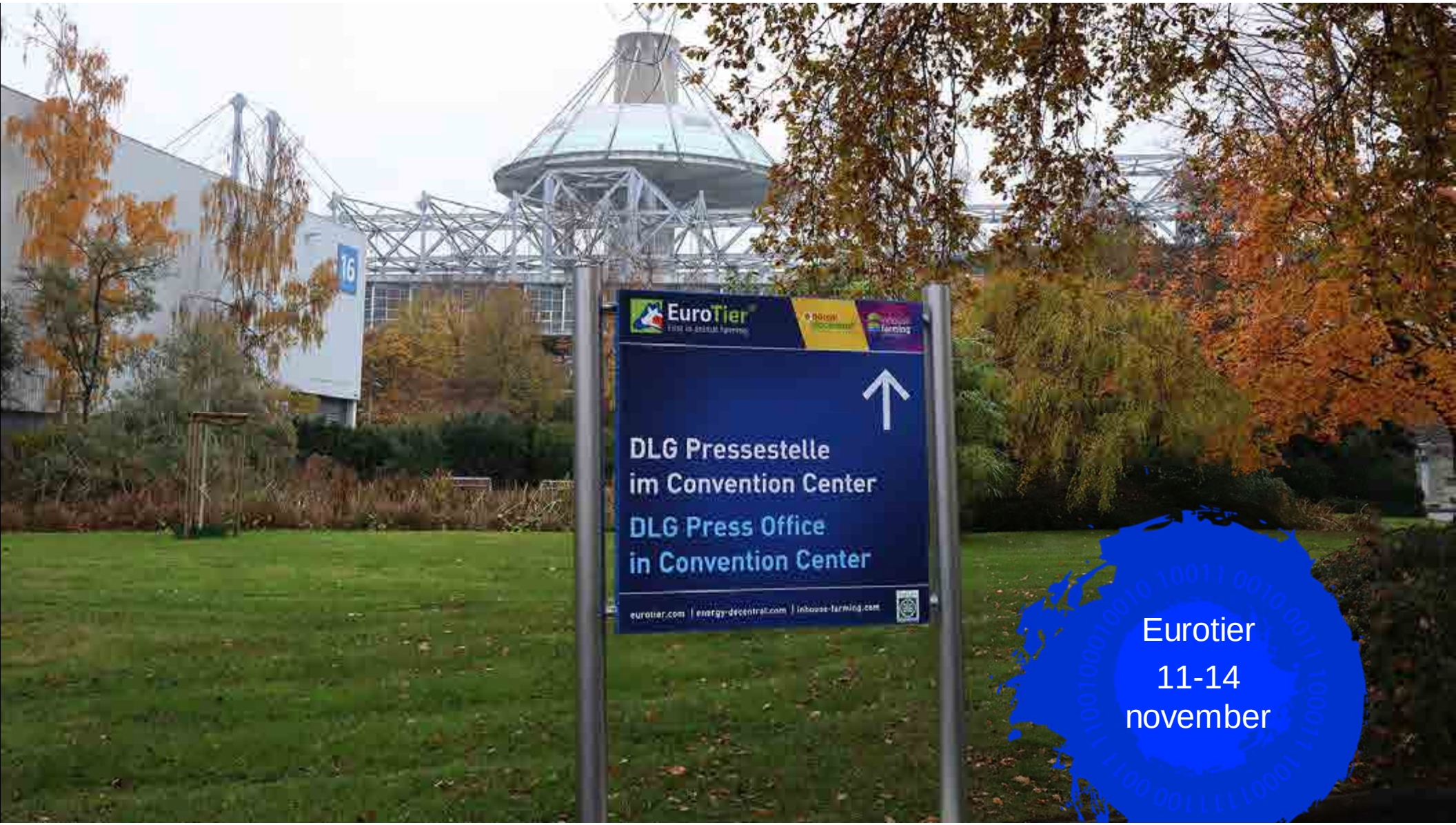

Trade fairs in focus


Borgeby
26-27 June


Agtech
Sweden
En innovationsmiljö
Kunskapsnav


Elmia
AMAZONE
SILOKING
Elmia Lantbruk
16-18 oktober


SeedEye
Kunskapsnav
Kunskapsnav
Agtech
Elmia Lantbruk
16-18 oktober

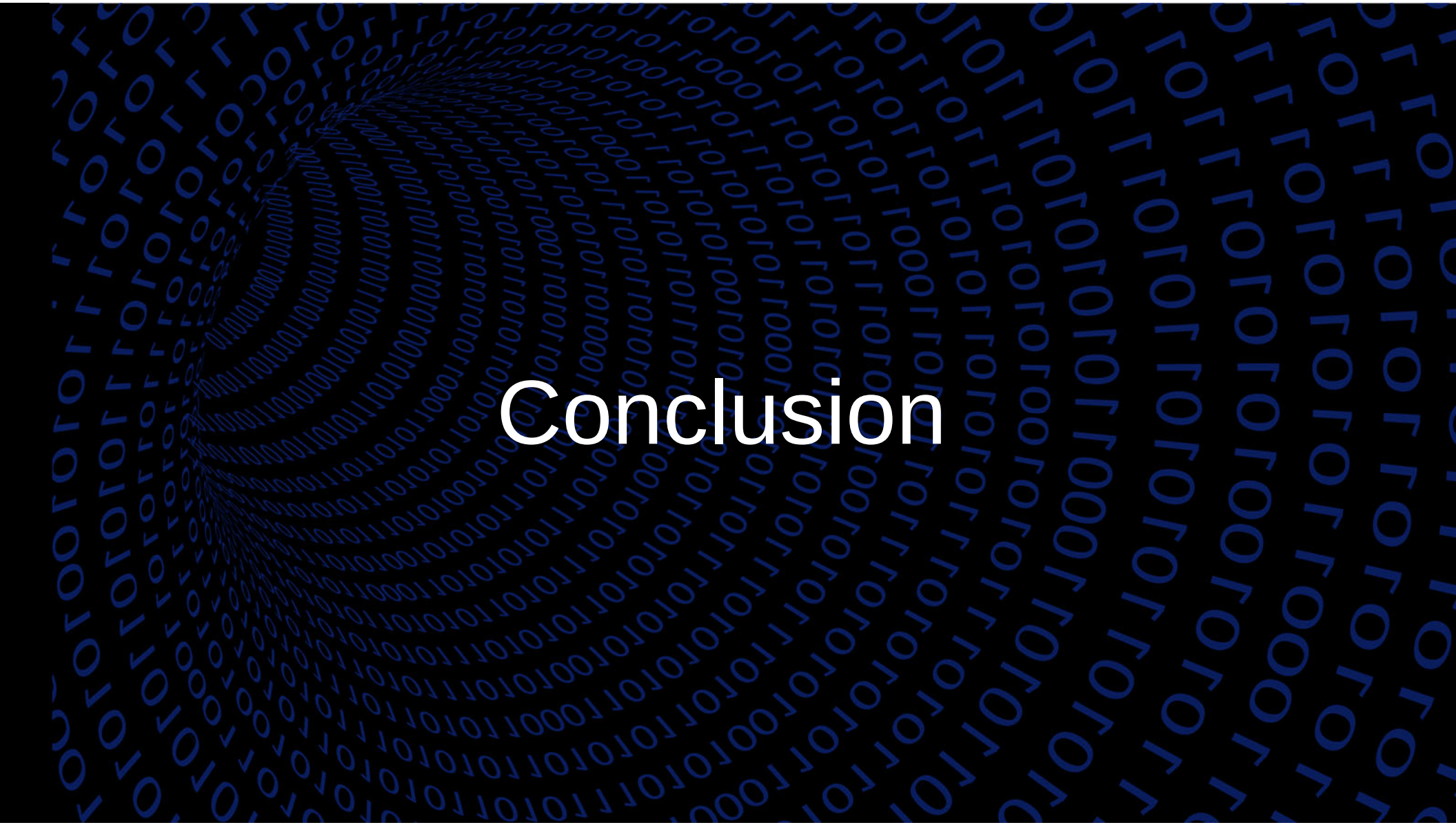

EuroTier
DLG Pressestelle
im Convention Center
DLG Press Office
in Convention Center
Eurotier
11-14
november


INNOVATIONEN, DIE VERBINDEN


Cloud


HOW PROXCEL WORKS


WE PROVIDE A NEW WAY

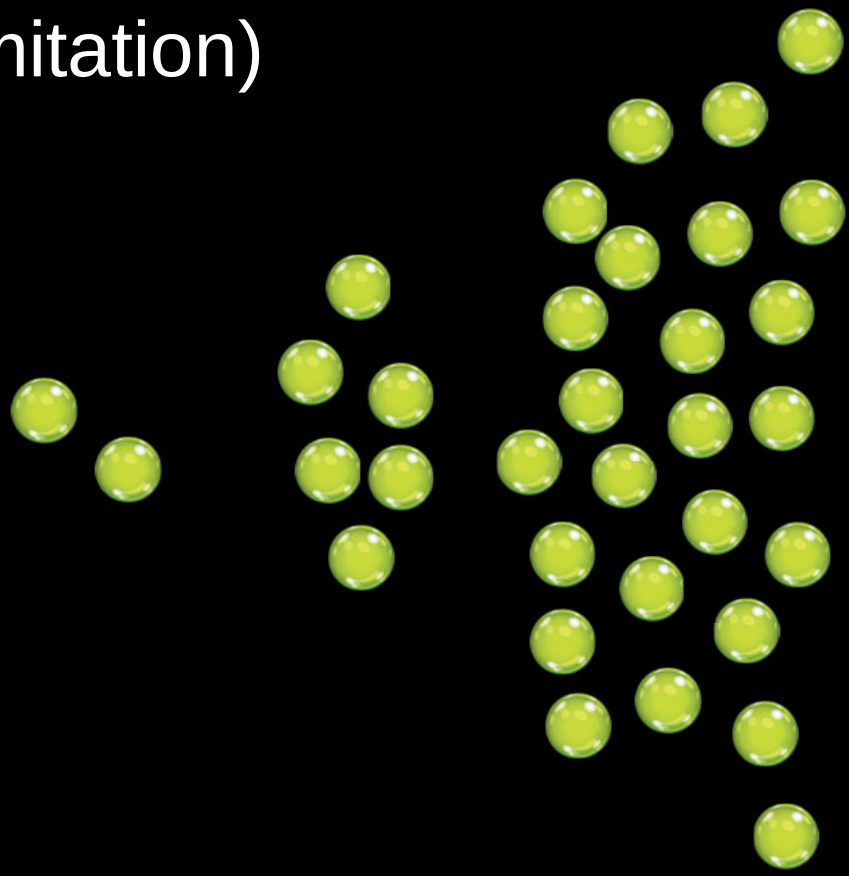

Conclusion

1 Responsible innovation

+

2 Responsible diffusion (imitation)

+




Herbert
Simon
1978

We need an investment in **pedagogy** to stimulate the spread of innovative concepts

Thanks!

per.frankelius@liu.se
karolina.muhrman@liu.se
www.digitaliseringsnavet.se

References:

Need for innovation
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Imitation and diffusion
Tarde, G. (1903). The Laws of Imitation. New York: Holt.

Innovation
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Need for external information
Aguilar F.J. (1967) Scanning the Business Environment. New York: Macmillan.
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Frankelius, P. (2009) Simon's theorem reconsidered – towards a theoretical framework for competitive intelligence. The Third European Competitive Intelligence Symposium, June 1–12.

Need for pedagogy
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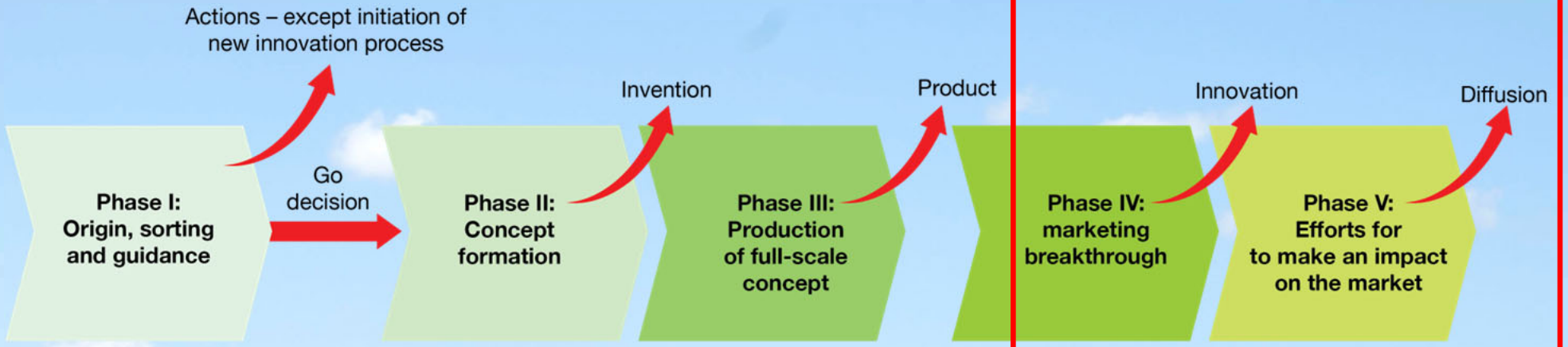
Summing up

Knowledge hub for agricultural digitalization



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Eidgenössisches Departement für
Wirtschaft, Bildung und Forschung WBF

Agroscope

UAV sprayers in Switzerland

Image: S. Rüttimann

Thomas Anken, Agroscope Tänikon, 8356 Ettenhausen, thomas.anken@agroscope.admin.ch

Use of UAV sprayers in Switzerland

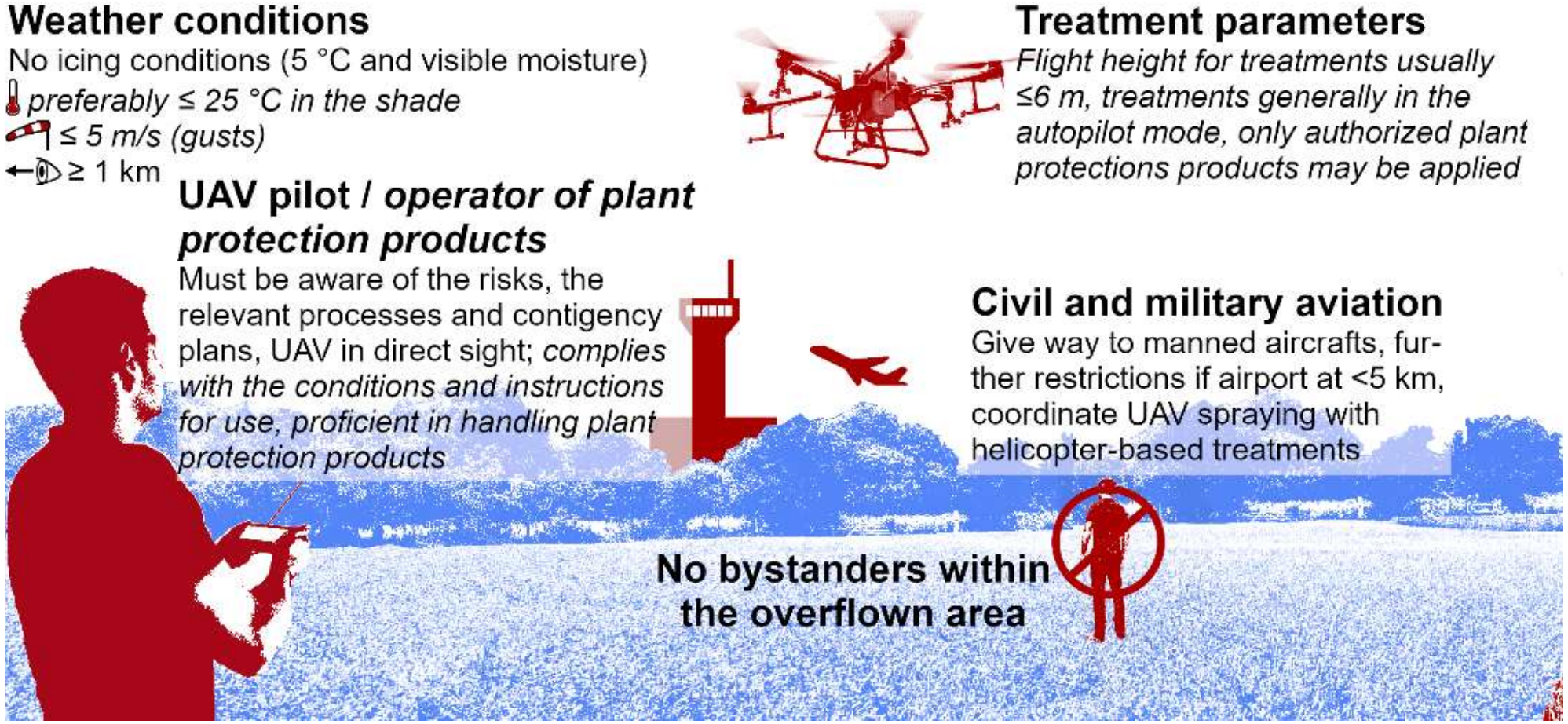
Quick technical development since 2015

Up to 100 kg weight, 45 lt tank for spray liquid
→ typically 100 l/ha spray liquid

- **100 UAV** sprayers homologated since 2019
- Use mainly in **wineyards** 900 ha of wines
- Quick development for distribution of **slug pellets** in crops
- Surfaces sprayed by **helicopters** decreased since from 1500 ha to 900 ha/year
- Each type of UAV needs to be homologated and each UAV passes a **sprayer test** all 3 years

Thomas Anken | Agroscope , Tänikon 1, CH-8356 Ettenhausen

Regulation in Switzerland



Legal frame:
https://www.bazl.admin.ch/bazl/en/home/drohnen/specific/spraying.html

Homologation of spray drones

Testing criterias for the homologation

- spray system fulfils principles of ISO 16122
- transversal distribution of spray liquid: coefficient of variation < 15 %
- accuracy of automated flight route: +/- 50 cm

Max. lateral windspeed (check for drift reduction):

Distance from UAV	Height above soil	wind speed
10 m	1 m	5 m/s
	2 m	3 m/s
20 m	1 m	3 m/s
	2 m	2 m/s

Thomas Anken | Agroscope , Tänikon 1, CH-8356 Ettenhausen

Sprayer test: Control of spray system (ISO 16122)

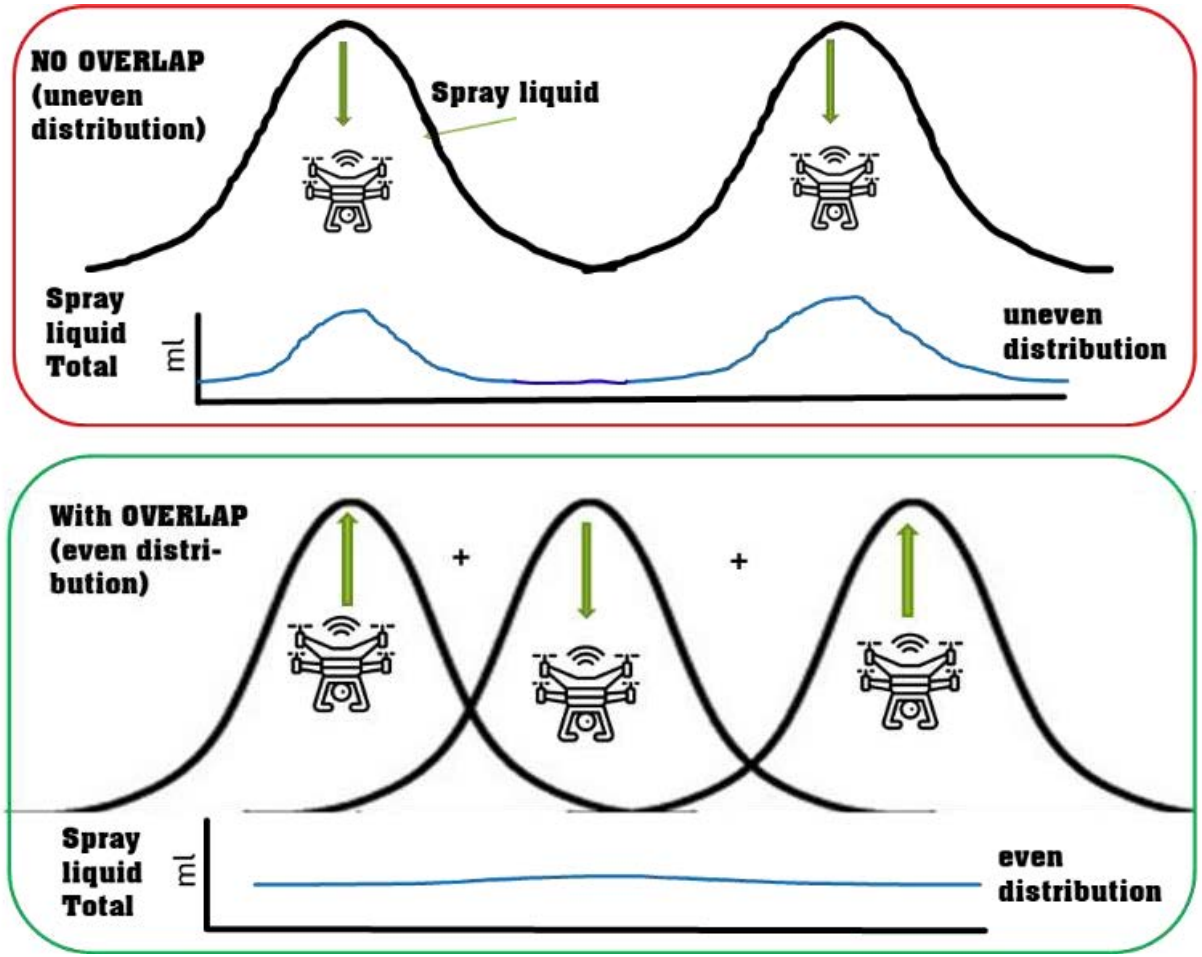
Standard checks of the spray system like:
filters available, dripping of nozzles after stop of spraying,
nozzle flow, flow or pressure indication, leakages, weights…

Sprayer test: Transversal distribution of spray liquid

Patternator (6 m x 3 m, same principle as the ones for field sprayers)

- UAV is hovering at the same place over the patternator
- lateral wind is strongly influencing the distribution
- flying height 2.5 m

Regular distribution needs overlap of the swathes



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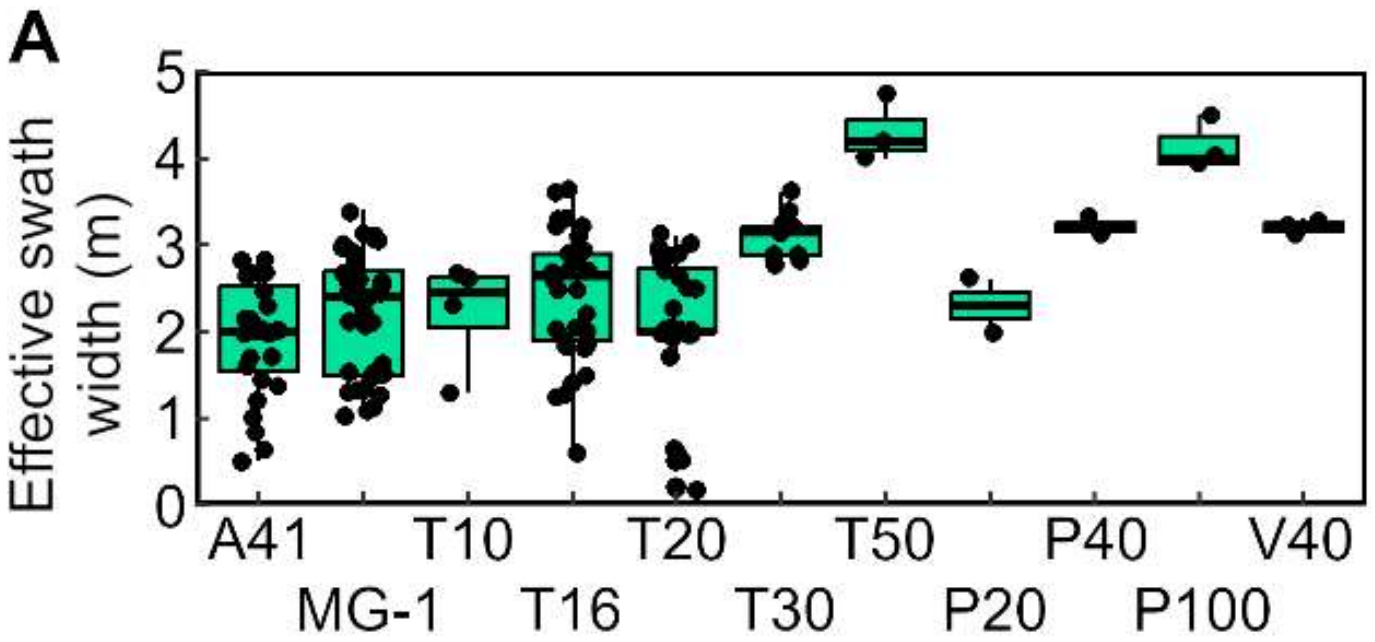
Swath widths are smaller than indicated by the manufacturers



drone width and take-off weight determine the swath width
→ a UAV with a width of 3 m will not spray 10 m

Thomas Anken | Agroscope , Tänikon 1, CH-8356 Ettenhausen

Comparison of 3 methods to measure transversal distribution

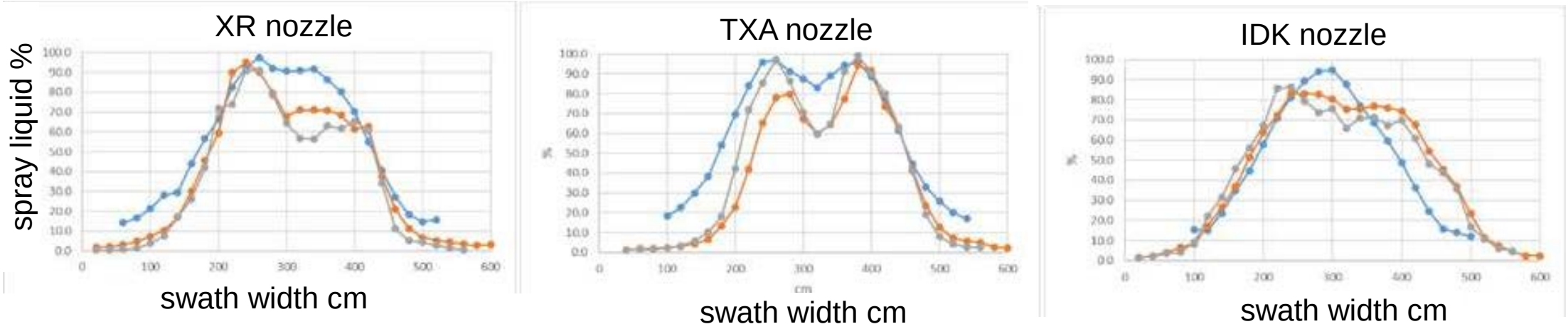
patternator

tracer/ water
sensitive paper

→ tracer and photometric analysis
→ water sensitive paper: treated surface determinded by computer vision (in collaboration with Syngenta)

Thomas Anken | Agroscope , Tänikon 1, CH-8356 Ettenhausen

Transversal distribution of different nozzles & test methods



patternator tracer water sensitive paper

- Teejet XR (flat fan) & TXA (hollow cone), Lechler IDK (flat fan air injection) (Drone DJI T16)
- «water goes where the wind blows» → no significant influence of nozzles
- no significant differences between different methods

(Anken et al. 2024)

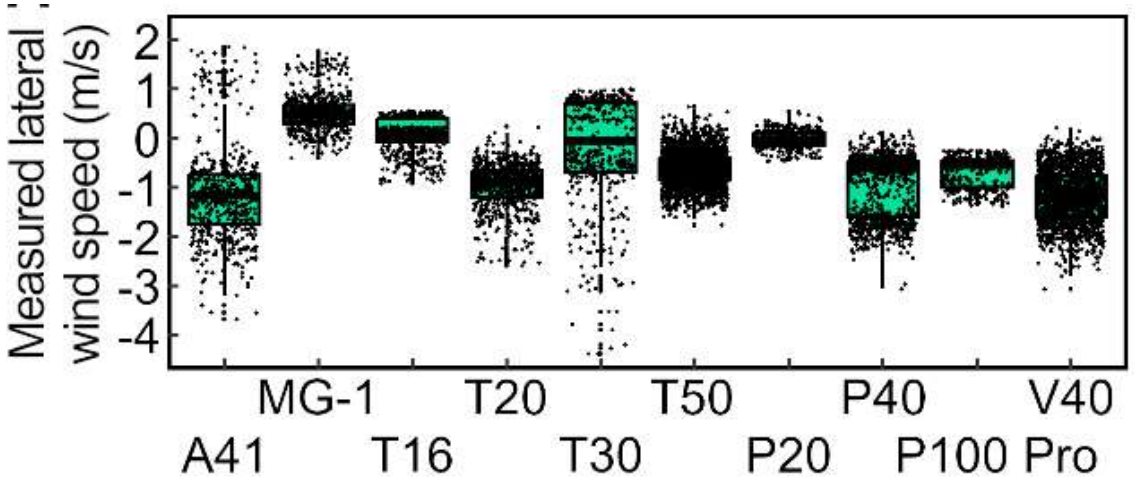
Thomas Anken | Agroscope , Tänikon 1, CH-8356 Ettenhausen

Homologation: Measuring wind speeed

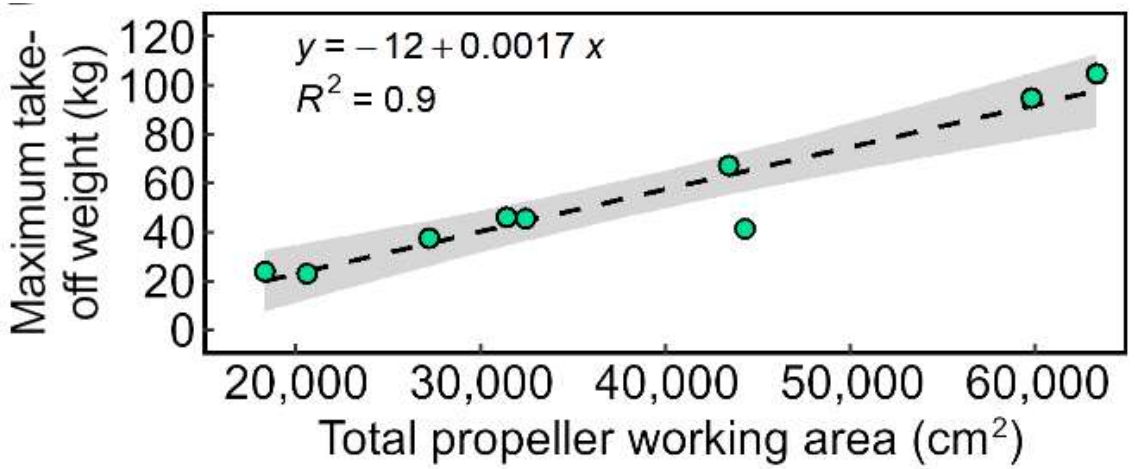
three dimensional ultrasonic sensors allow the measurement in three directions (10 Hz)

Wind speeds and take of weight of homologated drones

wind speed at 10 m distance 1 m height

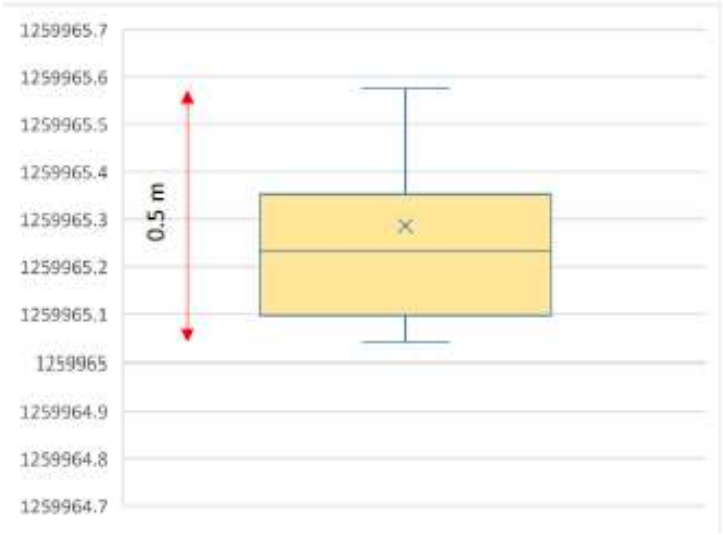


→ lateral wind speeds show litte variation across different models



→ larger propellers not higher revolutions carry the supplementary weight
→ we assume this to be the explanation for the quite low wind speeds

Homologation: Accuracy of flight route



achieved accuracies
in general:

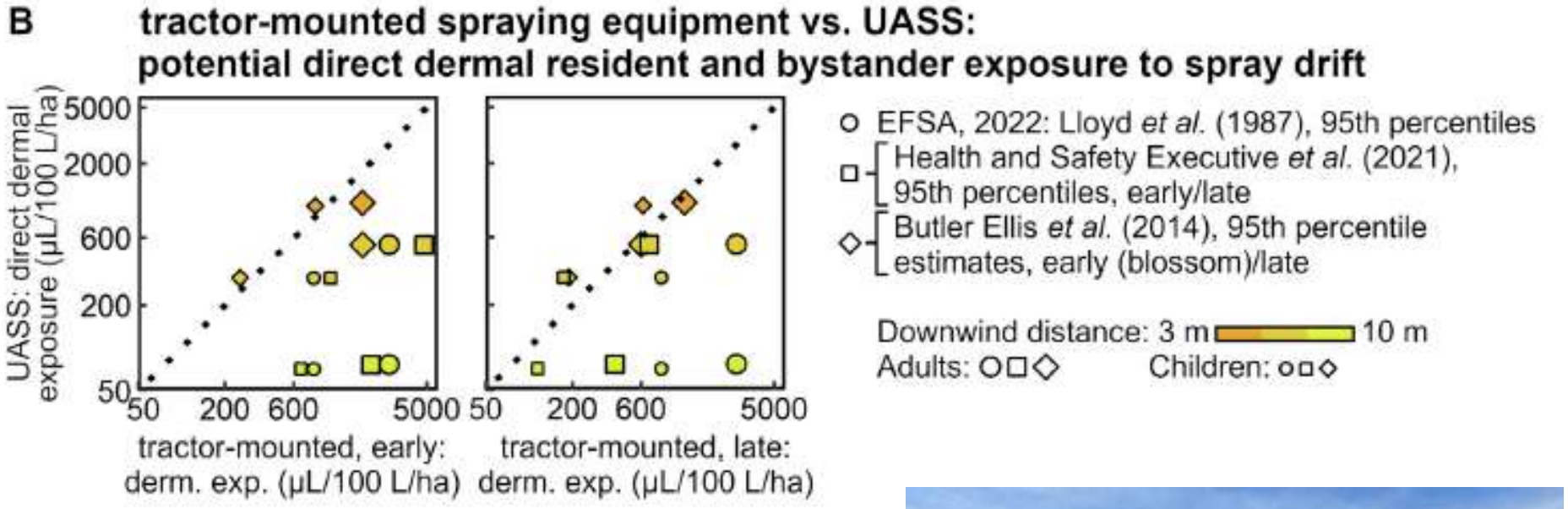
- values are within 0.5 m
- 50 % of values +/- 10 cm

UAV is flying along a defined route simulating a field

RTK-GNSS data logger to measure the deviation

RTK logger

Drift and bystander measurements

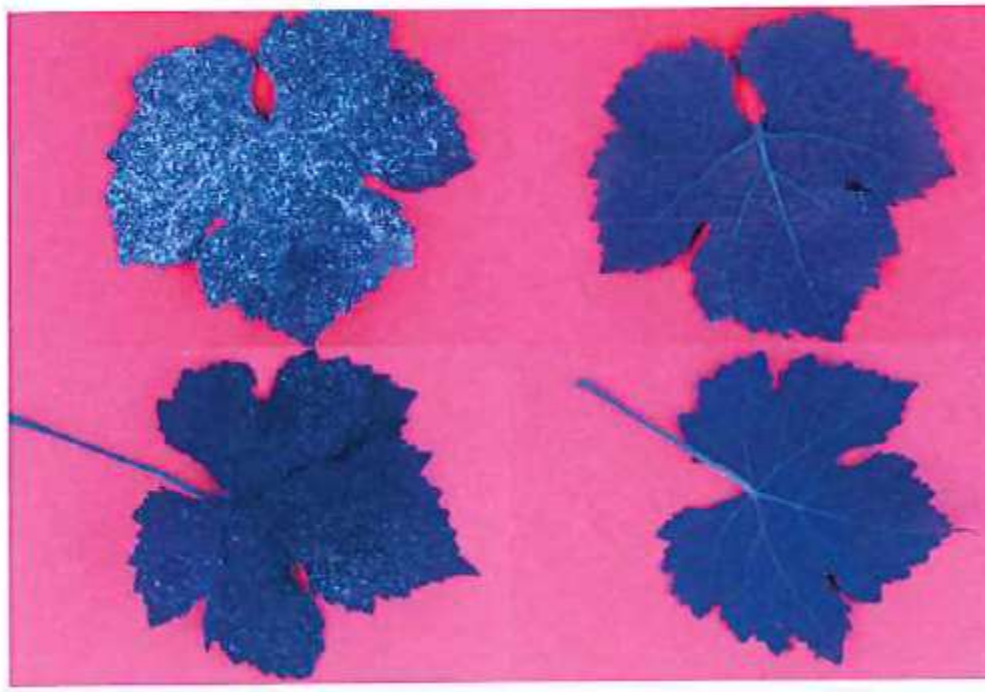


(Dubuis et al. 2023)

→ spray drift of drones is lower than standard tractor mounted air blast sprayers

Efficacity of the treatment on vine

leave upside leave underside



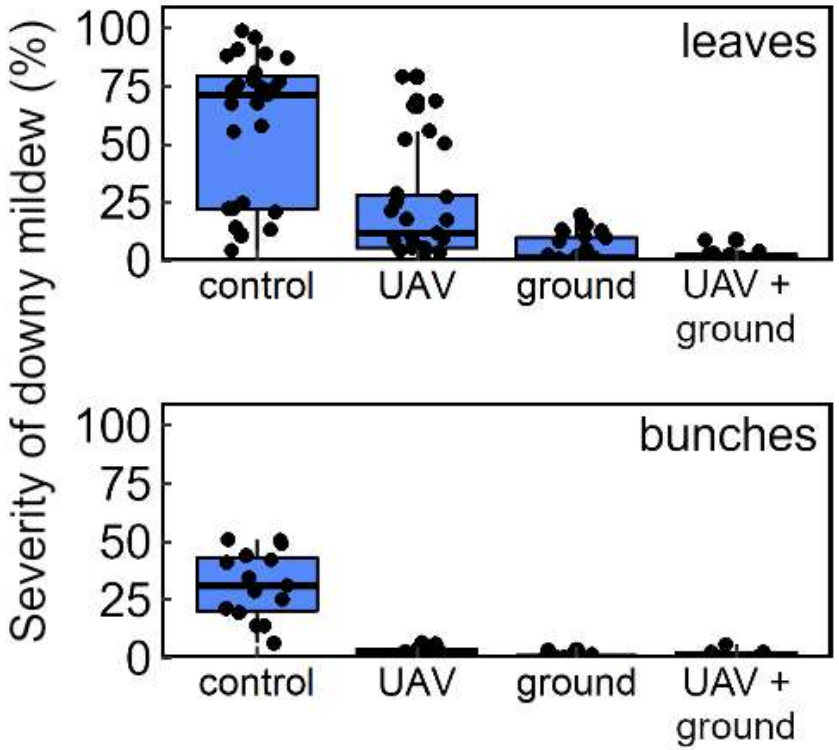
top of plant

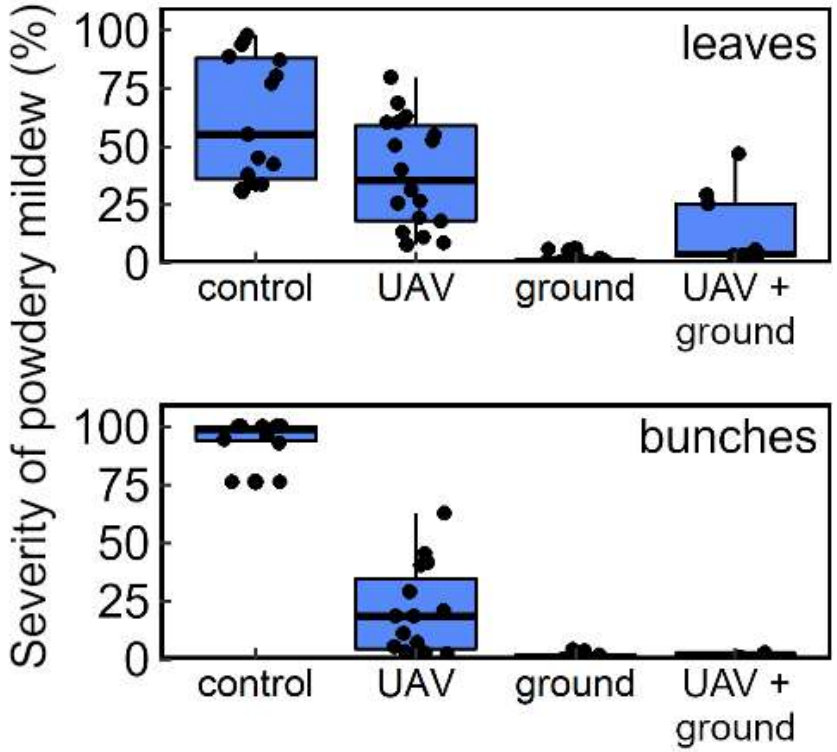
bottom

downsides of leaves and bottom of plants and bunches are not well treated
→ top leaves act like an umbrella

(Dubuis & Jaquero 2021)

Efficacy of the treatments on vine





Control: no treatment
UAV: UAV treatments only
Ground: Standard treatments with air blast sprayer
UAV + ground: UAV in early stages, ground treatment for bunches

(Dubuis & Jaquero 2022)

Conclusions

- drones found their place in vineyards with steep slopes
- homologation and sprayer tests work well since 5 years
- many positive echoes as hard, exposed work with knapsack sprayers can be replaced
- drones are replacing helicopters but not tractors
- limits in efficacity have to be well respected

Thomas Anken | Agroscope , Tänikon 1, CH-8356 Ettenhausen

UAV sprayers and drift measurements in Norway

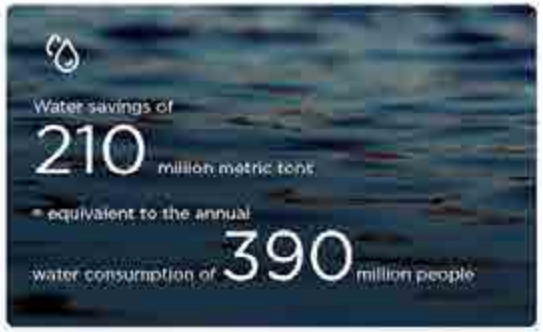
Nils Bjugstad, REALTEK, NMBU

The 5th Agromek EurAgeng NjF Joint Seminar
Herning 2024 11 26


Cumulative treatment of
500
million hectares
Data as of June, 2024


1/3
of China's farmland


Chemical product reduction of
47
thousand metric tons


Water savings of
210
million metric tons
= equivalent to the annual
water consumption of 390 million people


Training of
6,000
instructors
300,000
pilots

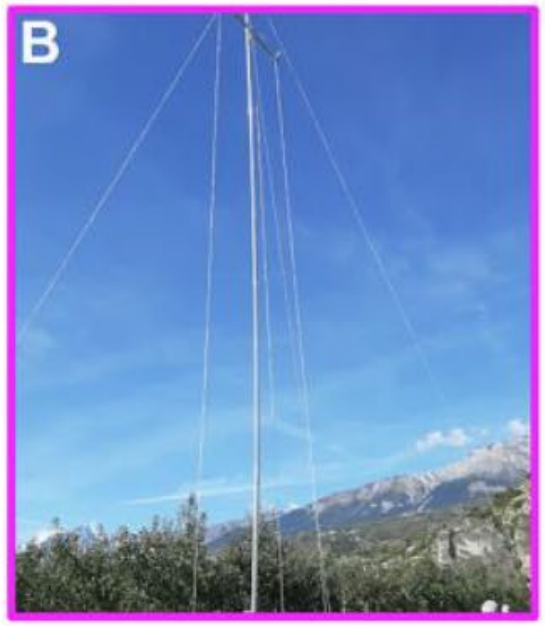

100
Countries and regions

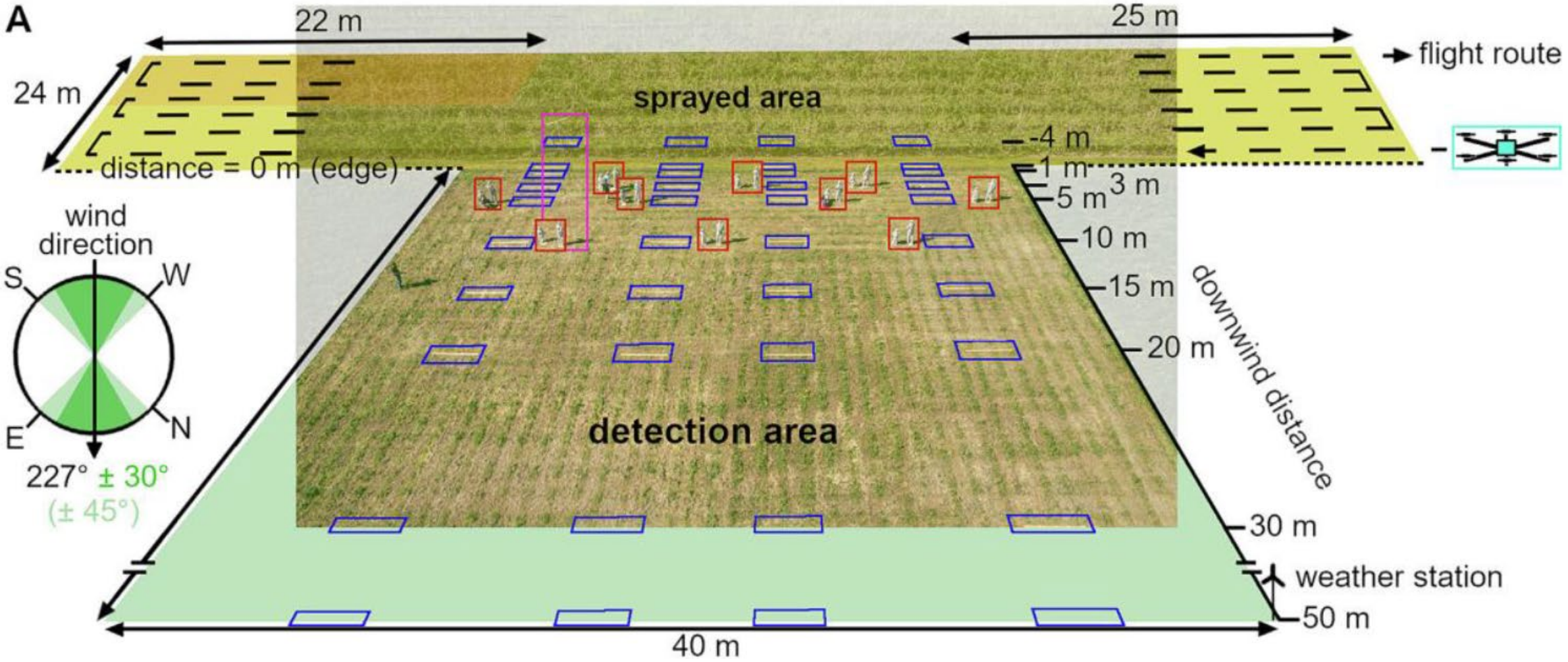

Carbon emission reductions
of 25.72 million metric tons
= equivalent to the carbon sequestration
of 1.2 billion trees

UAV sprayers and possibilities in Norway

- Hilly areas
- Small fields
- What about quality of distribution
- Degree of drift hazard
- Capacity

Several methods in use
(ISO standards for drift measurements)





Dubuis et al, 2023

Objectives

- Get a literature overview of methods of spray drift and in particular when using UAVs sprayers
- Evaluate possible methods for a pilot study measuring spray distribution and drift
- Perform some experiments with the most suitable method
- Evaluate the results due to distribution and spray drift by using this method

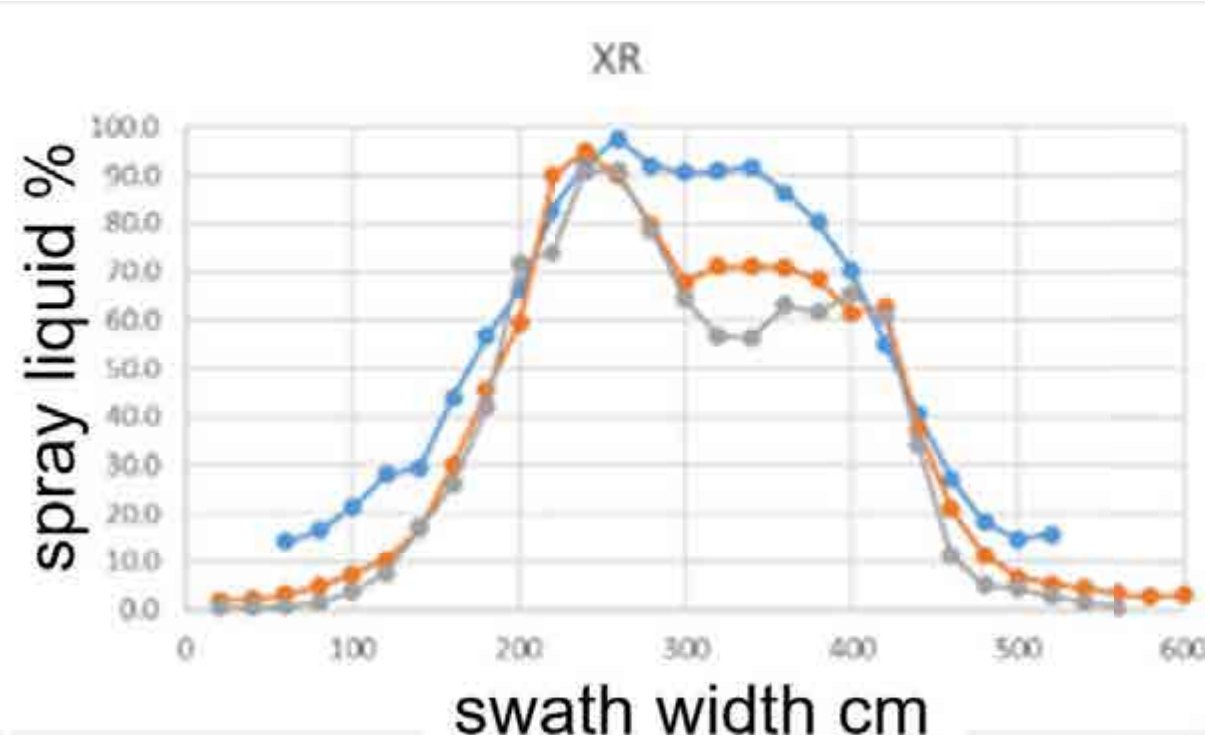
Comparison of 3 methods to measure transversal distribution

- patternator
- tracer and photometric analysis
- water sensitive paper: treated surface determinded by computer vision

executed in collaboration with Syngenta

- yellow water sensitive paper
- white filter paper for tracer

Transversal distribution of different nozzles and measuring methods



patternator
tracer
water sensitive paper

- Teejet XR (flat fan) & TXA (hollow cone), Lechler IDK (flat fan air injection) (Drone DJI T16)
- «water goes where the wind blows» → no significant influence of nozzles
- no significant differences between different methods

(Anken et al. 2024)

Gobbler Swath Width Analyser

Tested in Belgium (IVLO)

David Nuyttens, _ILVO, Belgium, 2024

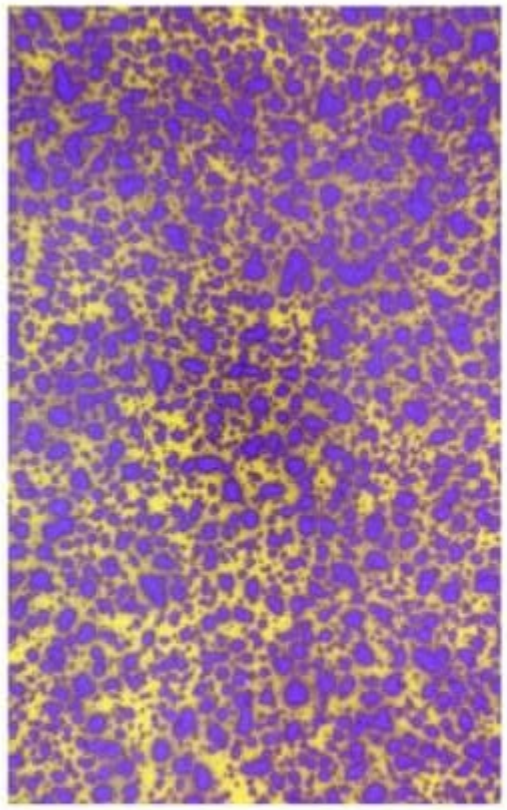
Tested in Belgium (IVLO)

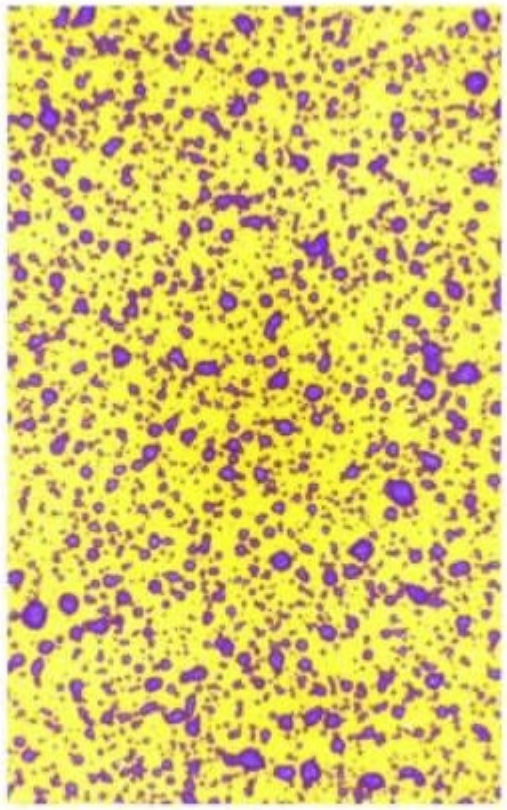
David Nuyttens, _ILVO, Belgium, 2024

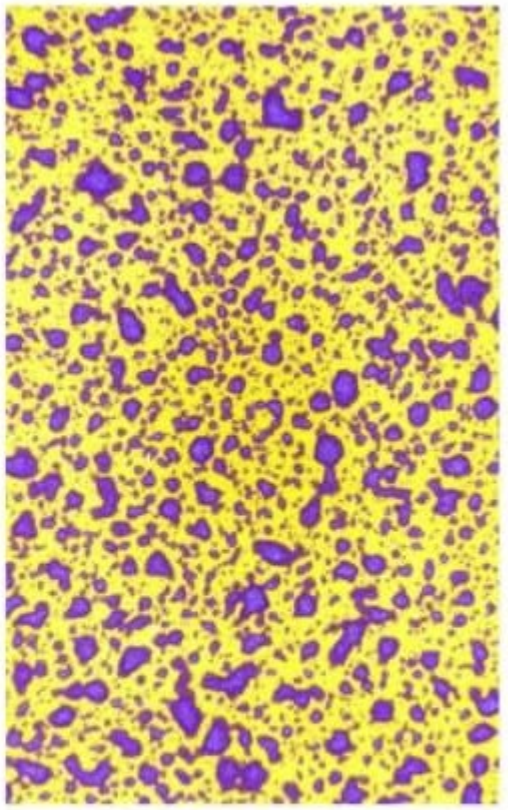
Tests of different water sensitive paper

www.sprayers101.com

Tests of different water sensitive paper







Syngenta SpotOn WSPaper

Sprayed Simultaneously

www.sprayers101.com

Method used in our experiments

Gobbler Swath analyser and paper roll

- Similar relative distribution of spray swath
- Quick method
- Possible to measure airborne drift?

Huge benfits compared with ISO drift measure methods

Parameter	Drift hazard decreasing	Drift hazard increasing
Spray drone configuration	Nozzles correct to propellers	Nozzles outside propellers
Flight height	Low	High
Wind speed	Low	High (if possible < 3 m/s)
Wind direction	Away from sensitive area	Against sensitive area
Forward speed	Low*	High
Drop size (nozzle, pressure)	No drops < 100 µm	Large part < 100 µm
Drop size range	Narrow span and > 100 µm	Wide span and < 100 µm
Additives	Suited additives	No additives
Vegetation type, size, density	A lot of vegetation filter effect	No vegetation
Drone weight	Heavy drone*	Light drone
Wash down	High air volume created*	Low air volume created
Distribution / spray picture	Ideal triangle picture	Poor distribution profile
Temperature	Low temperature	High temperature
RH	High RH	Low RH
Volume rate	High volume rate	Low volume rate
Terrain type and variation	Even and easy terrain	Huge variations
Tilting of drone	No tilting	Huge degree of tilting

Layout of paper roll (distribution and airborne drift)

Layout of paper roll (distribution and airborne drift)

Layout of paper roll (distribution and airborne drift)