Sprayertest for Spot Sprayers

example of Ecorobotix

Thomas Anken, Harald Kramer, Jaco Kole

Spot sprayer with automated single plant recognition

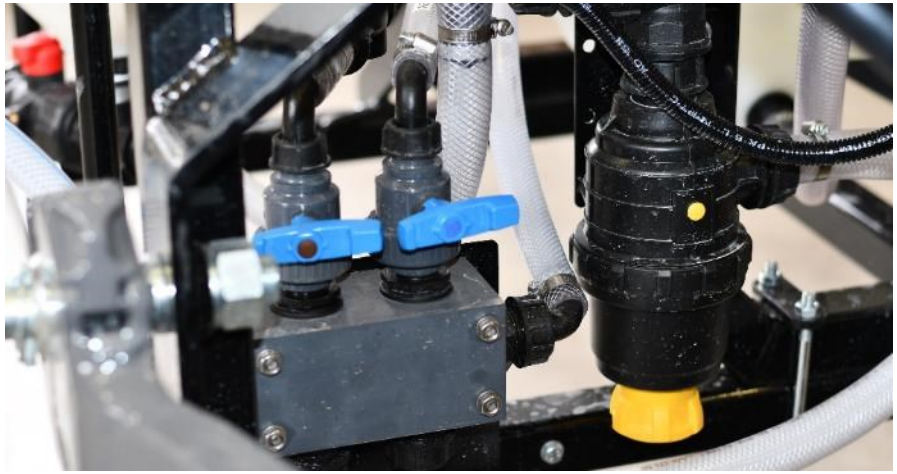
3 independent units equiped with cameras, 6 m working width

Other machines appear on the market too:
https://allgaeuautomation.de/
https://rumex-gmbh.de/
https://www.steketee.com/
https://ferrarigrowtech.com/
https://garford.com/
….

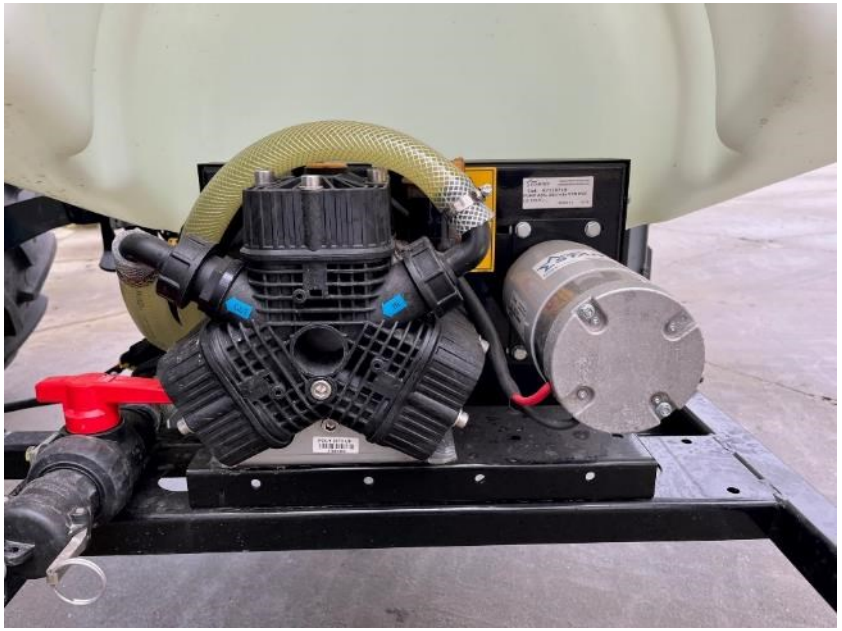
Garford

Steketee

Ecorobotix: Spray liquid tank, electric pump, valves & filters in front of the tractor (Agroscope, 2021)



Modified tank indicator and pump (SKL, 2023)

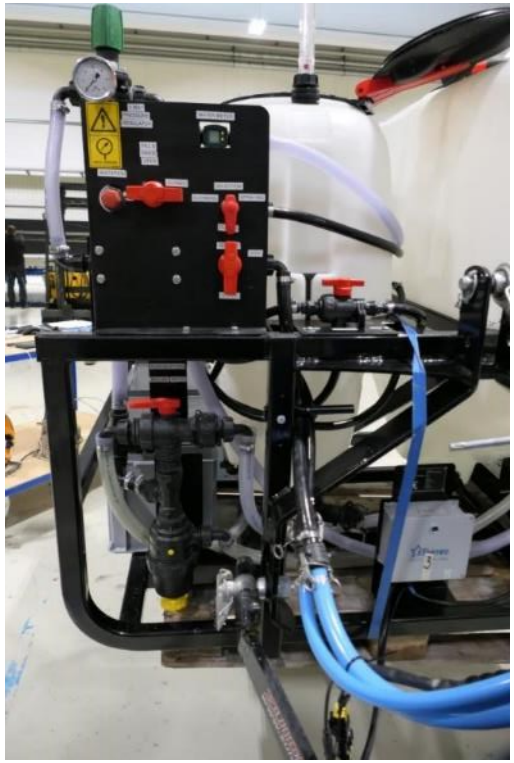


Liquid systems: Observations of NRW

- pressure sensor was not working
- tank needs to be adapted
- pressure filter was not accessible (placed underneath)

Bild: Kramer, H.

Sucction filter 80 (NRW)



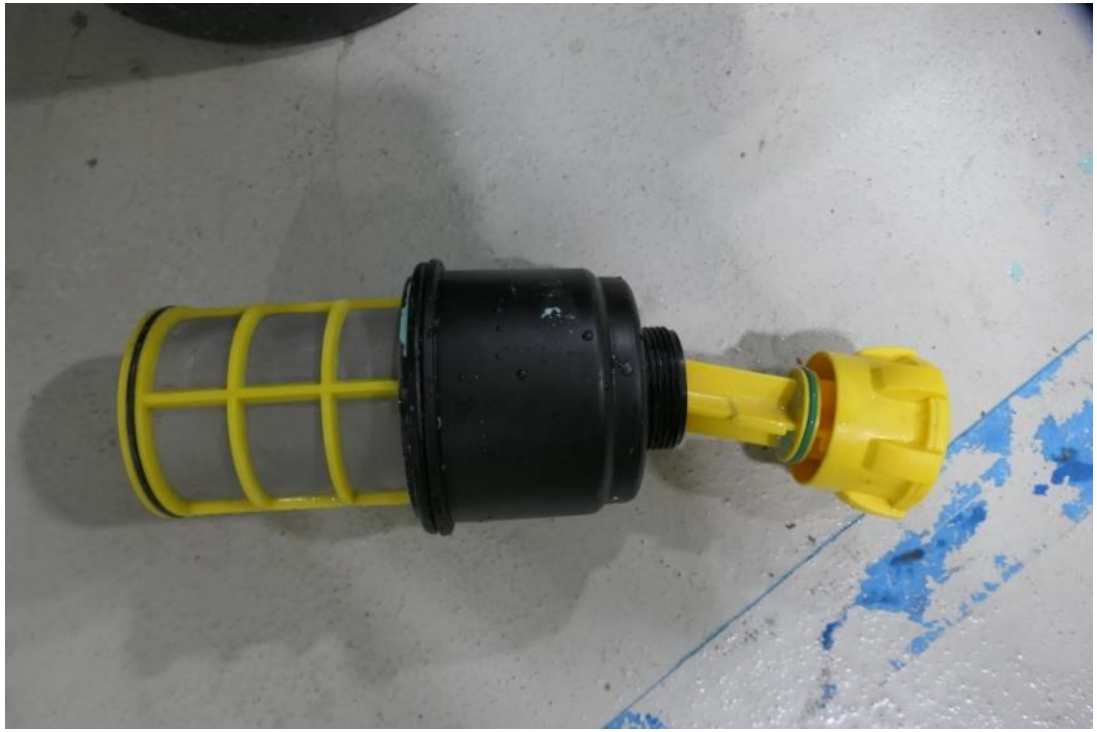


Image: Ladiges, C.

Performance of the pump (NRW)

Measured at a pressure of
5 bar = 38 l/min

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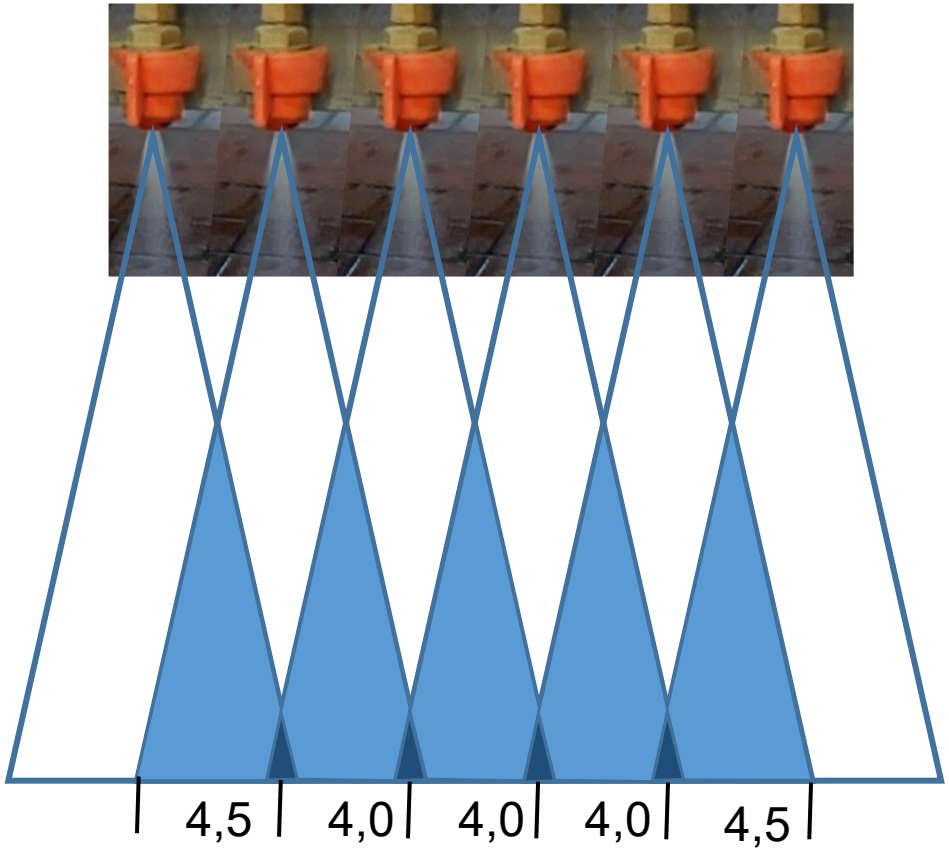
Boom with nozzles spaced 4 cm, each controlled by a solenoid

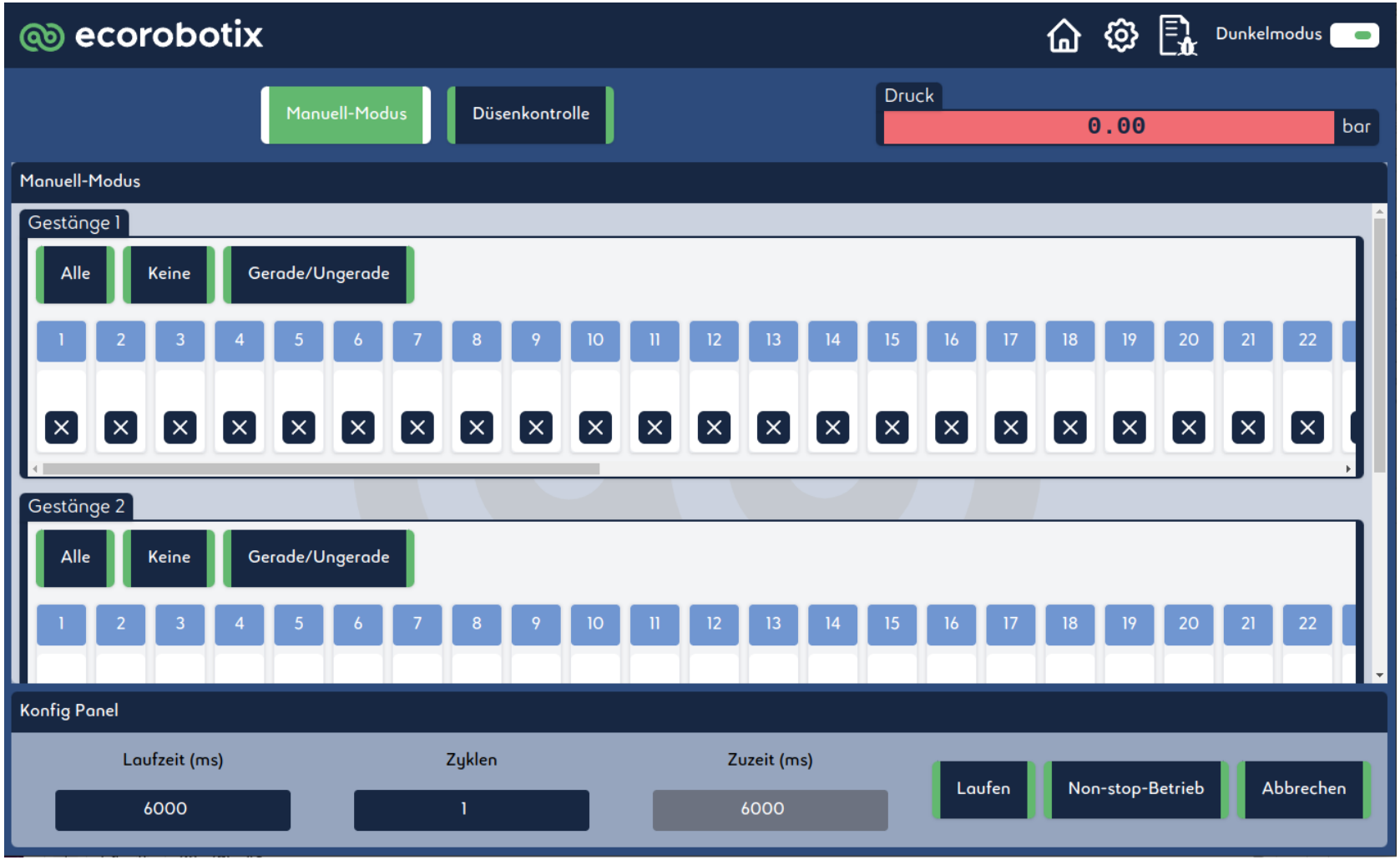
Nozzles OC1X502 (Euspray)



- Nozzle distance 4 cm
- size 005 (0,2 l/3bar)
- 52 nozzles/ element (∑ 156 nozzles)
- Output of all nozzles together or single nozzles?
- coefficient of transversal distribution possible?

Bild: Kramer, H.

Single nozzles can be freely selected on the steering tablett



Determination of the nozzle flow (NRW)

A time period can be selected on the tablet

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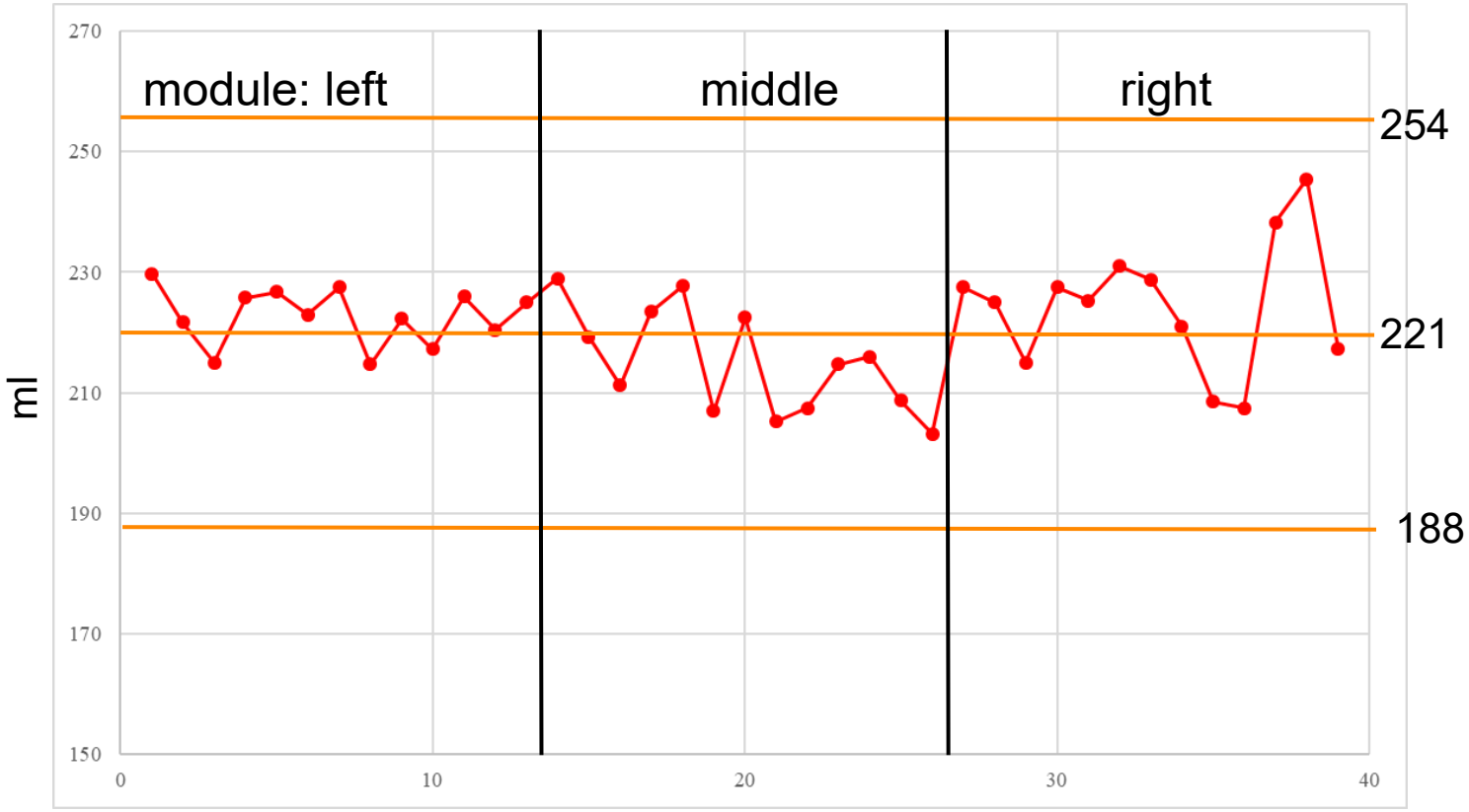
Results of the 3 modules (NRW)



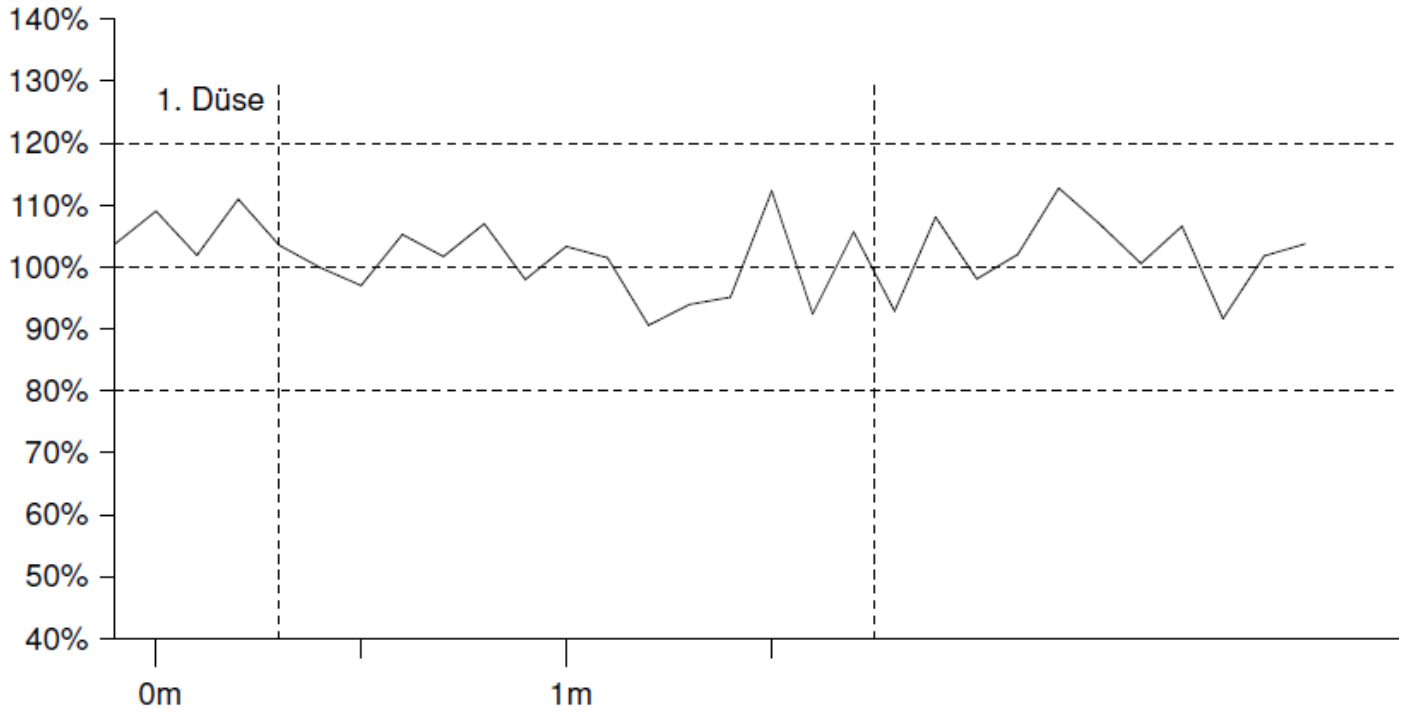
- 39 measurements (156/4)
- single nozzels calculated Ø = 221 ml
- 15% of 221 ml (188/254)

Use of patternator was successfull (NRW)

Bild: Kramer, H.

coeff. of var. – 22 cm distance from patternator (NRW)

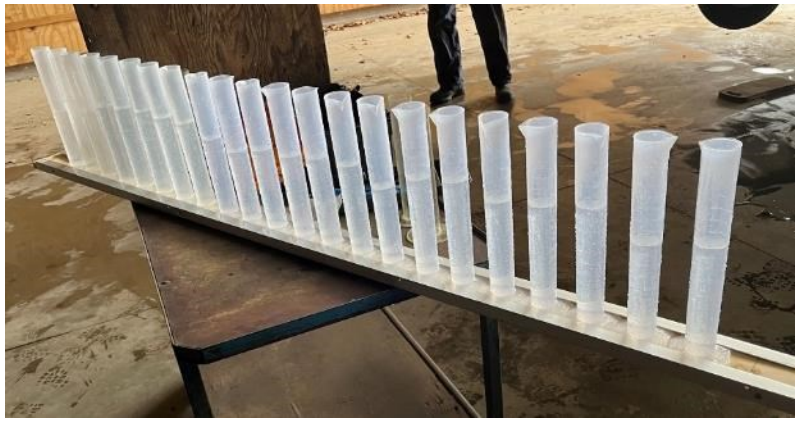
- cv = 5,9
- ARA only can open 75 nozzles at the same time
- nozzles needs to be opened and closed at the overlapping areas
- evt. nozzles could be opened and closed according to test procedure



Measuring the transversal distribution

Per 2 m working width Ecorobotix has 52 nozzles (156 nozzles per 6 m work. width)
→ Different solutions are possible to measure transversal distribution

Agroscope (each nozzle)



SKL (each 2nd nozzle)

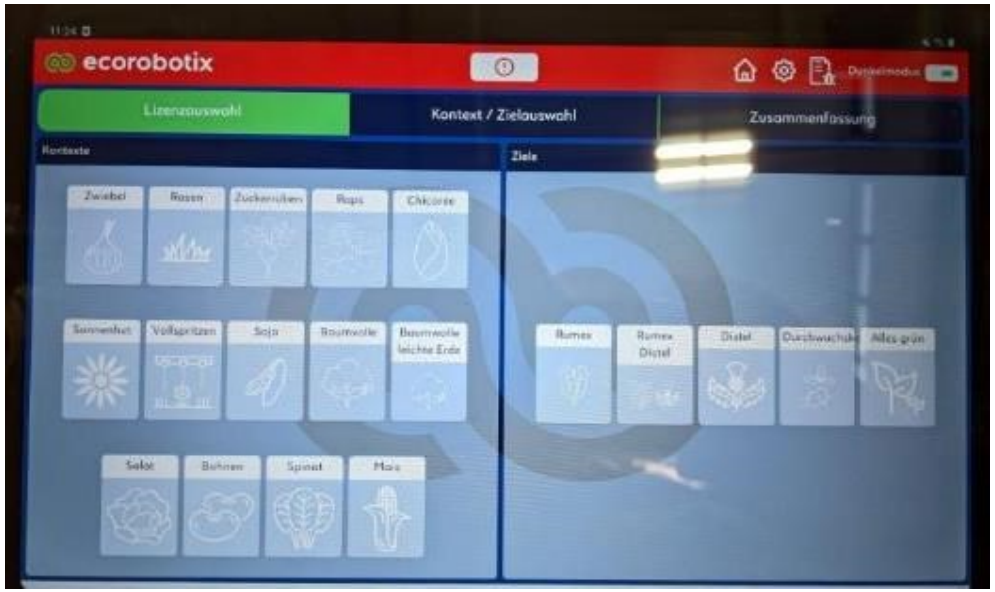
NRW: patternator

Recognition is done by 2 cameras and NVIDIA Jetson

nozzles

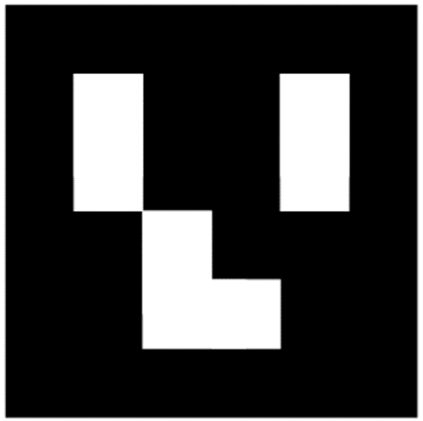
cameras & calculation units

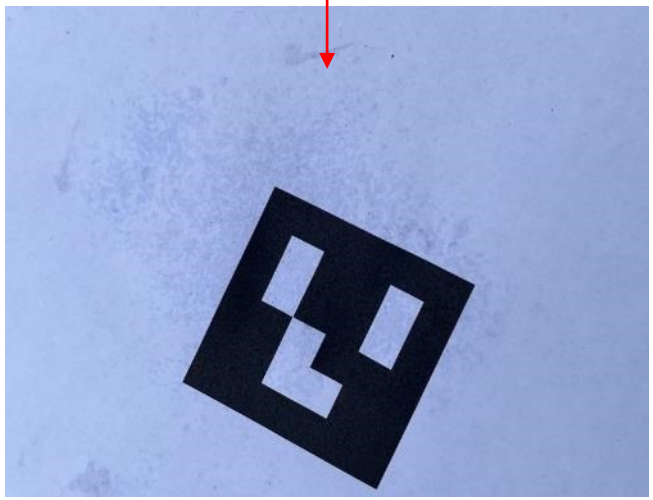
Tablett connected by WLAN
→ selection of menues



Testing camera with QR-code (SKL 2023)

→ only opening/closing of nozzles at the right place is tested



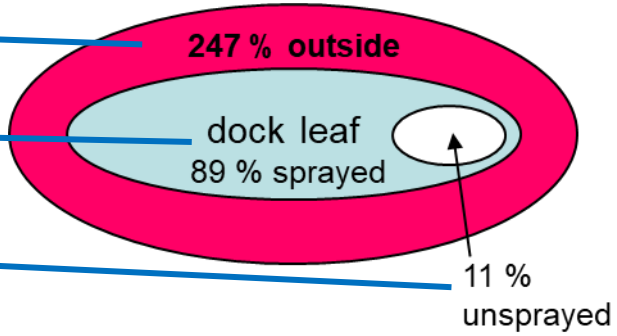


Fluorescent tracer to determine the sprayed areas Agroscope 2021

→ Broad leaved dock plants placed on brown paper indoor

Lumilux tracer allows a precise quantification of the areas

Sprayed areas (average, n=20)



Recognition of green plants (NRW)
(menu for spraying all plants)

→ well feasible

Bild: Kramer, H.

Problems at SKL during testing

1. Pump
   - Bertolini POLY 2073.
   - Max flow acc. Bertolini 75 l/min
   - Sticker on the machine 30 l/min
   - Measured during inspection 62 l/min
2. Agitation
   - Max output: 156 nozzles x 0,24 l/min per nozzle = 37,7 l/min in total
3. Tank indicator
   - Not visible from driving position what has been fixed.
4. Measuring pressure drop
   - Not possible while there is no constant flow (flushing) possible
5. Measuring nozzle flow-rate
   - Takes a lot of time (156 nozzles with low flow)
   - Was not possible because of lack of constant flow mode: software was adapted
6. How testing the camera system?

Conclusions and next steps?

- NRW and SKL propose to test the sprayers using the protocolls of the strip sprayers
  → creation of a SPISE-advise (English) based on these indications?
- One or more solutions have to be defined how the transversal distribution is measured
  → patternator and single nozzle-flow measurements?
- A standard function (software) is needed to be able to test the nozzles
  → which function («test mode») shall be demanded for all companies
  ex. opening of all nozzles during 30 seconds
- Procedures and criterias to measure opening/closing of nozzles (QR-code, plants, minimal accuracies…) or shouldn't this be included in the testing protocoll?
- How to proceed for new sprayers? Will other countries accept CE, without additional tests, like this is the case for crop sprayers in most countries? Mutual recognition of tests like the one of JKI?
- A solution for other spot-sprayers like Allgäu Automation, Rumex GmbH, Steketee, Ferrari etc. is needed → basic principles are the same
- Other propositions?