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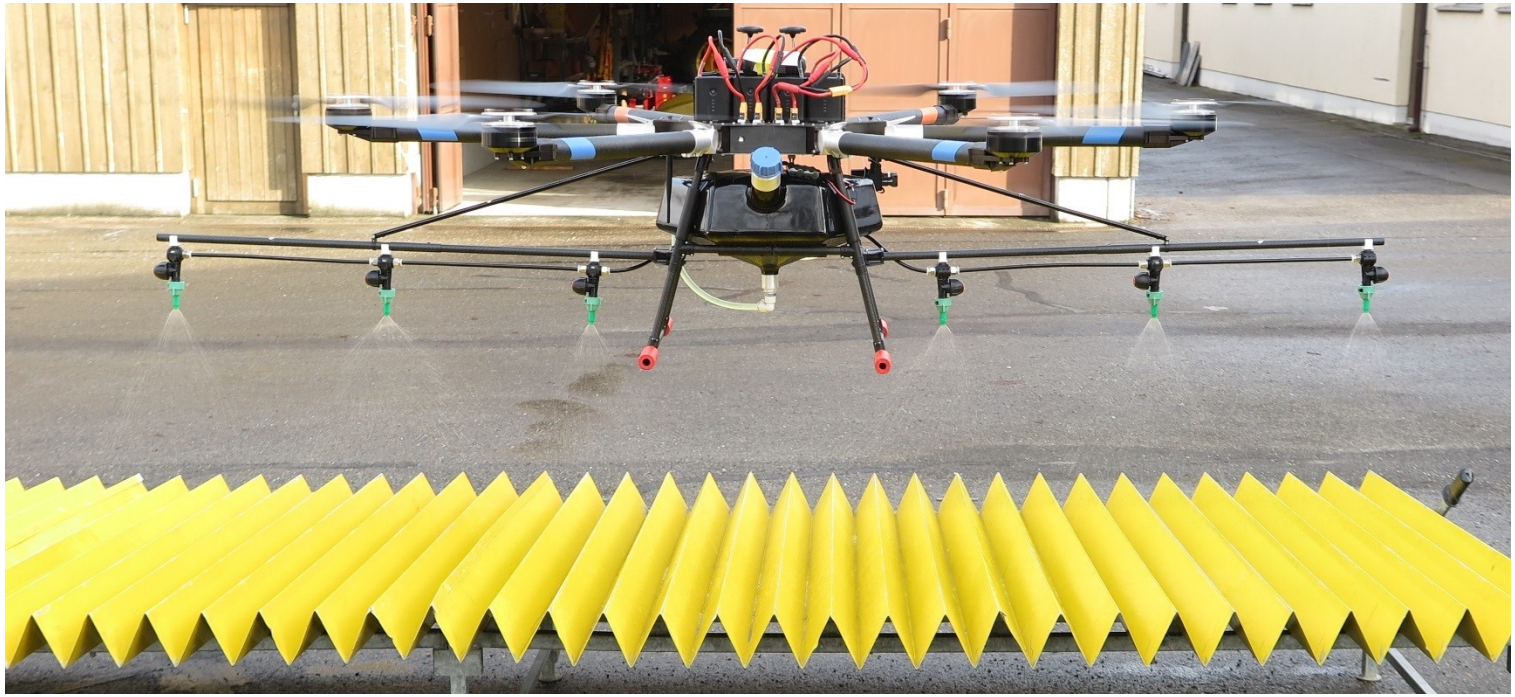
Homologation of spraying drones in Switzerland



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Drones have changed Trichogramma distribution

Will drones replace helicopters in steep wineyards?

BAFU, CH

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Characteristics of drones

advantages

- low flying height and low air flow are reducing drift of plant protection products
  → lower drift than standard orchard sprayers
- RTK-GNSS-steering allows very accurate distribution

disadvantages

- low carrying capacity of about 10-15 lt
- same spraying quality as helicopter but not as good as standard orchard sprayer

How can we homologate drones?

→ Aerial applications are not allowed in EU

A homologation process has been established in Switzerland in cooperation with five federal offices (aviation, agriculture, environment, health, food safety)

All agree, that drones open new opportunities and have the potential to replace the helicopter.

A standard process is in force since 2019.

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Two stage homologation

- Federal office of civil aviation will do the registration and homologation
  → simplified homologation for drones up to 35 kg
  → standard protocol has to be presented
  (flying safety, training of pilots…)

  www.bazl.admin.ch/drohnen

- Testing stations are responsible for the sprayer test

Swiss sprayer test for drones (I)

Element	Characteristics
Pump and tubes	Leak-proof system, no pressure regulation is requested. Hoses without friction.
Agitation system	The agitation does not have to take place at the same time as the application -> Y-valve for mixing & rinsing
Nozzles	JKI nozzle table adapted pressure. Flow rate compared to the ISO nozzle table: +/- 15% Individual nozzle output from the mean output: +/- 10%. No dripping of the nozzles more than 5 seconds after stop
Lateral distribution	Testing on a groove patternator with a width of at least 3 m, 1.5 x spraying width Coefficient of variation: max. 15% (mean of 3 measurements)
Tank	The tank has to be leak-proof and its level should be easy to read. Residual volume should be lower than 4%.
Pressure gauge	A pressure gauge is to be carried as an accessory.

Swiss sprayer test for drones (II)

Element	Characteristics
Strainer	No separate strainer is necessary on the drone, nozzle filters are sufficient.
Drone-port	The spray drone must be able to land on a drone-port for filling, emptying and rinsing allowing to capture plant protection products (100 % of drone tank volume)
Automated navigation	The drone must be equipped with a precise navigation system. Deviation from a predefined flight route: max. +/- 50 cm.
Wind speed	Wind speed of drone's airflow is measured on an open field covered with grass by means of tridimensional wind-speed sensors at distances of 10 and 20 m laterally from the drone
Sprayer test all 3 years	Sprayer test like all other equipments. Probably including mixing and storage tank used to work with drones

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Swiss sprayer test for drones (III)

Max. wind speeds for multicopters
→ in case of higher wind speeds drift measurements are required

Distance from drone	height	max. wind speed m/s
10 m	1 m	5 m/s
10 m	2 m	3 m/s
20 m	1 m	3 m/s
20 m	2 m	2 m/s

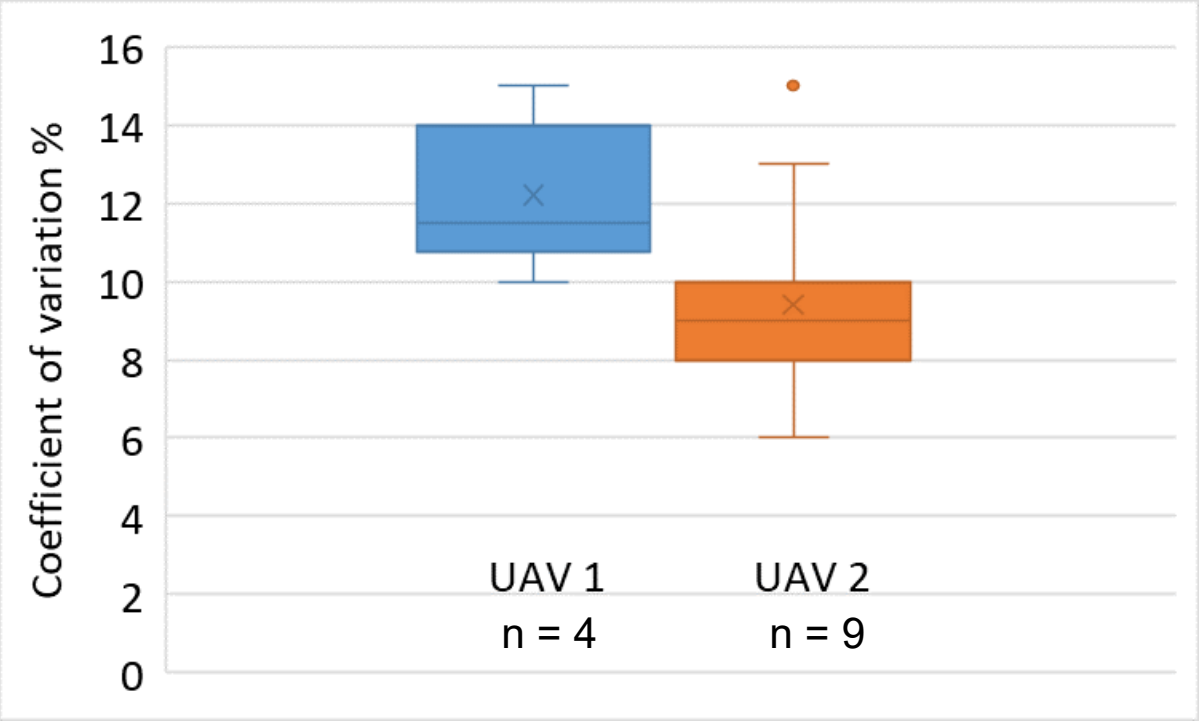
→ Measurement of the accuracy of navigation and wind speed are only measured once (homologation) for each type and not repeated during the triannual sprayer tests

Technical parameters of two tested drone types

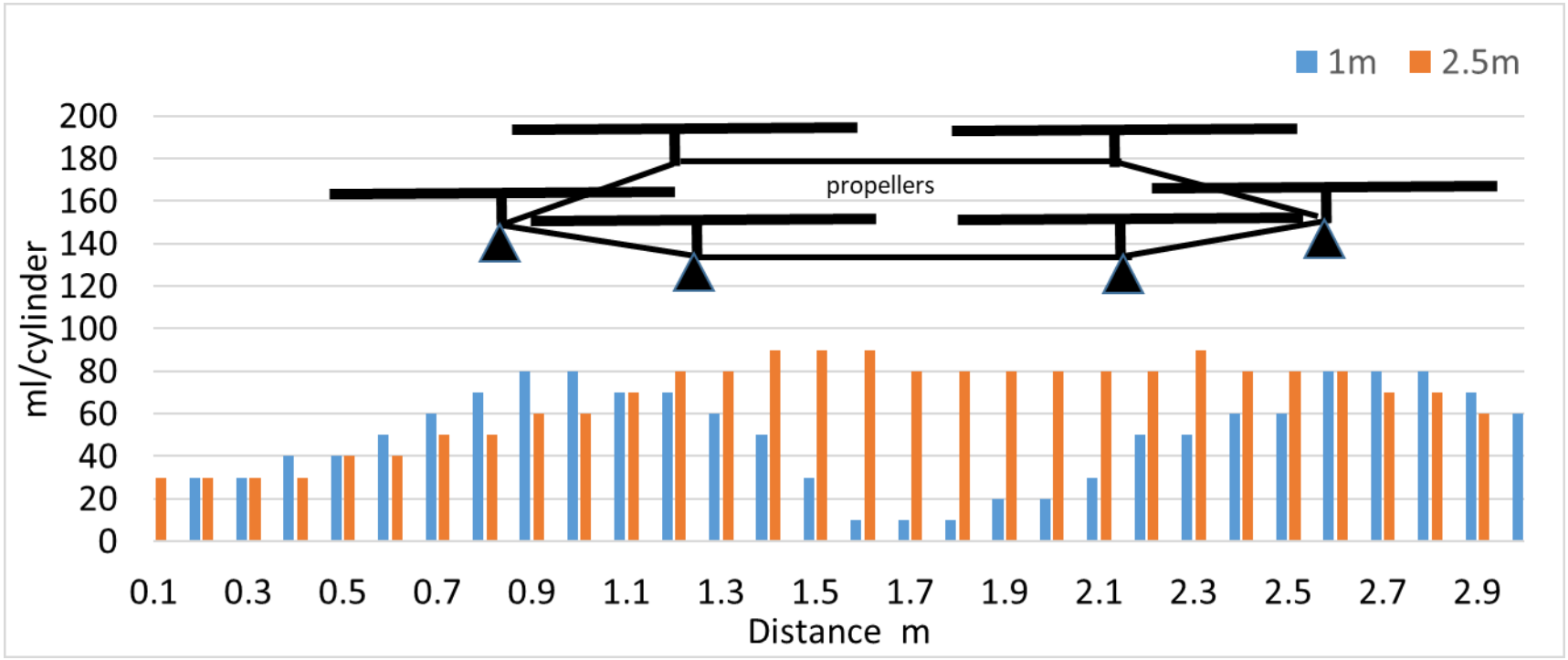
Parameter	UAV1	UAV2
Producer	Homeland Surveillance (US)	DJI, (CN)
Type	Huanaco AG-V6A	Agras DJI MG-1
Number of rotors / engine	6 / TTA 1030	8 / DJI6010
Rotor diameter	76 cm	54 cm
Width (incl. propellers)	236 cm	204 cm
Full weight	37.5 kg	24.1 kg
Volume spray tank	15.2 lt	10 lt
Number of spraying nozzles	4	4

Paternator 3 m width

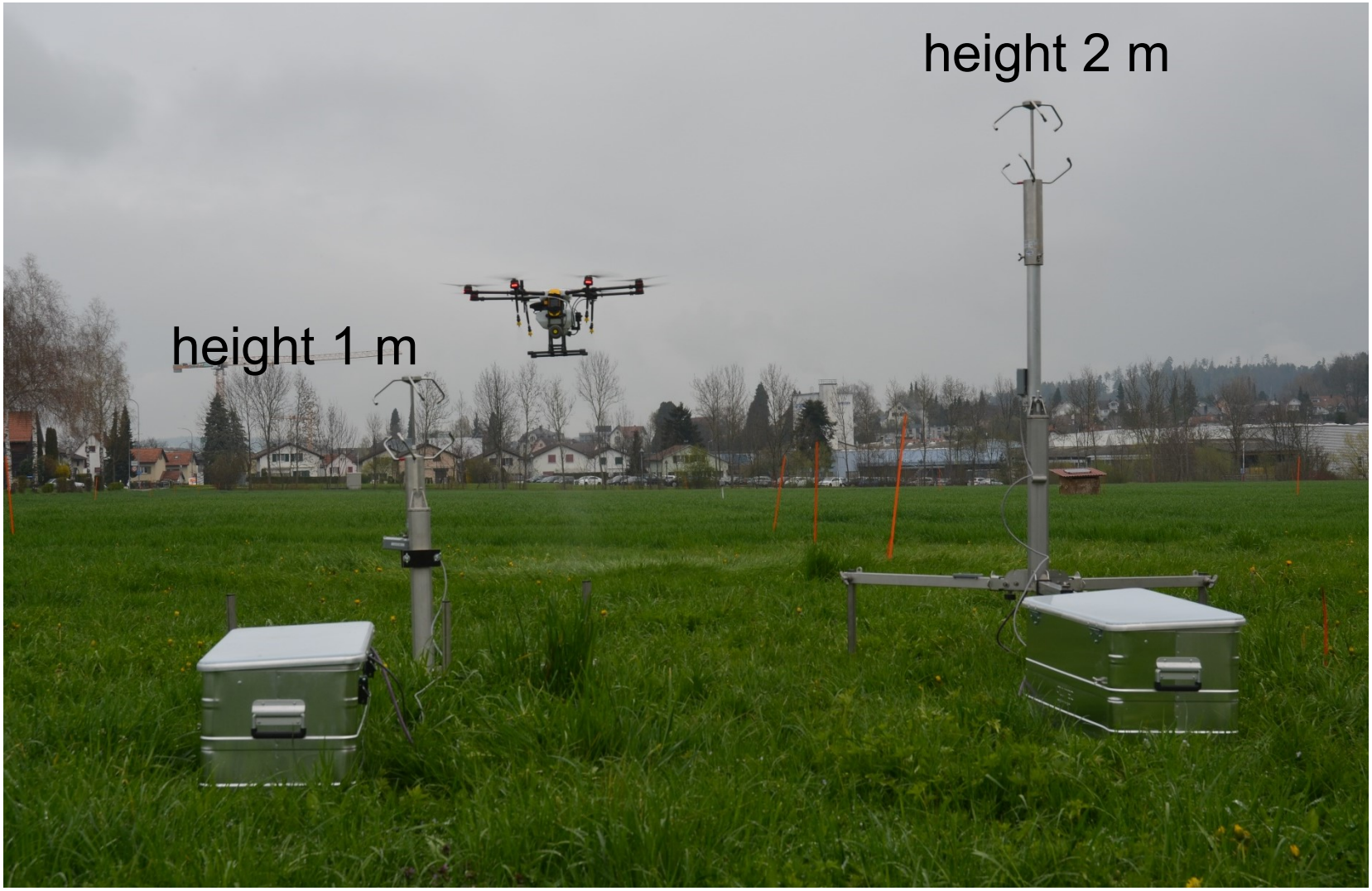
Quality of lateral distribution on patternator



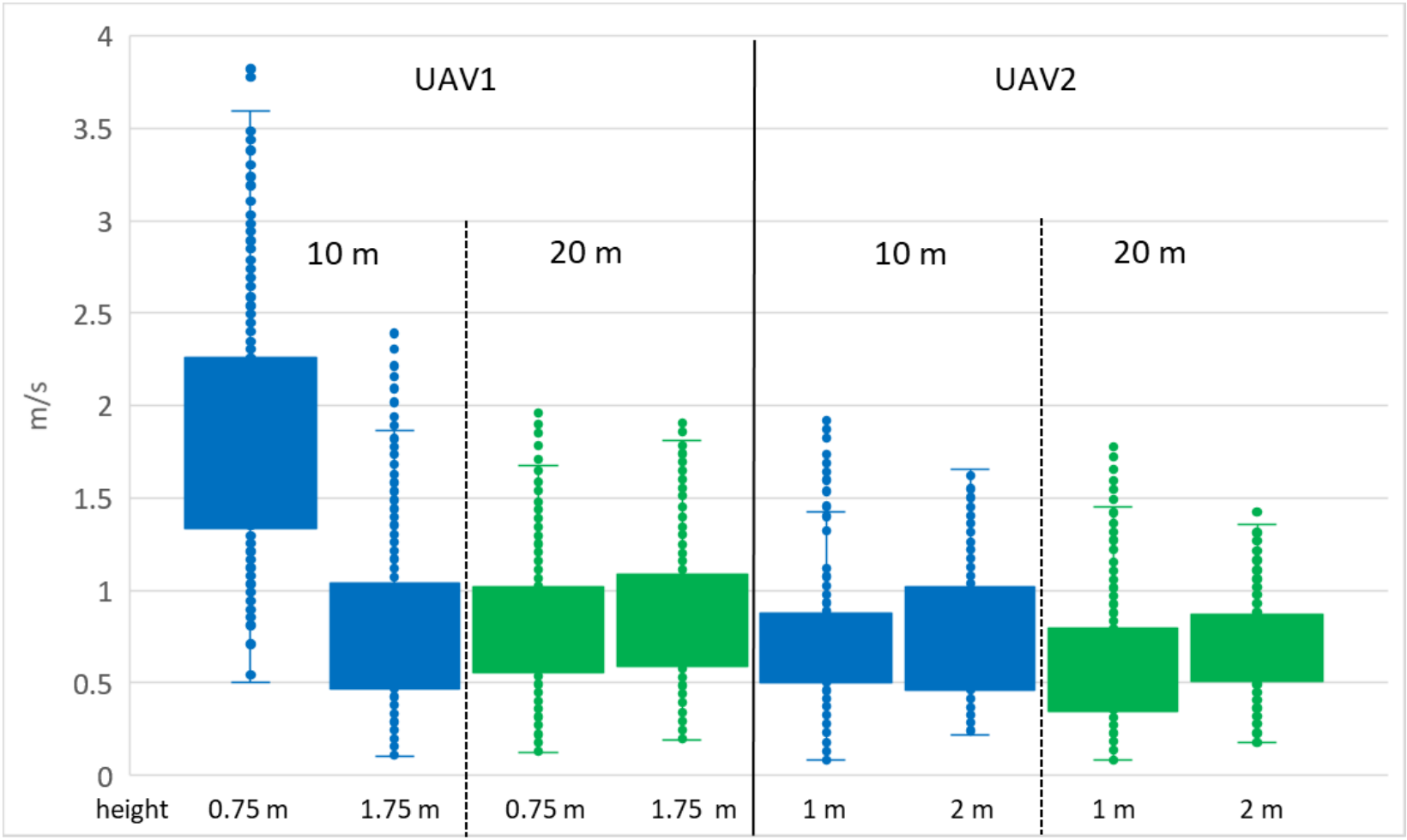
Flying height influences distribution of liquid (UAV1)



Windspeed measurement (distance 10 & 20 m)



Lateral wind speeds of two UAV



Thank you!