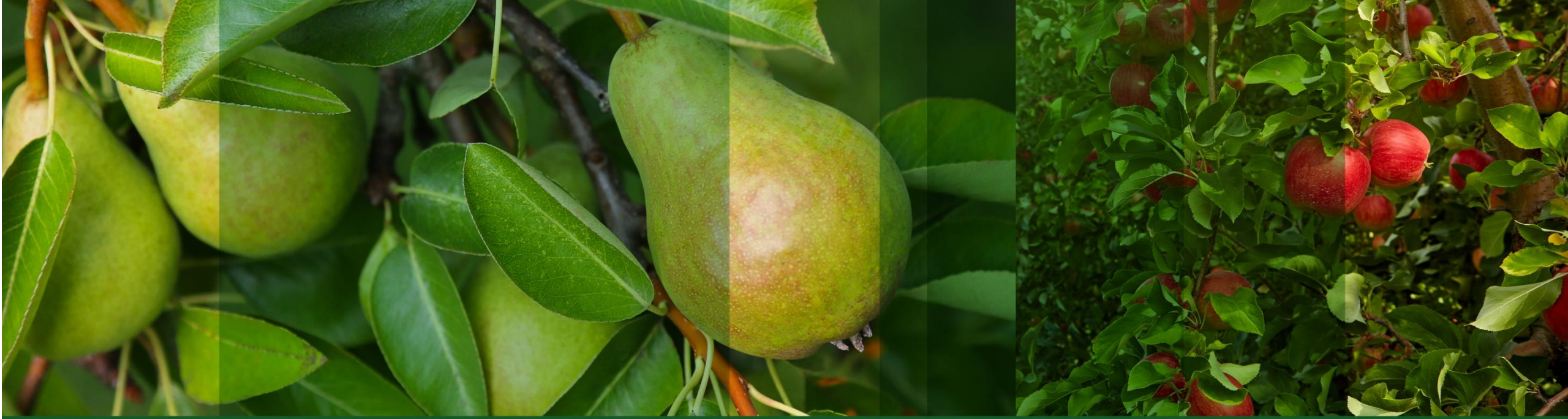




*Evaluation of crop sensing
assisted spraying in mature
South African apple orchards*

Philip Rebel | ProCrop





Evaluation of crop sensing assisted spraying in mature South African apple orchards

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PR@CROP
agricultural consultancy

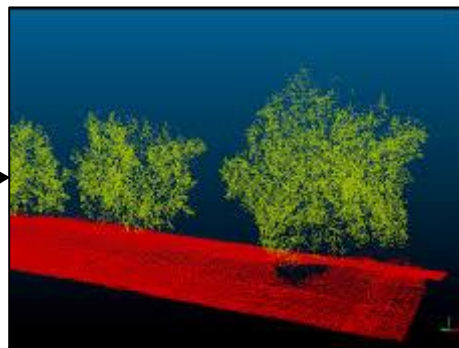
Canopy sensing and variable rate spraying

Crop sensing

- LIDAR, Ultra sonic, Stereo RGB, Satellite...
- Pre application/ real time



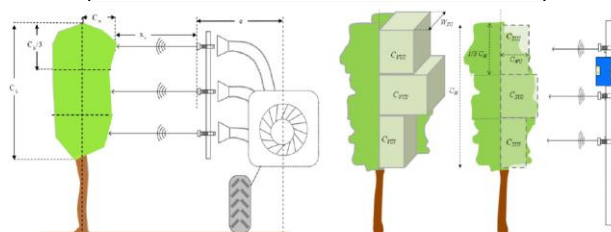
Target orchard



Canopy Data

analyses

Pre application or real time

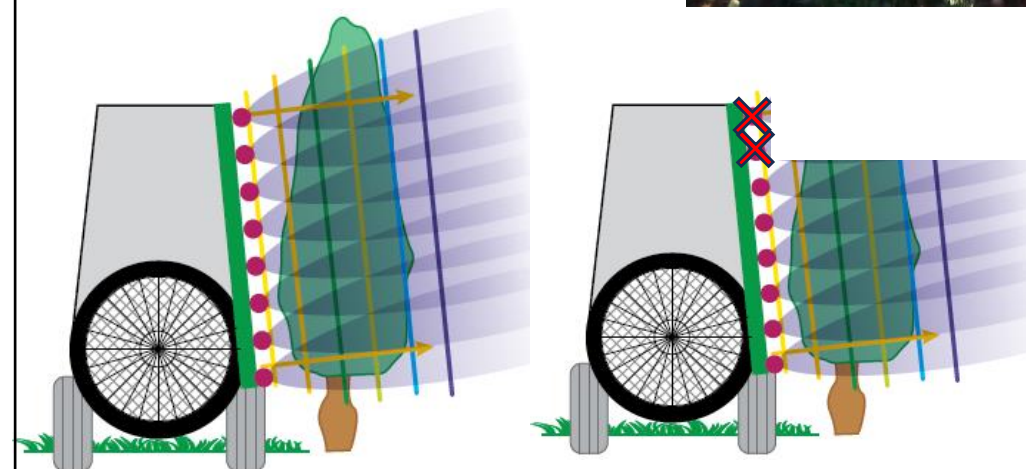


Llorens et al., 2011

Goals ?

- **Good deposition NB!**
- Pesticide savings possible
- Logistical improvement
- Possible drift reduction

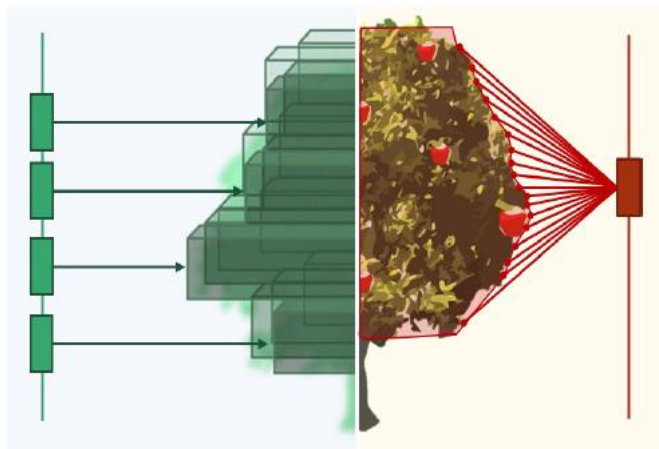
Variable/ Canopy adapted spray pattern



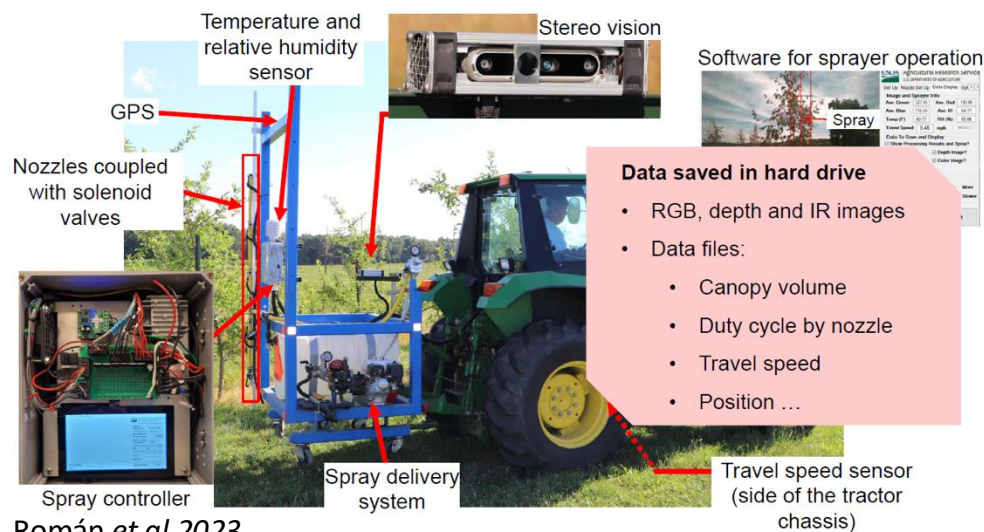
Crop sensing and spray application

Extensive research area within the last 8 years – 500 + Peer reviewed papers on topic

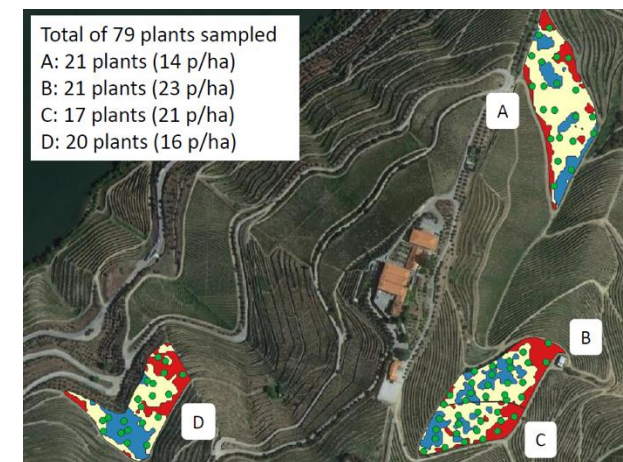
- Crop sensing methodologies researched:
 - LiDAR
 - Ultrasonic sensing
 - RGB/stereo vision
 - Multispectral canopy sensing
 - Satellite imagery
 - Satellite imagery and AI/deep learning canopy characterization
- **Why are we not using it??**
 - Barriers to implementation?



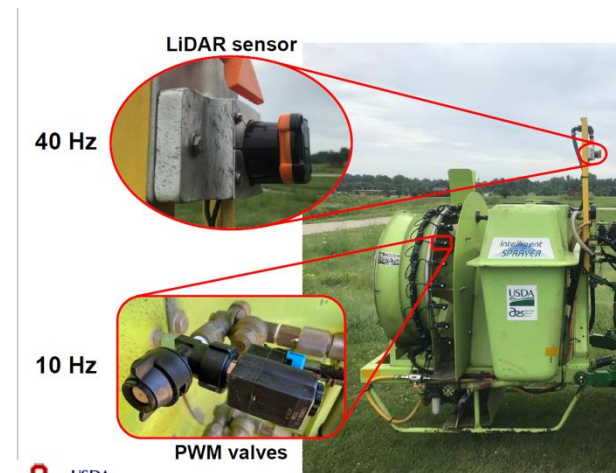
Román *et al.* 2023



Román *et al.* 2023



Garcia-Ruiz *et al.* 2023



Campos *et al.* 2023

Smart apply system - Afgri

GPS Module

Lidar Scanner

Control module –
Send LIDAR data to
solenoids for spray
modulation



Nozzles with
solenoid attached



Android control tablet for
spray operator monitoring
and operation of system

Deposition analyses – Deposition quantity – The percent total leaf/fruit area covered by active ingredient

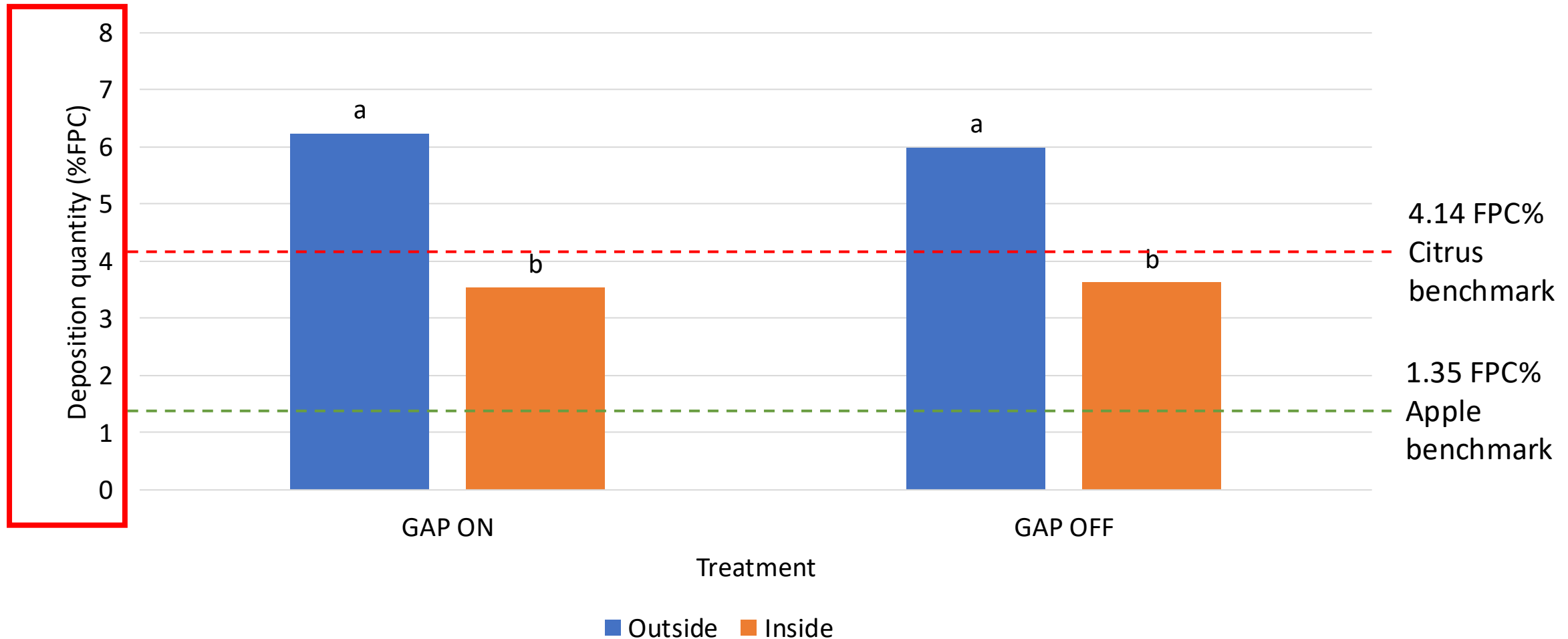


Deposition quantity (%FPC) trail one – Sparse canopy

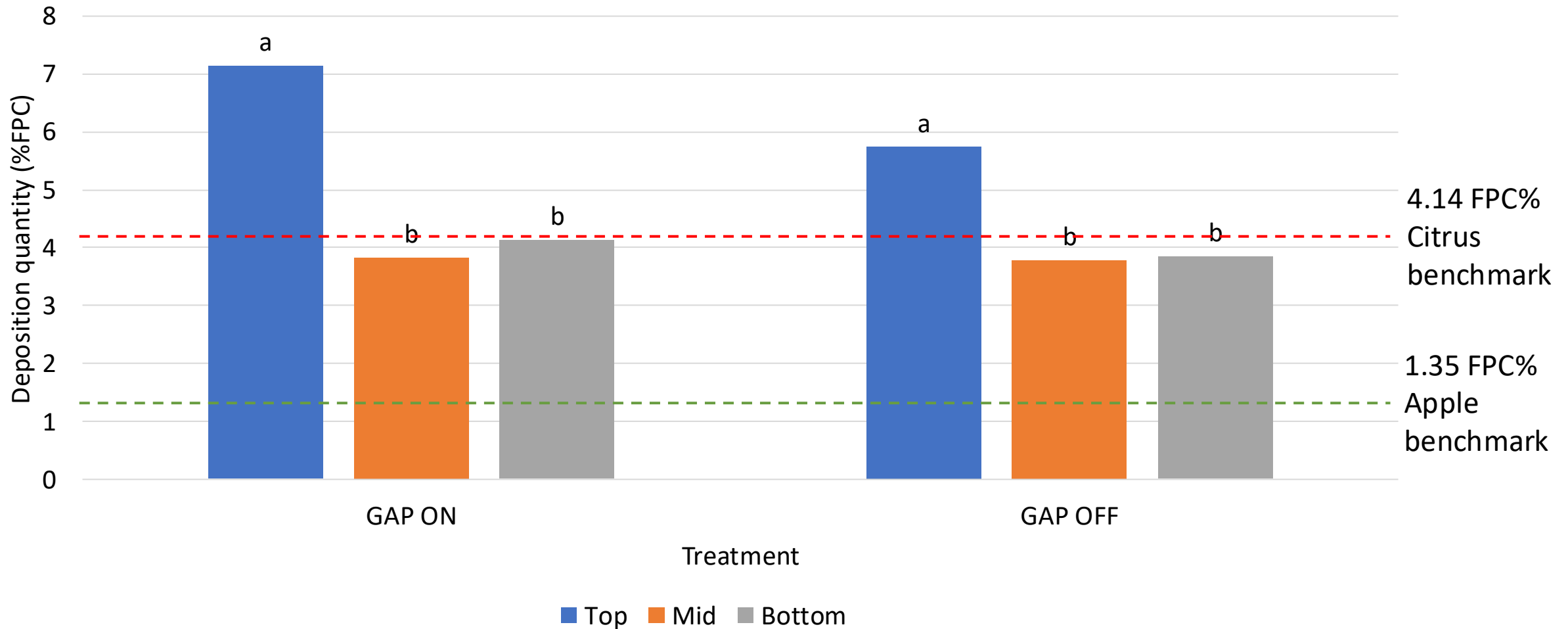
- Low-profile sprayer retrofitted with Smart Apply system
- 7 Solenoids per side
- Low reaction resolution:
 - Low number of solenoids per side
 - Low profile of spray machine
- Orchard TRV = 1668 L/ha
- Normal low volume calibration 650 L/ha
- 4.14 km/h driving speed



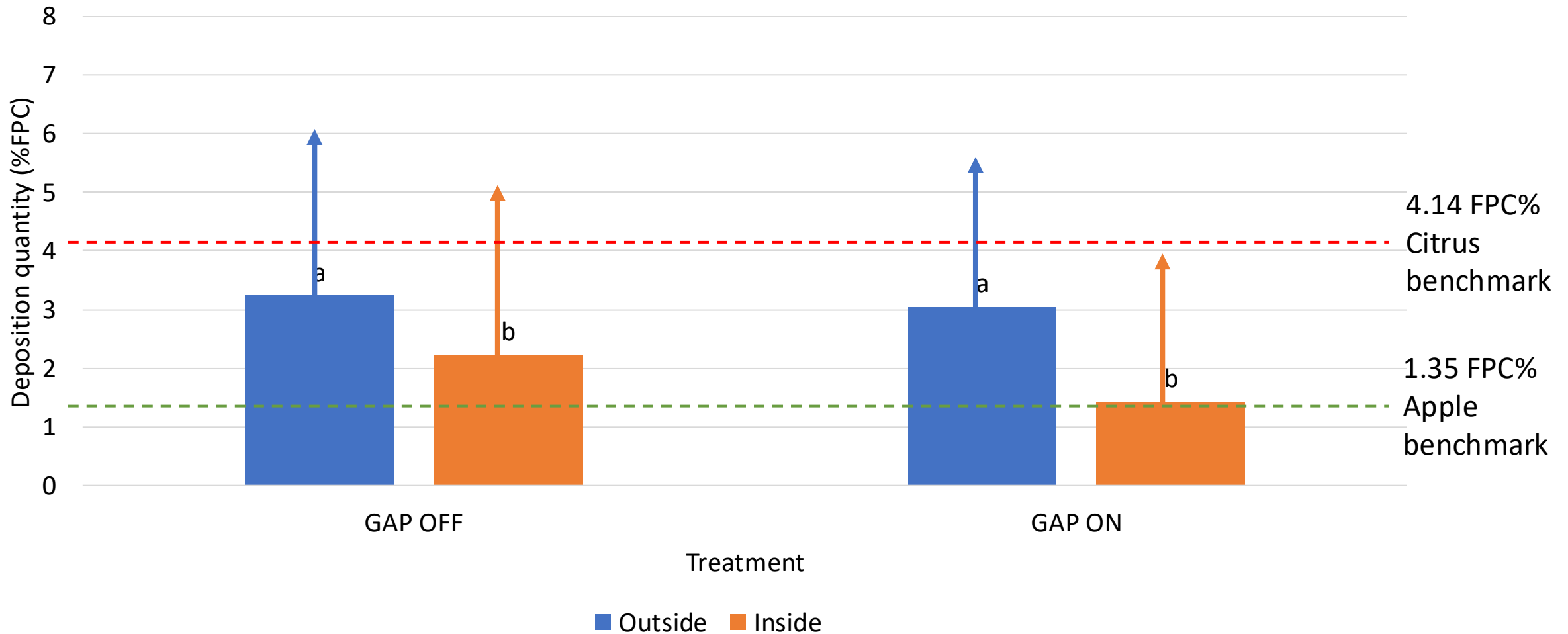
Deposie kwantiteit (%FPC) – Paardekloof 100% BBV spuit



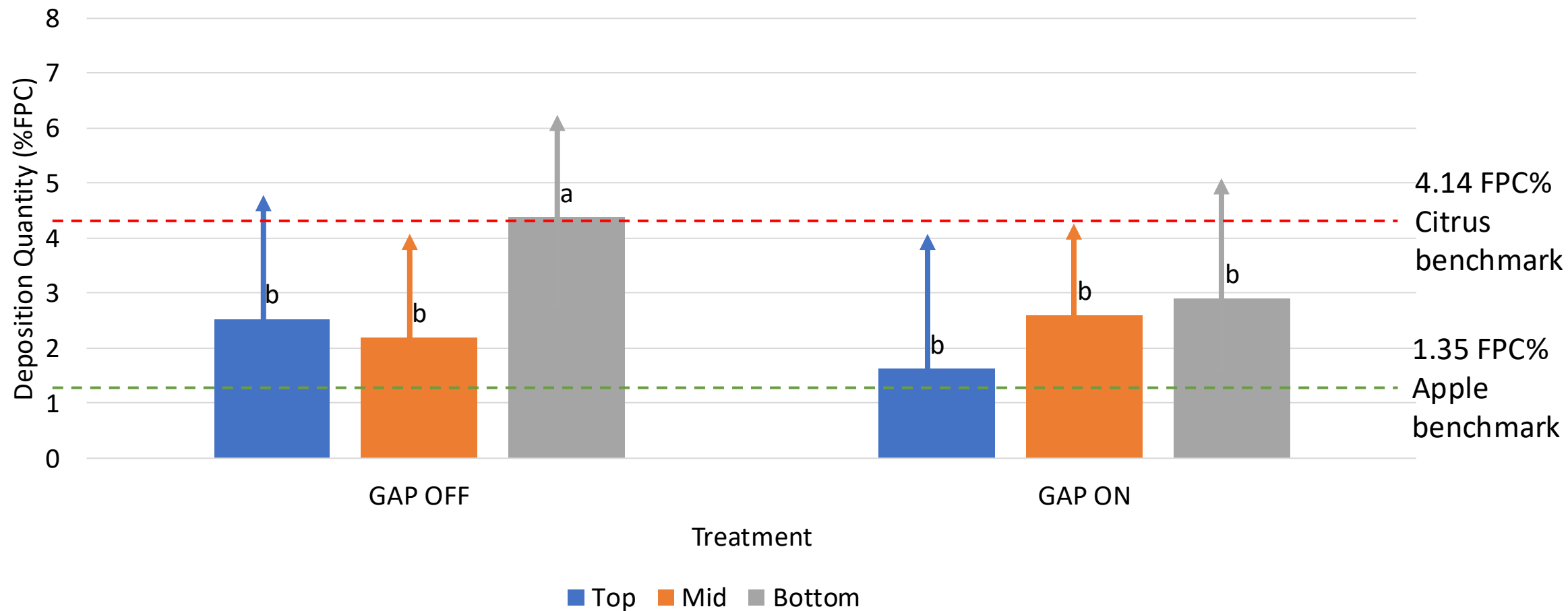
Deposie kwantiteit (%FPC) – Paardekloof 100% BBV spuit



Deposie kwantiteit (%FPC) – Trial Two – Full canopy December 2025



Deposisie kwantiteit (%FPC) – Paardekloof Vol blaredak - Nov

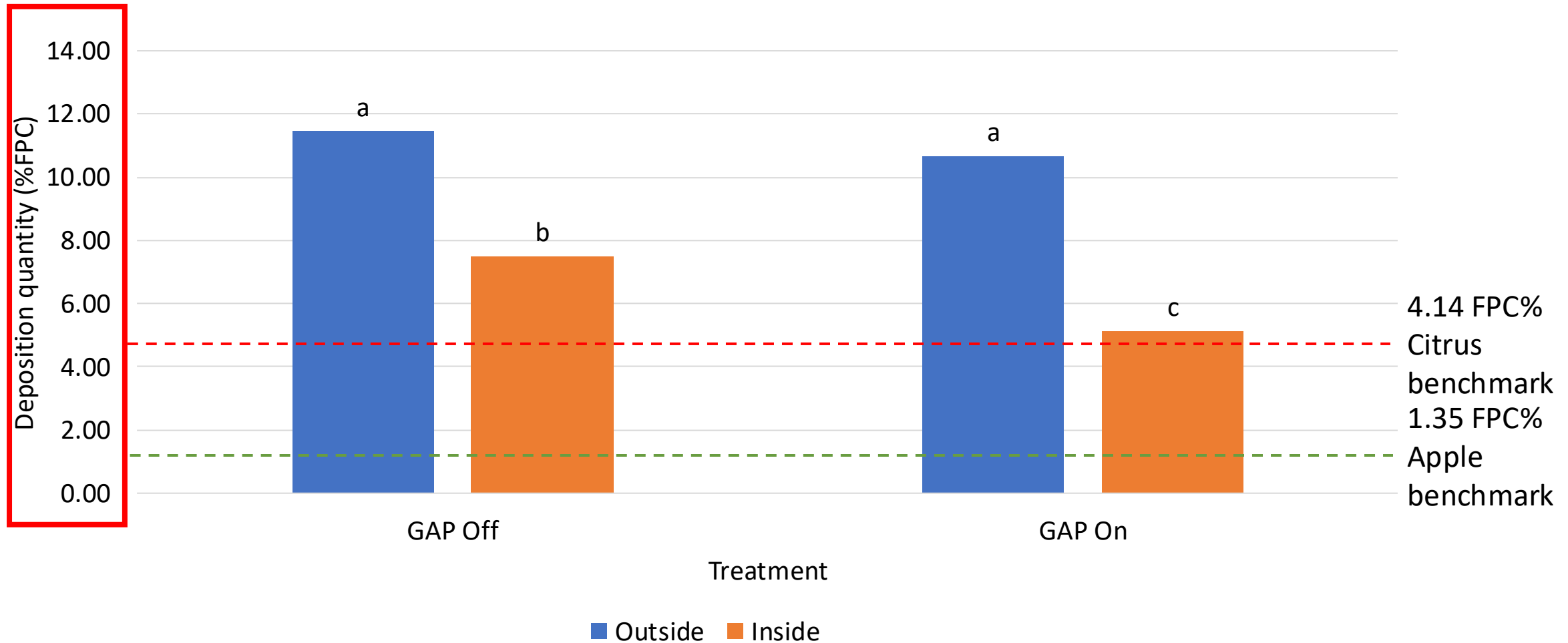


Deposition quantity (%FPC) – Trial three – High profile sprayer - Full canopy

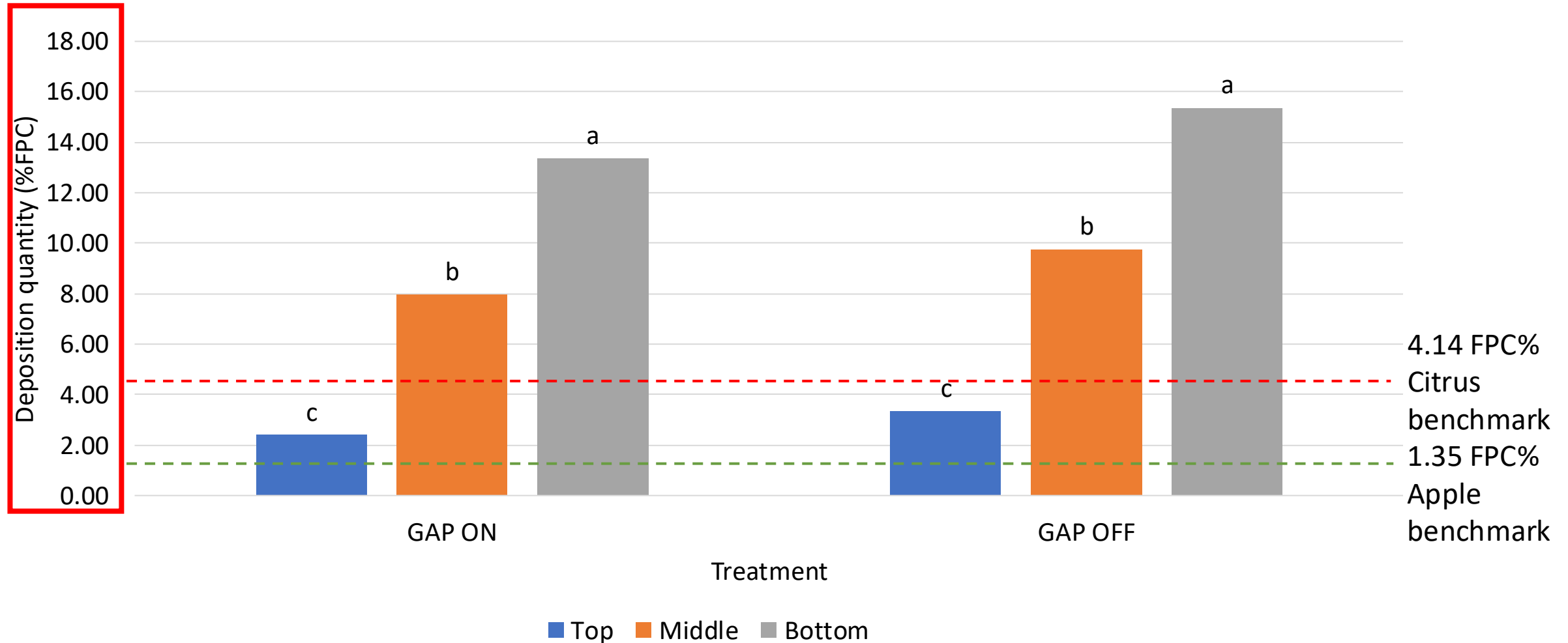
- High profile sprayer with 12 nozzles and solenoids per side
- High reaction resolution
 - High number of solenoids compared to canopy
- Orchard TRV = 1780 L/ha
- Normal low volume calibration 600 l/ha
- Driving speed = 5.2 km/h



Deposition quantity (%FPC) – Trial three



Deposition quantity (%FPC) – Trial three



Spray volume saving – Trial three

Block	Block 1	Block 2	Block 3	Block 4	Block 5
Block Ha	1.49	2.99	2.35	1.31	2.90
Low volume calibration (L/HA)	600	600	600	600	600
Delivery calculated by Smart Apply (L/HA)	536.91	551.84	541.96	552.11	557.88
Delivery calculated with normal calibration	894	1794	1410	786	1740
Delivery measured	800	1650	1300	700	1600
<u>Saving %</u>	<u>10.51</u>	<u>8.03</u>	<u>7.80</u>	<u>10.94</u>	<u>8.05</u>

- **Savings will depend on:**
 - Sprayer type used
 - Orchard uniformity – amount of gaps in canopy
 - Optimal sprayer setup ??
- ROI??
 - Can savings return on investment for canopy sensing system?

Conclusion

- Smart apply system realised statistically similar spray deposition parameters in all canopy positions compared to conventional spray application systems.
- An average of 9% spray liquid saving was recorded in different orchards.
 - Savings will depend on canopy growth phase and age of orchard
 - Uniformity of orchard
 - Size of farm
 - **Is your sprayer and calibration optimal for the target canopies?**
- Potential potholes?
 - Durability of electronic components in a farming/spraying environment
 - Internet connection needed for some systems to function properly
- So why are these systems not yet widely used and available?
 - Cost of systems often does not deliver ROI in an acceptable timeframe at the moment?
 - No drift and spray limiting regulations in place in SA yet?
 - Are we there yet? Focus on optimal sprayer calibration before new tech implementation





Thank you

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