Dose expression and use of Leaf Wall Area (LWA) with improved application techniques in fruit crops

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Fruit crop spraying in The Netherlands

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Introduction

- Research program “Innovative Efficient Application Techniques - IEAT” (PPS-KV1406044)
  - Partners: Agro-Chem Ind., Government, fruit growers organization, water boards, sprayer manufacturers
- Improve quality of spray application by:
  - Air amount and air distribution
  - Nozzle type and position
  - Liquid distribution
- First steps: quantify the liquid distribution in trees:
  - standard orchard cross-flow sprayer
  - multiple row sprayer
  - tunnel sprayer

IEAT research

- Project started in 2015.
- Single, Multiple row, Tunnel sprayers
  - continuous air slot, spouts
  - nozzle type (ATR, TVI)
  - air assistance (High, Low)
  - spray deposition
- Improved deposition => lower dose rate (maintaining threshold deposition => Q for AC-industry).
- Biological efficacy; Spray drift measurements; Registration procedures!

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Experiments

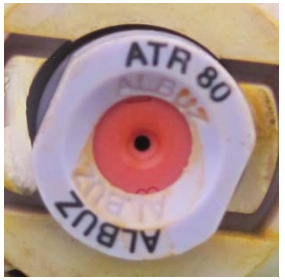
- Reference sprayer (Munckhof)

1. standard – conventional cross-flow fan sprayer (Munckhof); Albuz ATR lilac at 7 bar spray pressure (Very Fine spray quality).

Two row tunnel and Multiple row orchard sprayer to spray two tree rows from both sides (Lochmann, Munckhof)

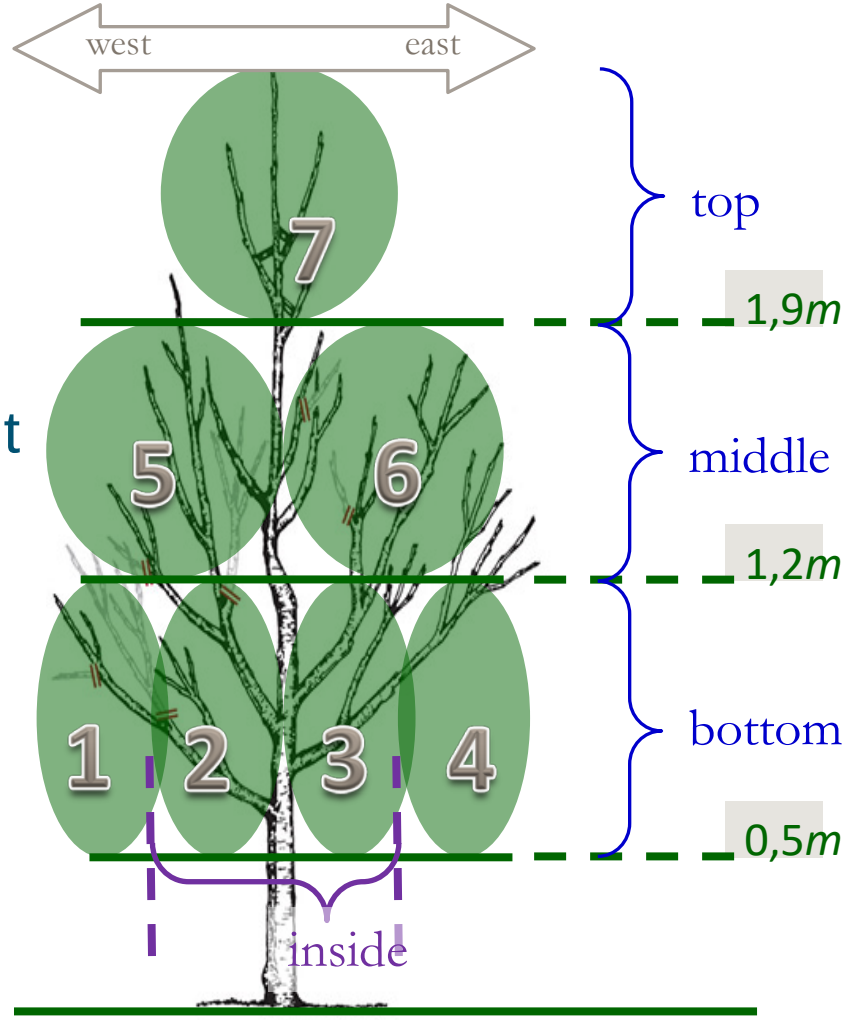
Albuz ATR Lilac nozzles, 7 bar, VF (High/Low air)

Albuz TVI 8001 nozzles , 7 bar, C (High/Low air)



Measuring spray deposition on leaves

- Dry after spraying
  - Pick the leaves
- 4 trees
- Each tree in 7 compartments
- Count leaves per compartment
- Pick every 10th leaf and store



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Measuring deposition – check on application rate and potential spray drift

- Check on application and spray drift potential by collecting on vertical poles
- Filter paper, 2 cm x 50 cm
- height of 300 cm
- 4 poles

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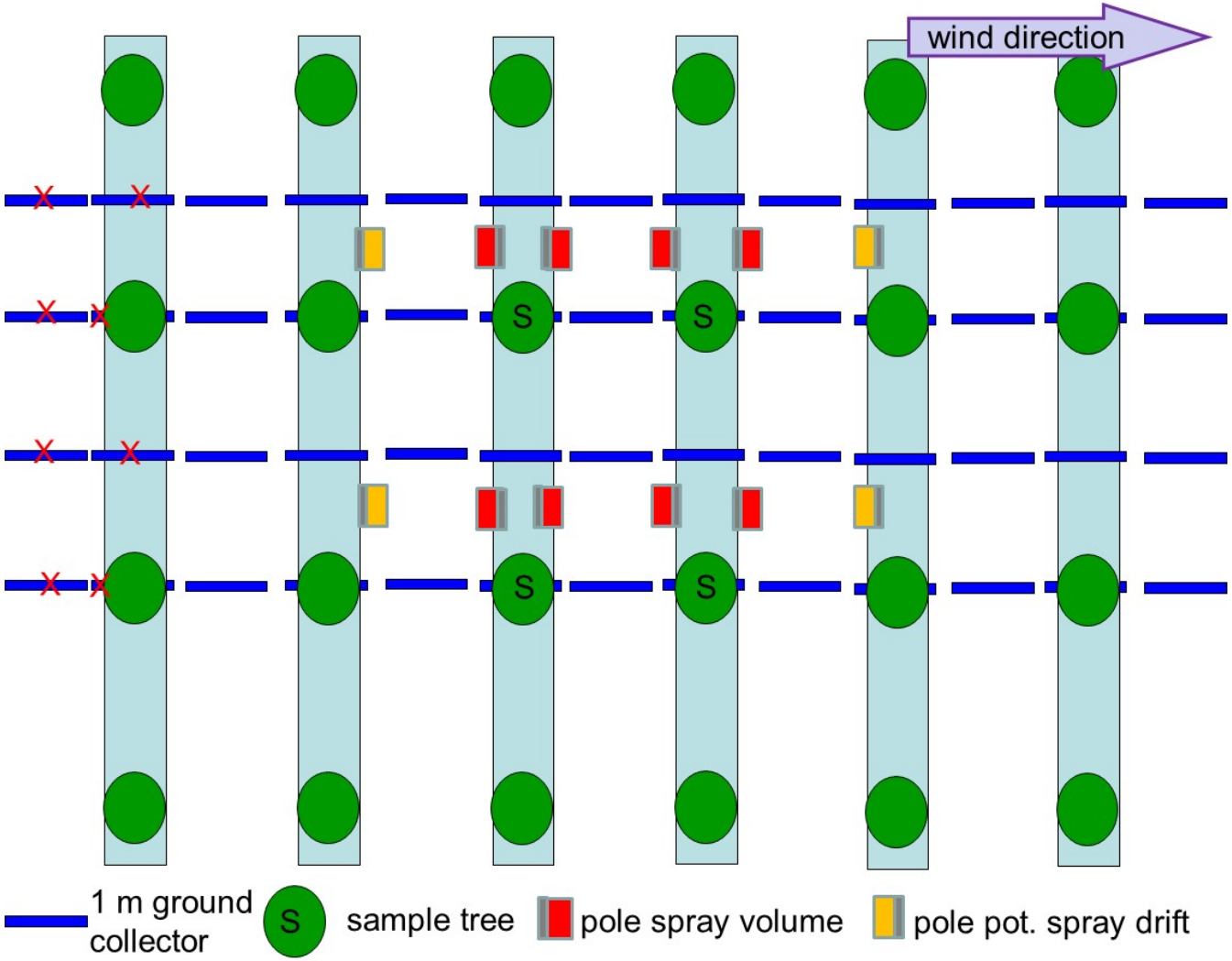
Sampling scheme



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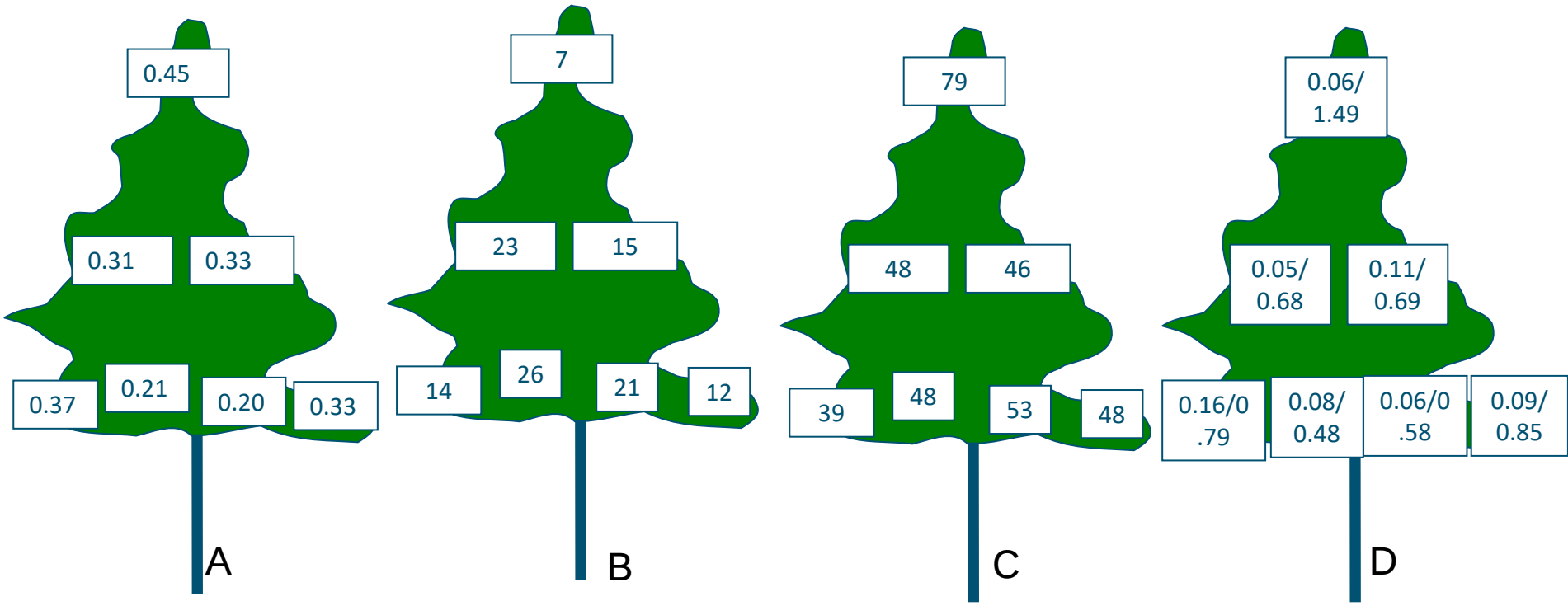
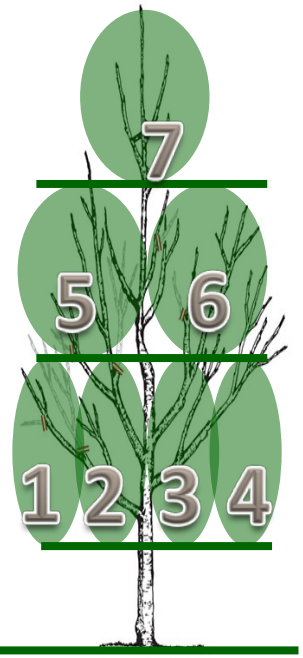
Spray deposition in tree - standard sprayer



Spray deposition in tree [µl/cm²]:

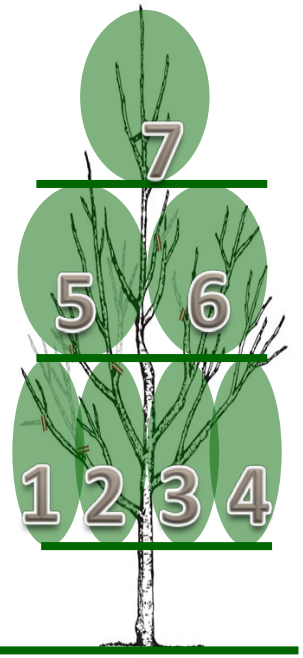
A. distribution in compartments; B. CV (%) per compartment of 4 trees; C. CV (%) inside a compartment; D. min/max per compartment

Spray deposition in the tree (µL/cm²)



		standard	Lochmann tunnel sprayer			
		ATR lilac	ATR lilac		TVI 8001	
		high	low	high	low	high
part	avg	**0.29**	**0.31**	**0.30**	**0.60**	**0.51**
7	top	0.32	0.43	0.36	0.51	0.43
6	mid east	0.37	0.38	0.33	0.62	0.54
5	mid west	0.31	0.39	0.40	0.67	0.57
4	bottom out east	0.34	0.35	0.37	0.73	0.65
3	bottom inside east	0.24	0.22	0.24	0.49	0.33
2	bottom inside west	0.20	0.14	0.17	0.46	0.40
1	bottom out west	0.23	0.28	0.22	0.72	0.65

Spray deposition in the tree (% spray volume)

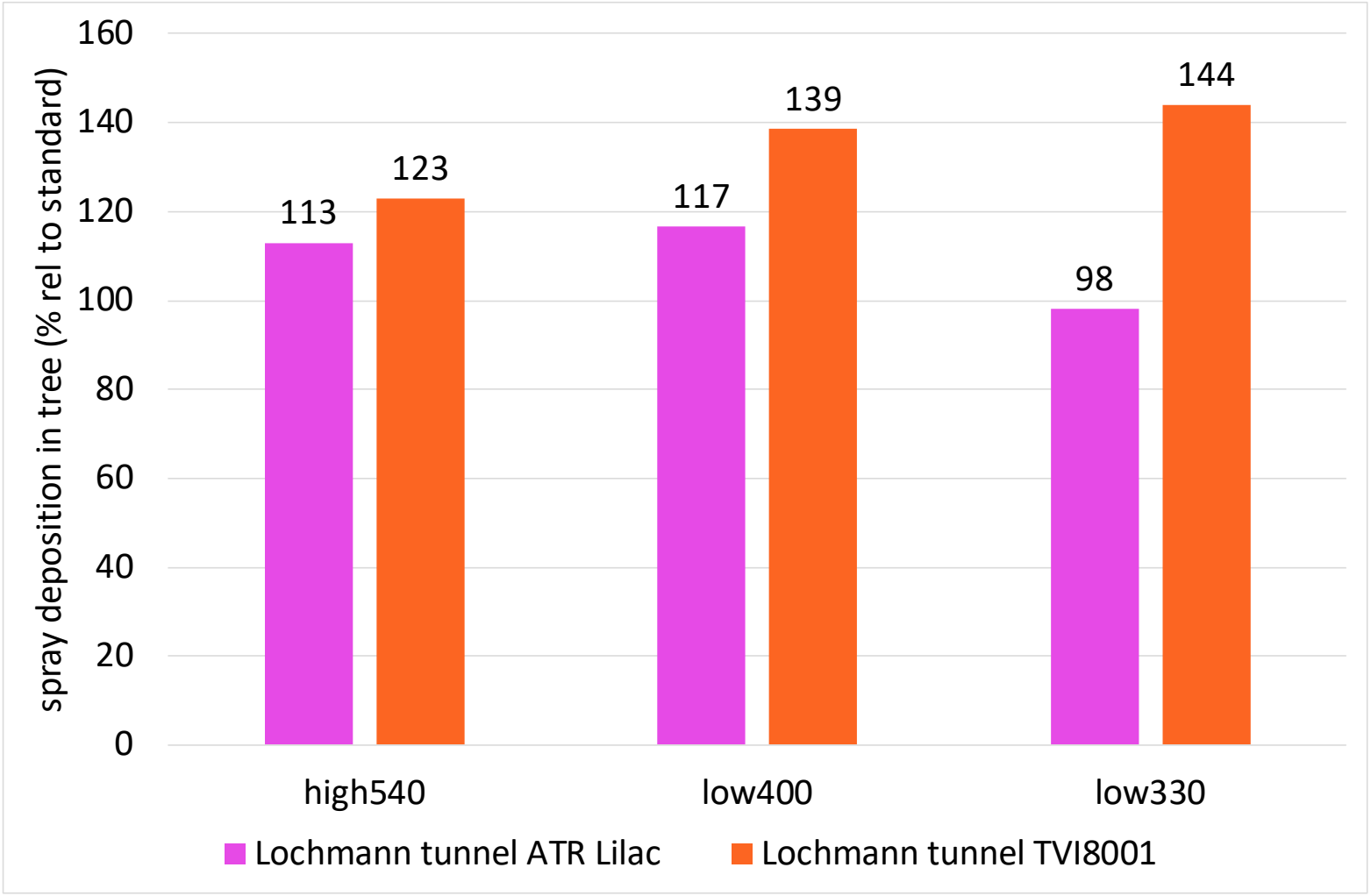


		standard	Lochmann	tunnel	sprayer	
		ATR lilac	ATR	lilac	TVI	8001
		high	low	high	low	high
part	avg	**14.2**	**16.7**	**16.1**	**20.5**	**17.5**
7	top	15.9	23.0	19.6	17.3	14.7
6	mid east	18.4	20.2	17.7	21.2	18.5
5	mid west	15.2	20.7	21.4	23.0	19.6
4	bottom out east	16.9	18.7	20.0	25.0	22.3
3	bottom inside east	11.8	11.9	12.8	16.8	11.2
2	bottom inside west	9.7	7.5	9.3	15.6	13.7
1	bottom out west	11.5	14.8	11.6	24.6	22.3

Spray deposition in tree (% spray volume)

			average		
machine	nozzle	Air assistance	Deposition (% spray volume)	rel [%]	95% (90%)
standard	ATR Lilac	high	14.2	100	a
Lochmann Tunnel sprayer	ATR Lilac	high	16.1	113	b
	ATR Lilac	low	16.7	118	c
	TVI 8001	high	17.5	123	c (c,d)
	TVI 8001	low	20.5	145	c (d)

Spray deposition in tree Lochmann 2R tunnel– relative to standard sprayer



Spray deposition in tree Munckhof 2R – relative to deposit of standard sprayer

Spray deposition in tree Munckhof CF – relative to deposit of standard sprayer

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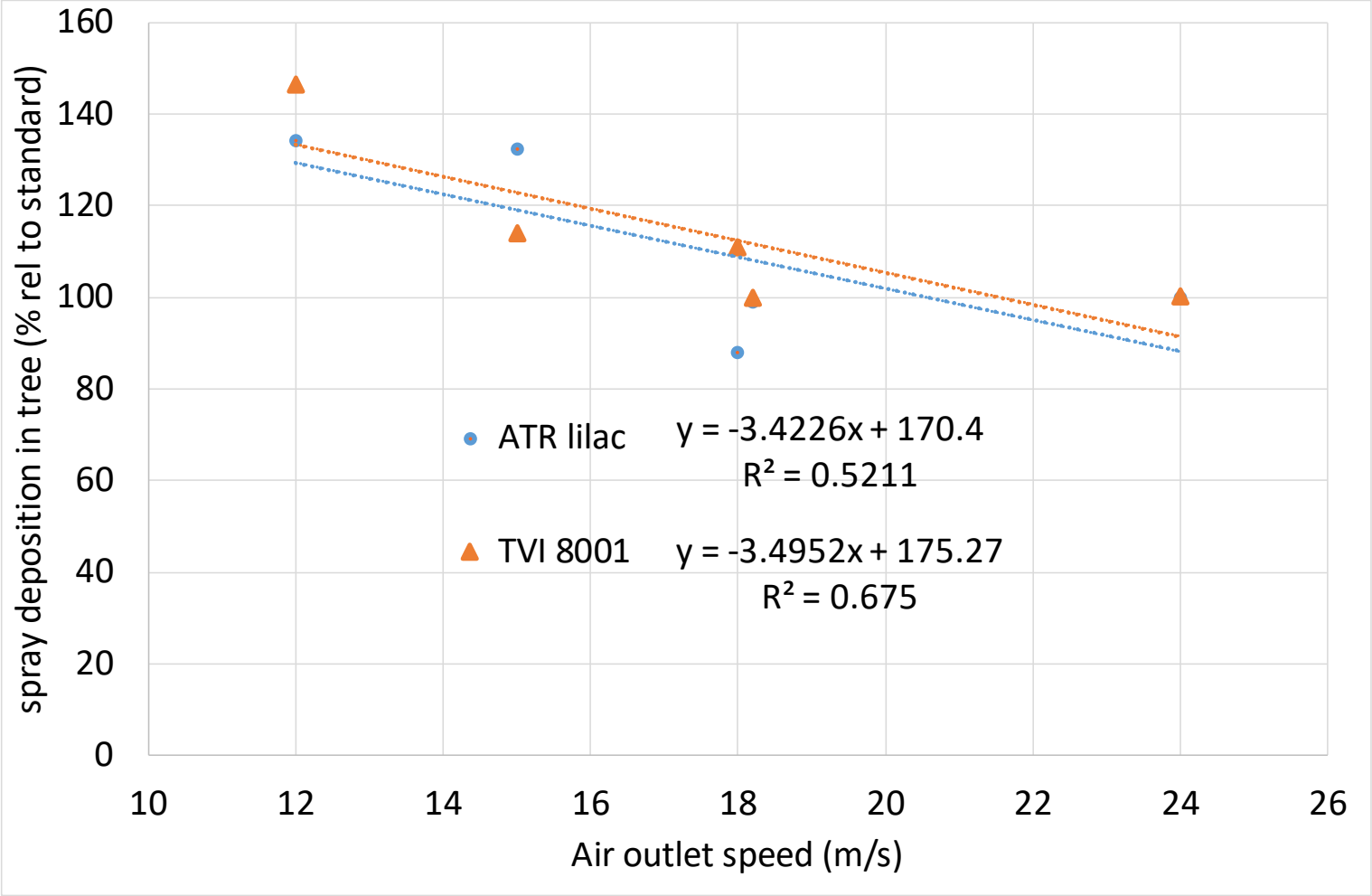
Relation air outlet speed (m/s) Munckhof CF and spray deposition in tree, rel to standard



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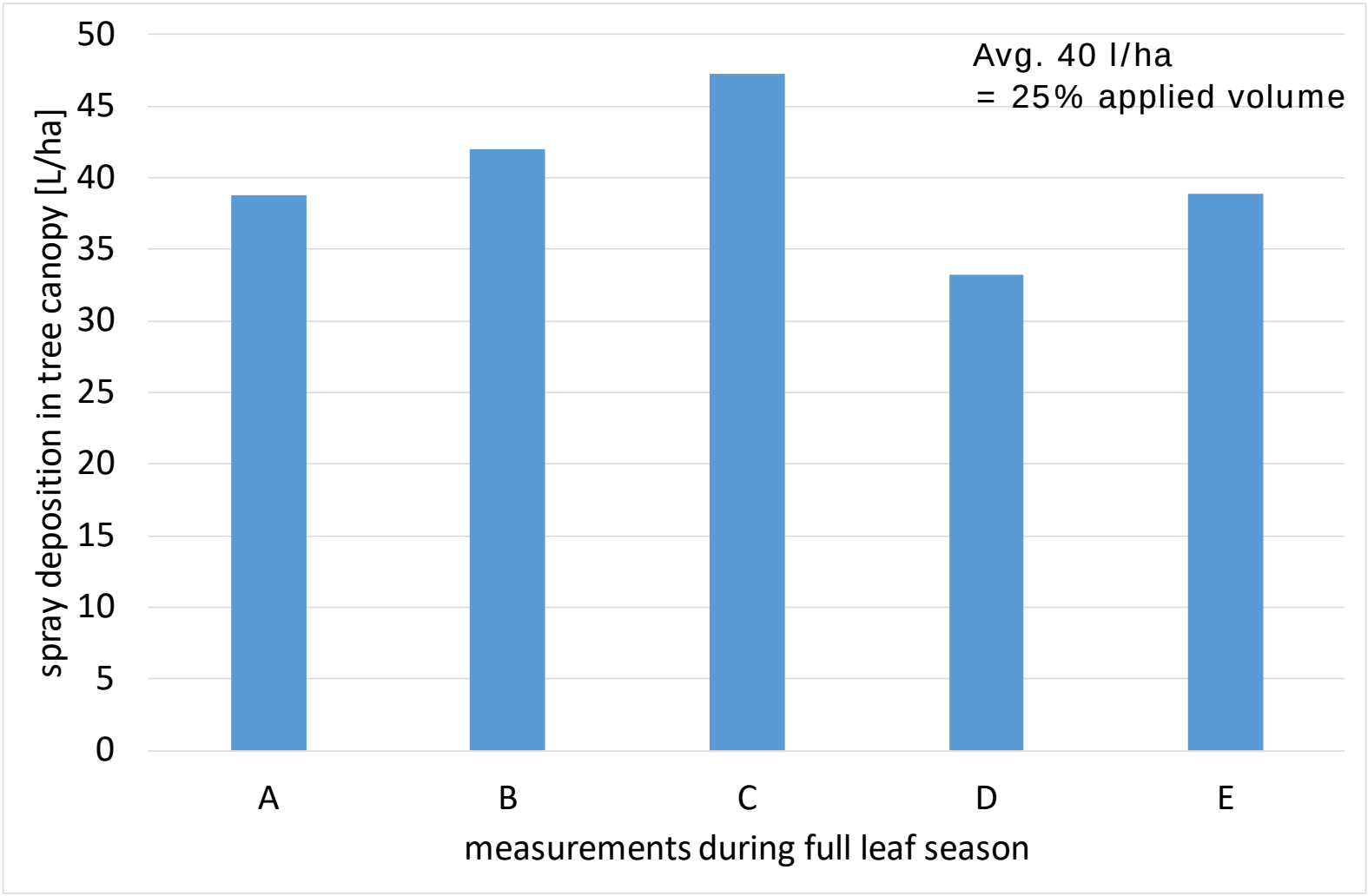
Spray deposition in tree canopy (l/ha) of standard during full leaf period



conclusions

- Increased spray deposition with tunnel and multiple row sprayers;
- Coarse spray quality venturi type nozzles increased spray deposition in the tree canopy compared to Very Fine hollow cone nozzle types;
- Low air settings increased spray deposition in the tree canopy;
- Optimal combinations for different sprayer types.

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Discussion

- Mass balance? (30-80 l/ha in tree; 30-60 l/ha on ground).
- Only 15%-50% of applied spray volume recovered in tree canopy.
- Deposition on wood parts of the tree (stem + branches = 30% projection surface) and fruits?
- Next step: reduced PPP-use class + DRT class = higher level/class of emission reduction.

Discussion

- How to implement more efficient application techniques in LWA (or other dose expression systems)?
- LWA: 4 m high trees – full dose =>2 m high trees – 0.5 dose?
- Product Stewardship!

Thank you for your attention

Suprofruit 2019

15th Workshop to take place at NIAB EMR, East Malling UK 15-19 July 2019.

Focus on developments in spray application techniques in fruit and other three dimensional crops.

PPS KV 1406044

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Productschap Tuinbouw

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