HORTGRO
Growing Fruit IQ

Technical Symposium 2026

SESSION 4

Taming the Spray

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Chair: Dr Gideon van Zyl | ProCrop

HORTGRO
Growing Fruit IQ

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Target adapted dosing and spray application in 3D crops in relation to the official German system

Dr Peter Triloff | Marktgemeinschaft Bodenseeobst eG Friedrichshafen

Target Adapted Dosing and Spray Application in 3D Crops in Relation to the Official German System

Dr. Peter Triloff
Marktgemeinschaft Bodenseeobst eG
Friedrichshafen

Hortgro Technical Symposium 2026, Somerset West, South Africa, May 25 - 29, 2026

Spray Application in 3D-Crops: Where Do Pesticides Go?

20 - 55% of a 100% pesticide dose applied, deposits at the target

Range = 2,75 x

4 - 6% of a 100% pesticide dose applied, evaporate

2 - 5% of a 100% pesticide dose applied, drift outside the treated area

30 - 70% of a 100% pesticide dose applied, deposit on the orchard floor*

Range = 2,34 x

The questions

How much is 100%?

What causes spray deposition vary by a factor of 2,75 and orchard floor deposit by 2,34?

The answers

100% = dose rate applied: registered or adapted

The factors 2,75 and 2,34 express the range of efficiency of spray application

(* = TU Torino und FEM San Michele, modified)

Making Spray Application in 3D-Crops More Efficient: The Basic Steps

Step 1 Improve spray application (air and liquid vertical distribution of the fan and its operation) to maximize the ratio of deposited versus released droplets and the quality of droplet deposition at the target (quantity, coverage, droplet density)

Step 2 After the optimization of a spray application reference
a) adapt max dose rates to the new technique (= registration)
and
b) adapt dose rates to the target (= use in the orchard)

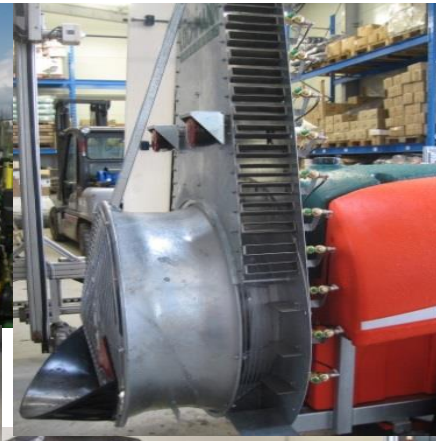
Step 3 After optimization of dosing and application is done, remaining spray drift needs to be reduced without killing steps 1 and 2.

The name:

Target-adapted dosing and spray application
(TOS = TarCheck®-Optimized Spraying)

Cross Flow Fan Types: A confusing diversity! Are all good? What is good?















Fan Types for 3D Crops: How to Find Out What is Good?

For judging a fan type, its air and liquid vertical distributions need to be visualised

Therefore test benches are required:

air test bench and liquid test bench (patternator)

Fan Types for 3D Crops: The Bad and the Good

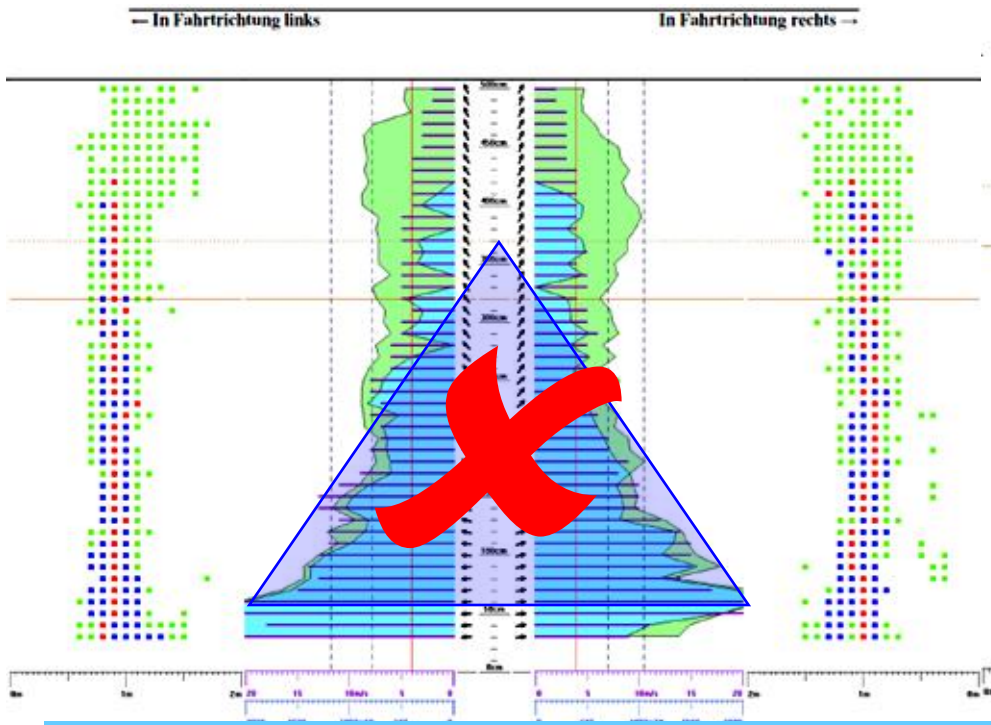
The task of the air flow is to transport the droplets from the nozzles into the target structure, but not remove them from there!

The fan is not an air force!

All negative effects increase and all positive effects decrease with an increasing vertical angle of the air flow and increasingly excessive fan speed!

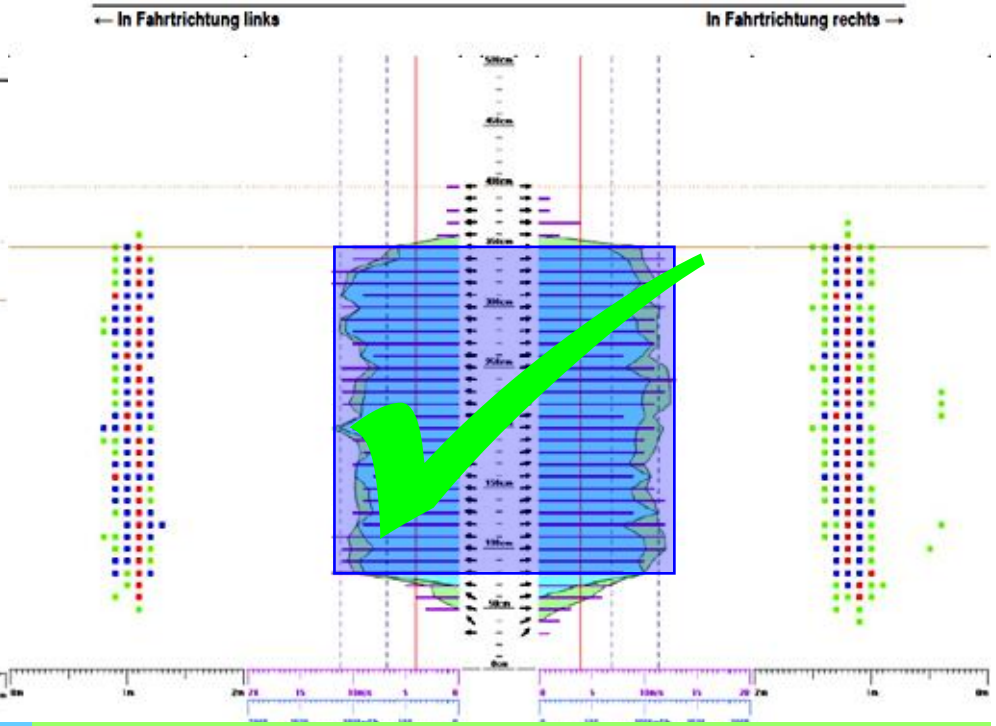
How needs the air distribution to look like at the air test bench as the prerequisite to transport a maximum of droplets released by the nozzles into the canopy and deposit them there?

Point source fan types: **triangular air distribution**



Blue area: Usable air flow with sufficient air velocity

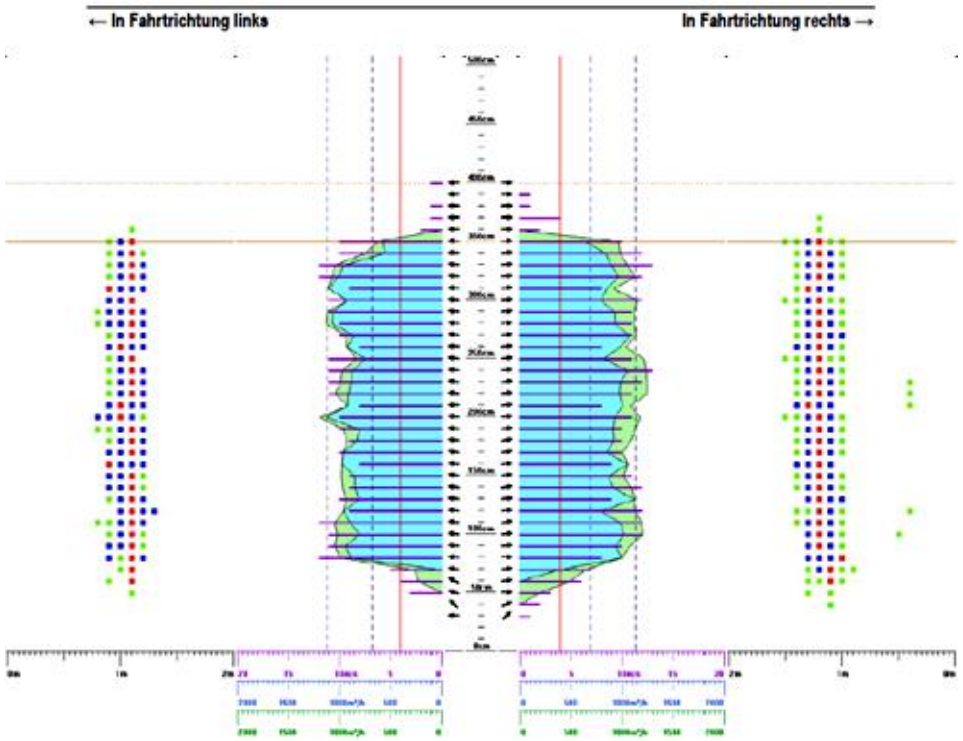
Cross flow fan types: **rectangular air distribution**



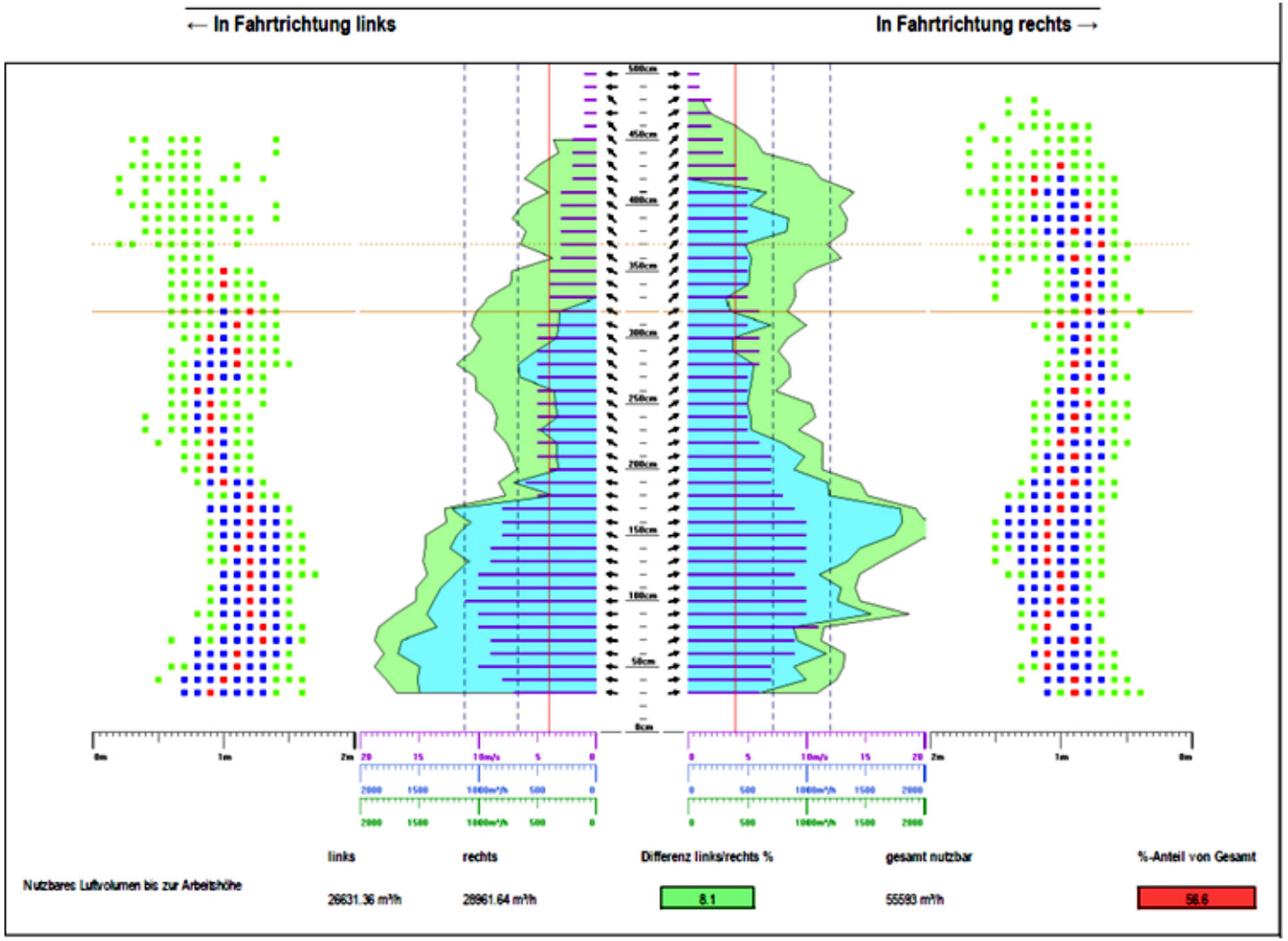
Green area: Non usable air flow with too low velocity already at the air bench

In the Beginning: The Air Distribution of Fans in Use on Fruit Farms

The goal



The reality



Axial fan with tower directly from the manufacturer

Blue area: Usable air flow with sufficient air velocity

Green area: Non usable air flow with too low velocity already at the air bench

In the Beginning: The Air Distribution of Fans in Use on Fruit Farms

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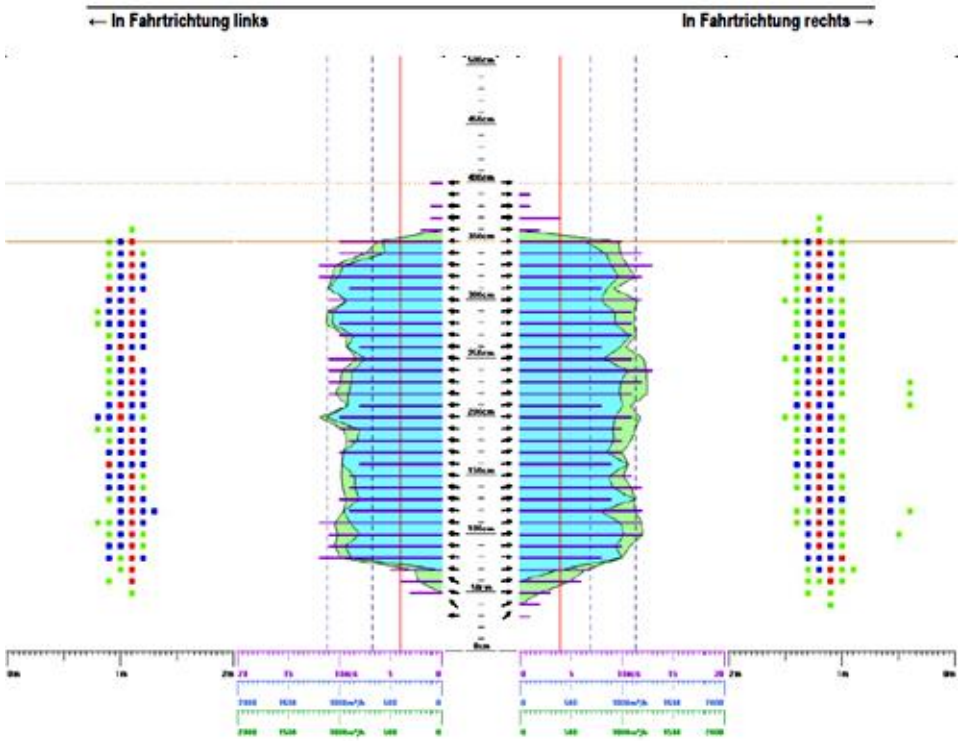
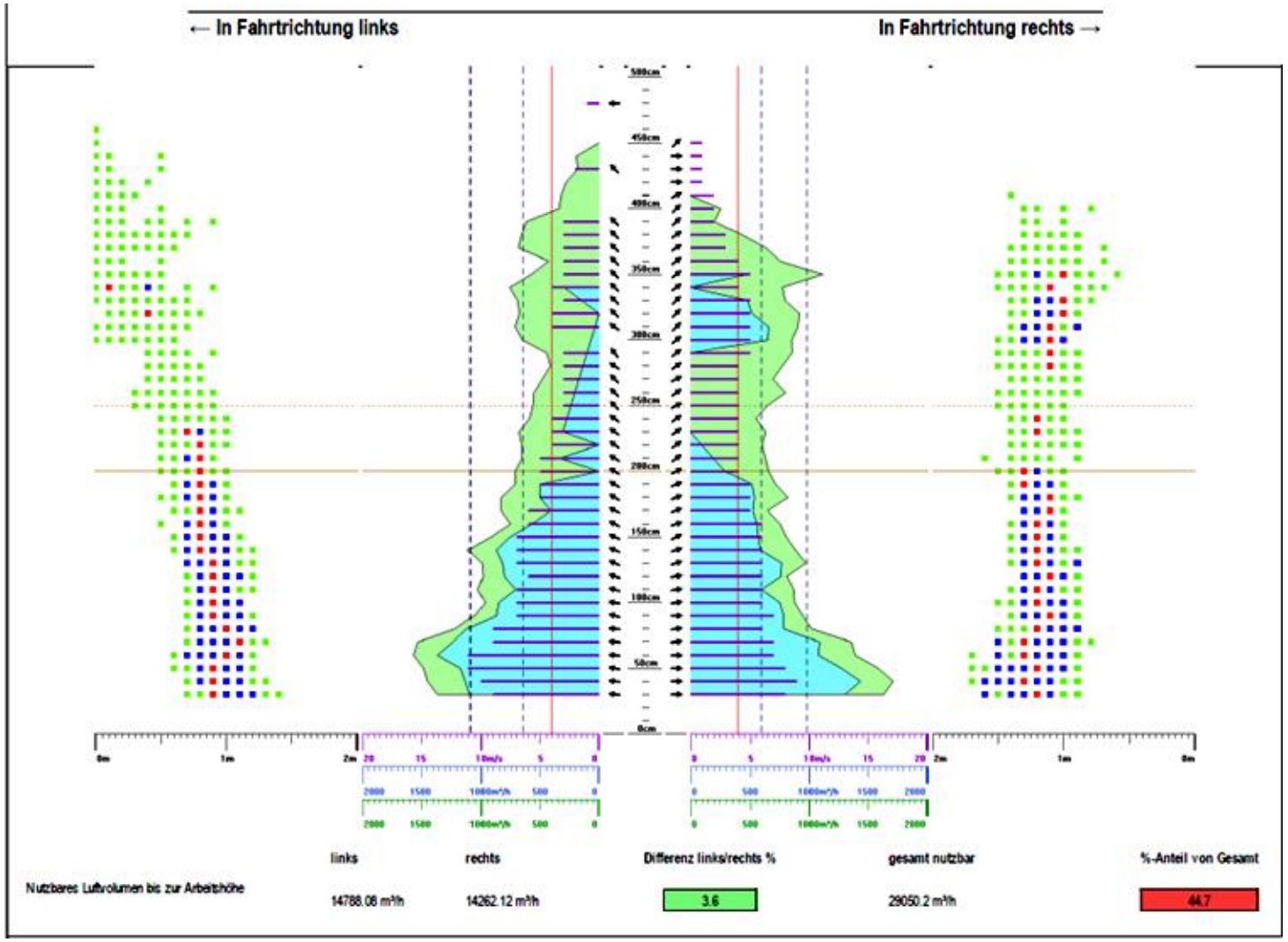


The reality



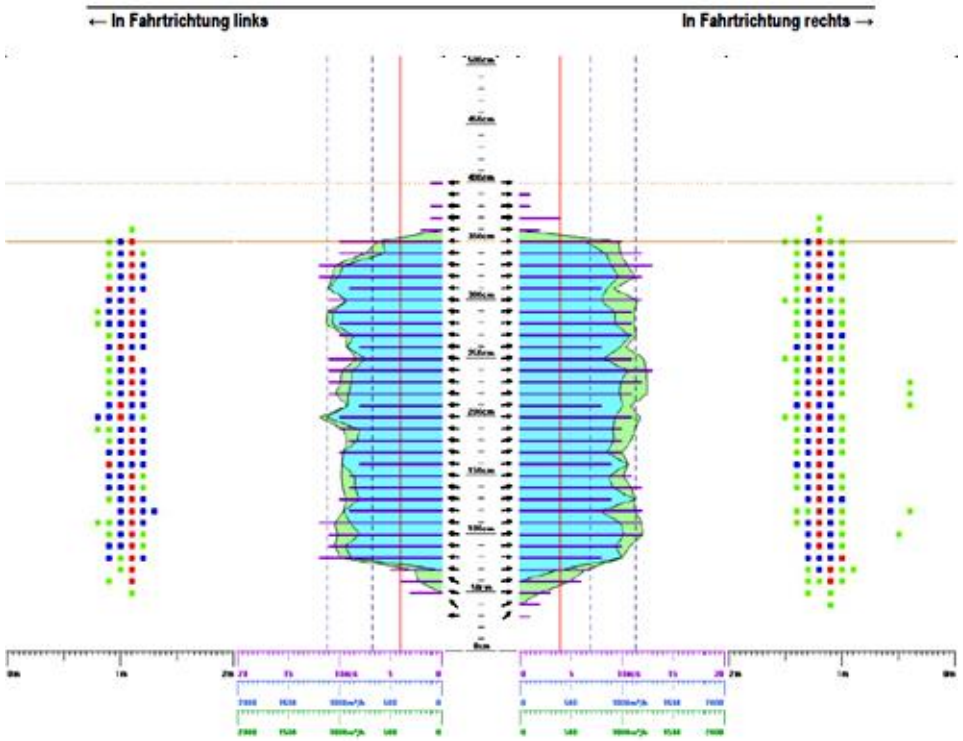
The explanation of continuous scab problems after purchase of the sprayer

Blue area: Usable air flow with sufficient air velocity

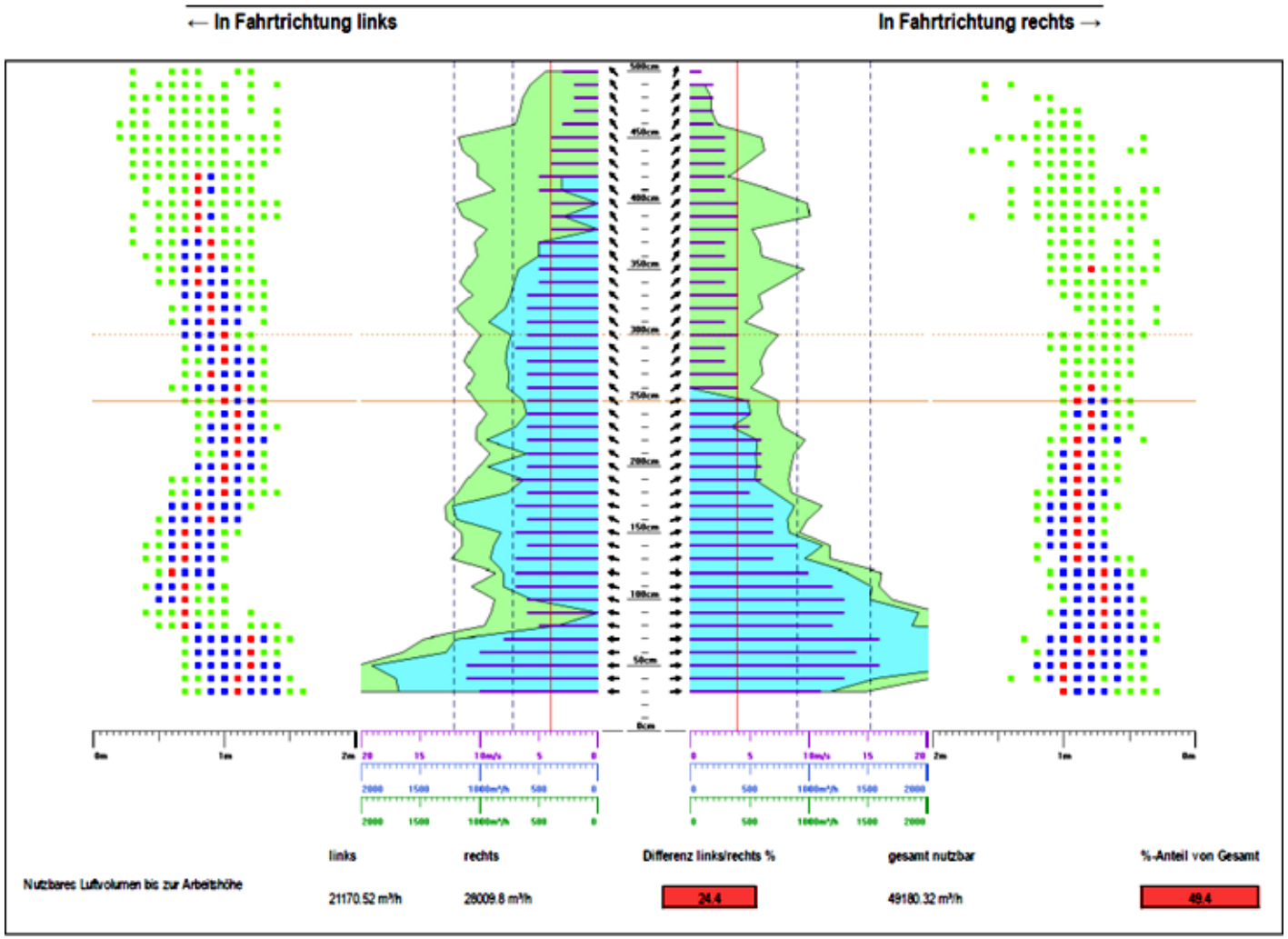
Green area: Non usable air flow with too low velcity already at the air bench

In the Beginning: The Air Distribution of Fans in Use on Fruit Farms

The goal



The reality



Unsuitable fan type (uneven working heights left and right)

Blue area: Usable air flow with sufficient air velocity

Green area: Non usable air flow with too low speed already at the air velocity

In the Beginning: The Air Distribution of Fans in Use on Fruit Farms

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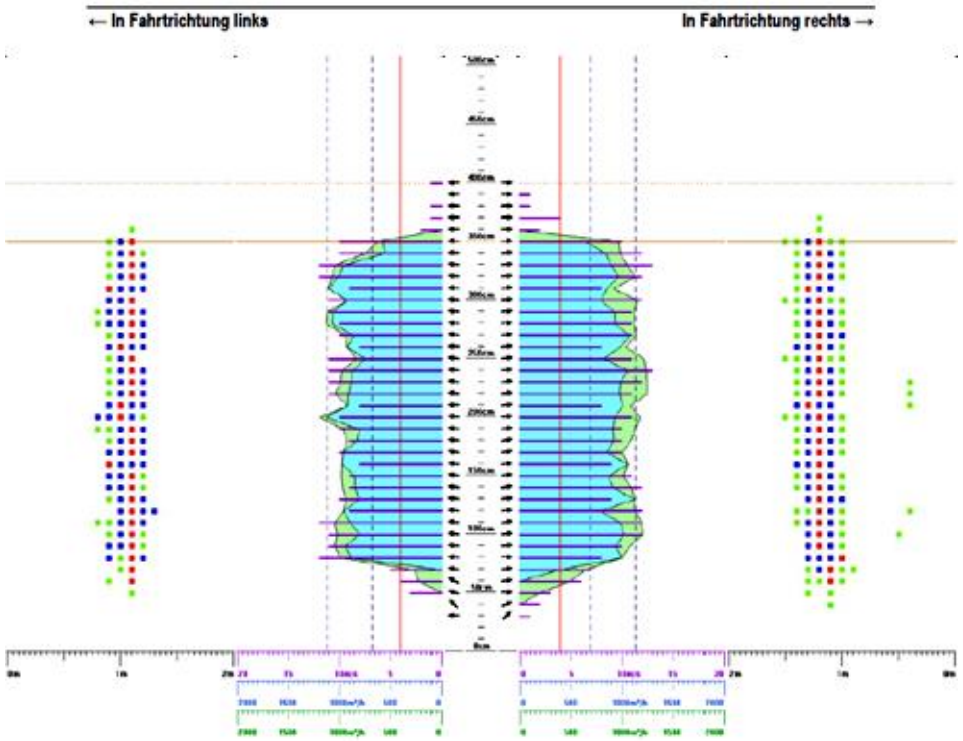

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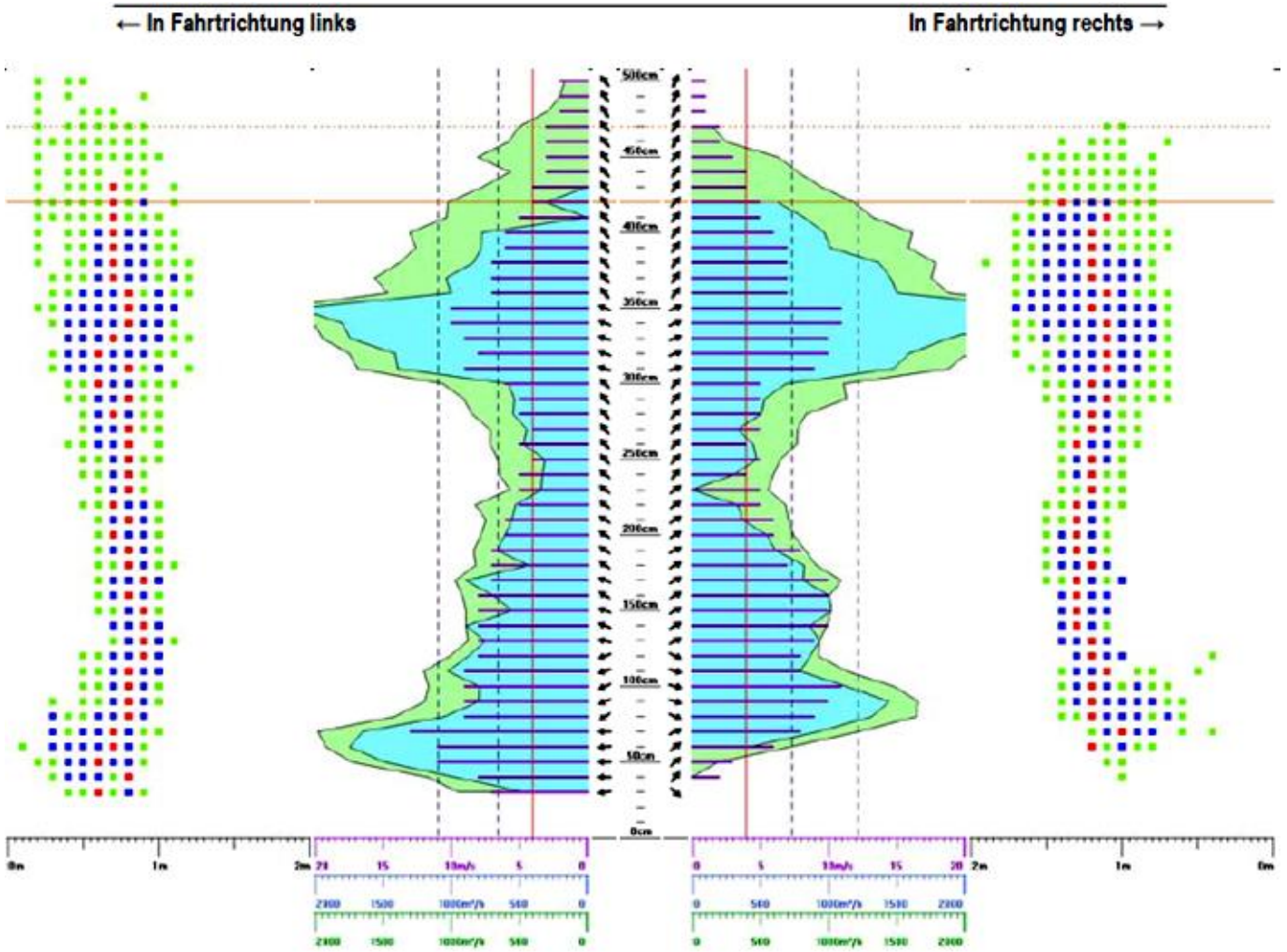


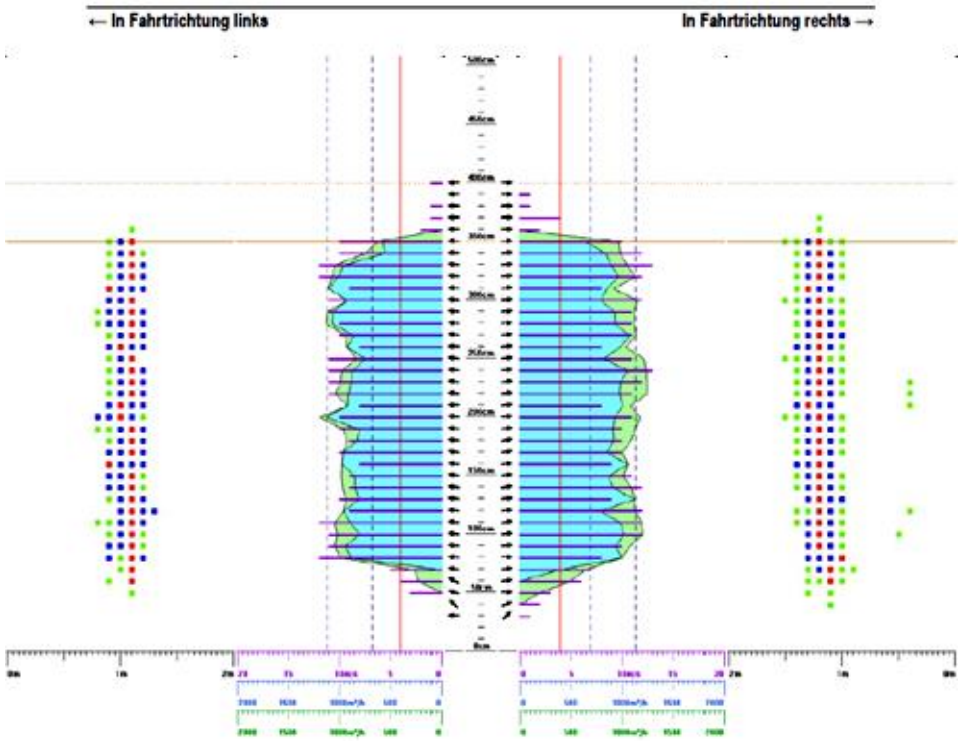
Tower sprayer with axial fan: The two air jets require a strange orientation of the nozzles above and below the jets to obtain a uniform liquid distribution

Blue area: Usable air flow with sufficient air velocity

Green area: Non usable air flow with too low speed already at the air velocity

In the Beginning: The Air Distribution of Fans in Use on Fruit Farms

The goal



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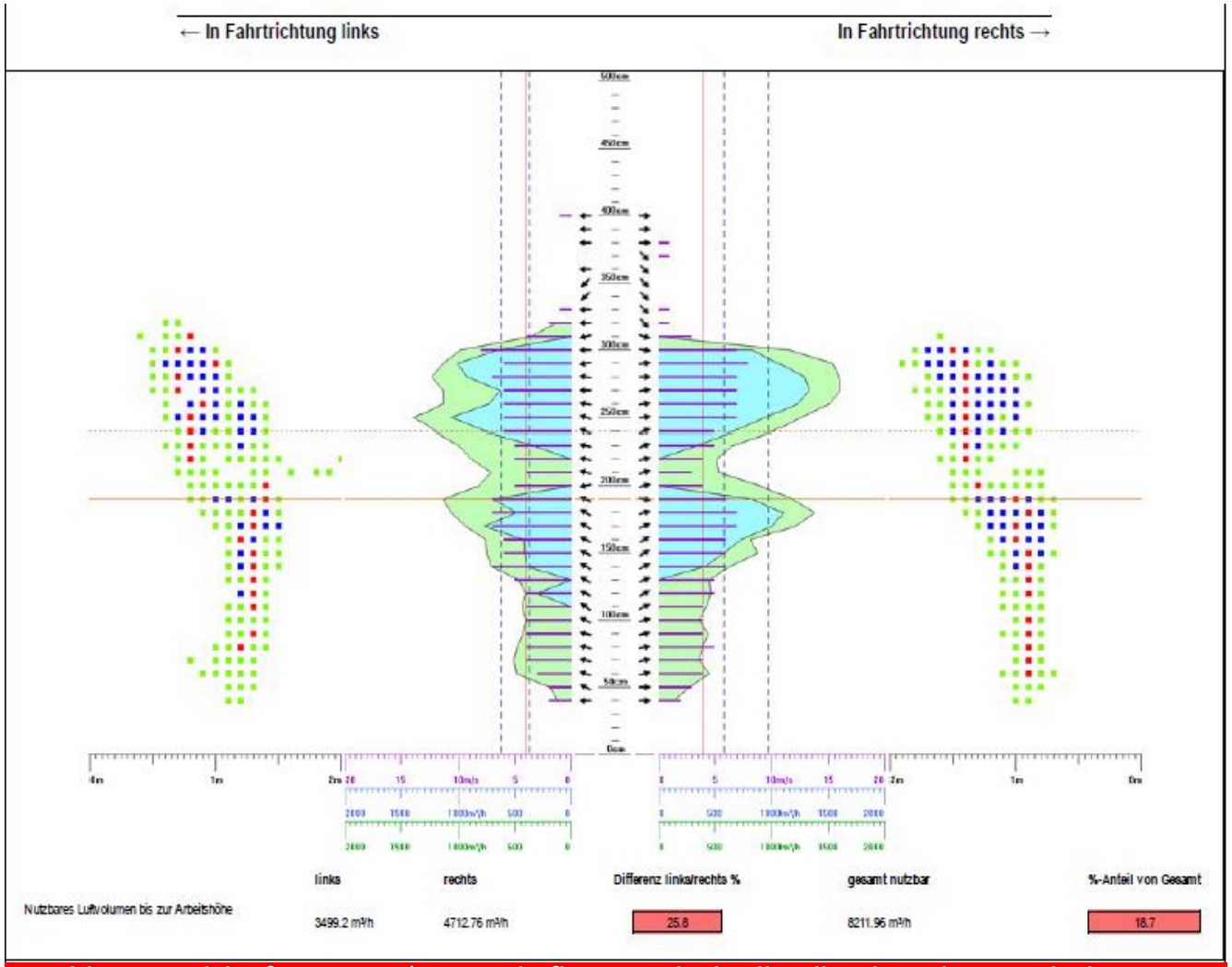


Non usable fan type (poor air flow and air distribution, has only been operated at 540 PTO II and max. 6 km/h)

Blue area: Usable air flow with sufficient air velocity

Green area: Non usable air flow with too low speed already at the air velocity

When Tree Hight and Air Distribution Do Not Match: The Cause of Home Made Problems!

This problem develops, when fan type and crop do not match!

Fan type and tree height not matching produces severe *home made* spray drift!!

Fan type and tree height not matching causes severe *home made* infestation from scab, mildew, aphids, …, beginning in the top of the tree!!

With a continuing loss of pesticides in 3D crops and increasing replacement by low efficiency products we cannot afford home made problems any longer!

The consequence:

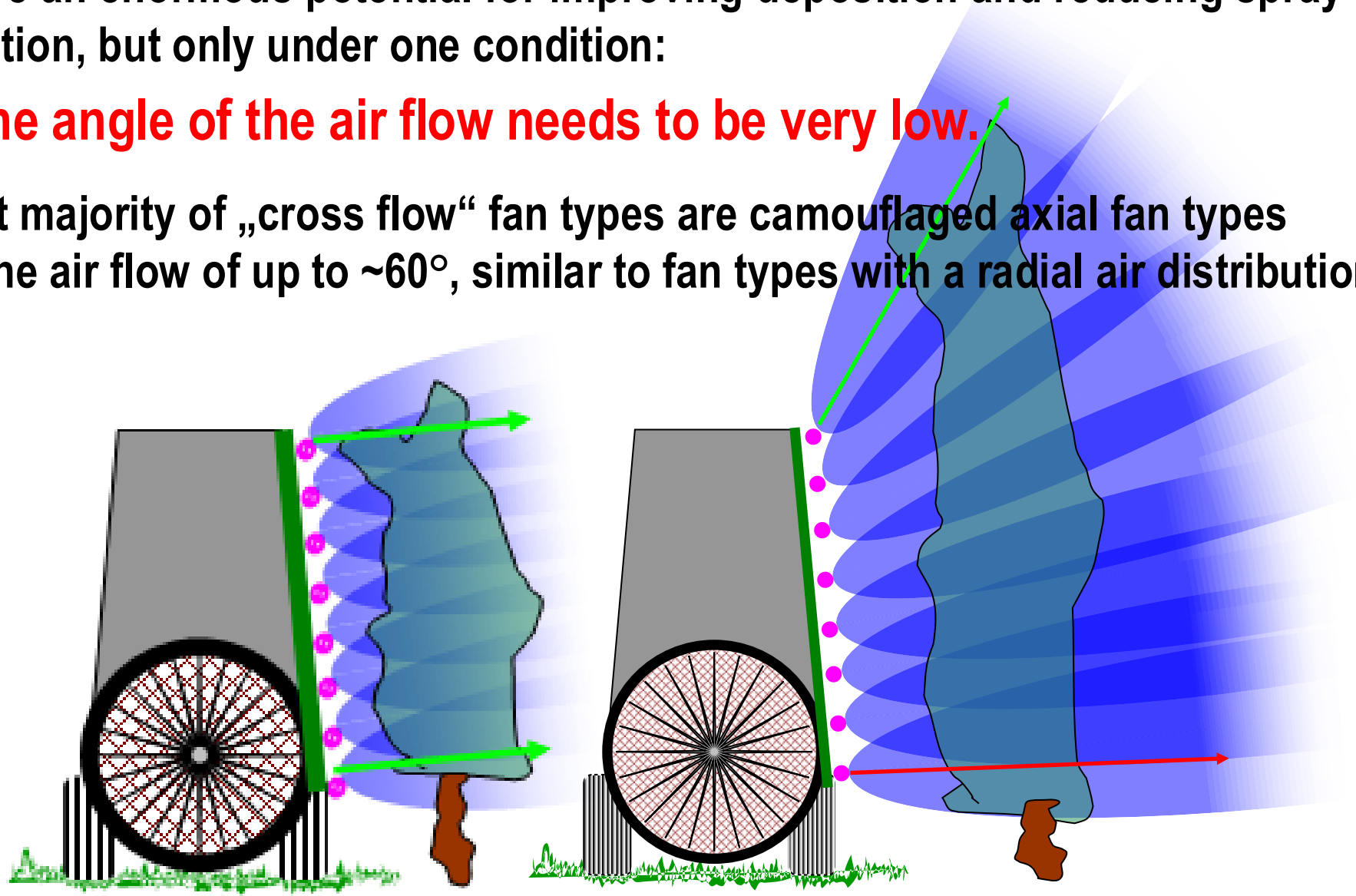
At narrow row distances: tall crops need tall fans or must become smaller!

Improving Spray Application: The Two Faces of Cross Flow Fan Types

Cross flow fan types have an enormous potential for improving deposition and reducing spray drift already by construction, but only under one condition:

The angle of the air flow needs to be very low.

Contrary to that, the vast majority of „cross flow“ fan types are camouflaged axial fan types because of an angle of the air flow of up to ~60°, similar to fan types with a radial air distribution



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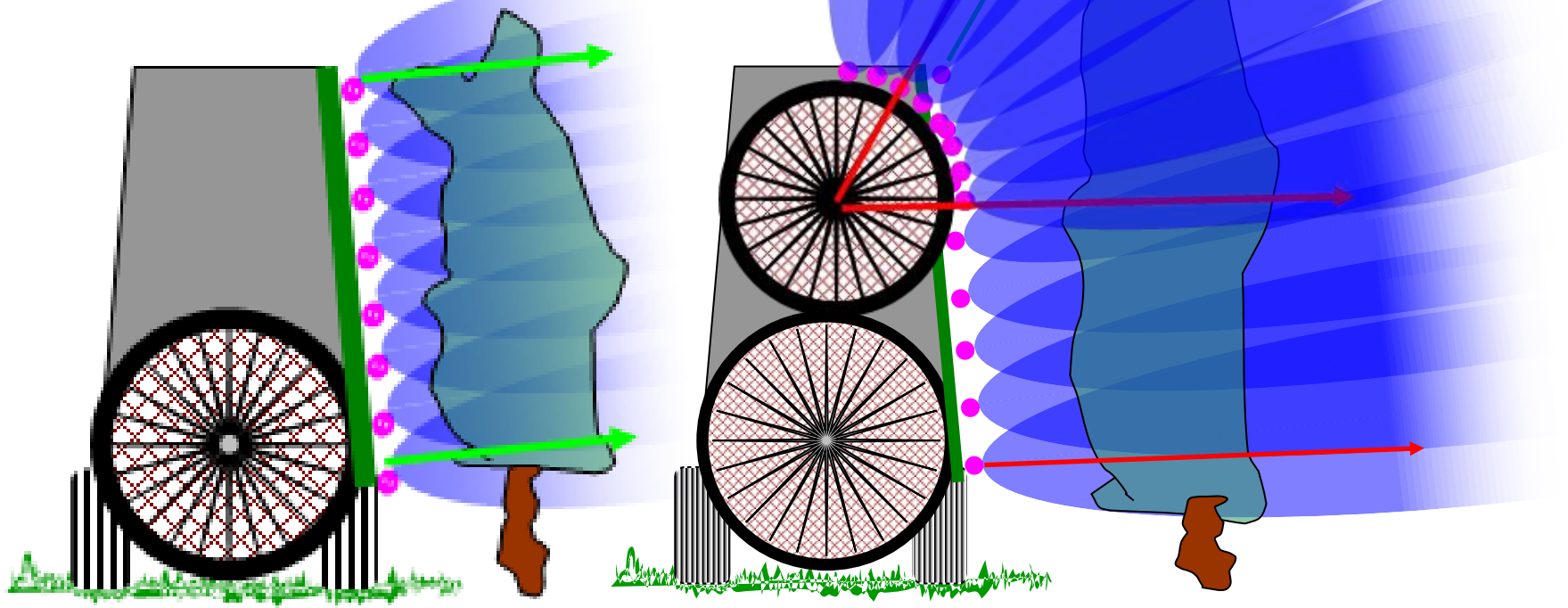
„Cross flow“ fan types with a high angle of the air flow are Trojan Horses: They carry a hidden axial fan at their top, changing working height by fan speed and forward speed



Improving Spray Application: How to Operate a Suitable Cross Flow Fan Type?

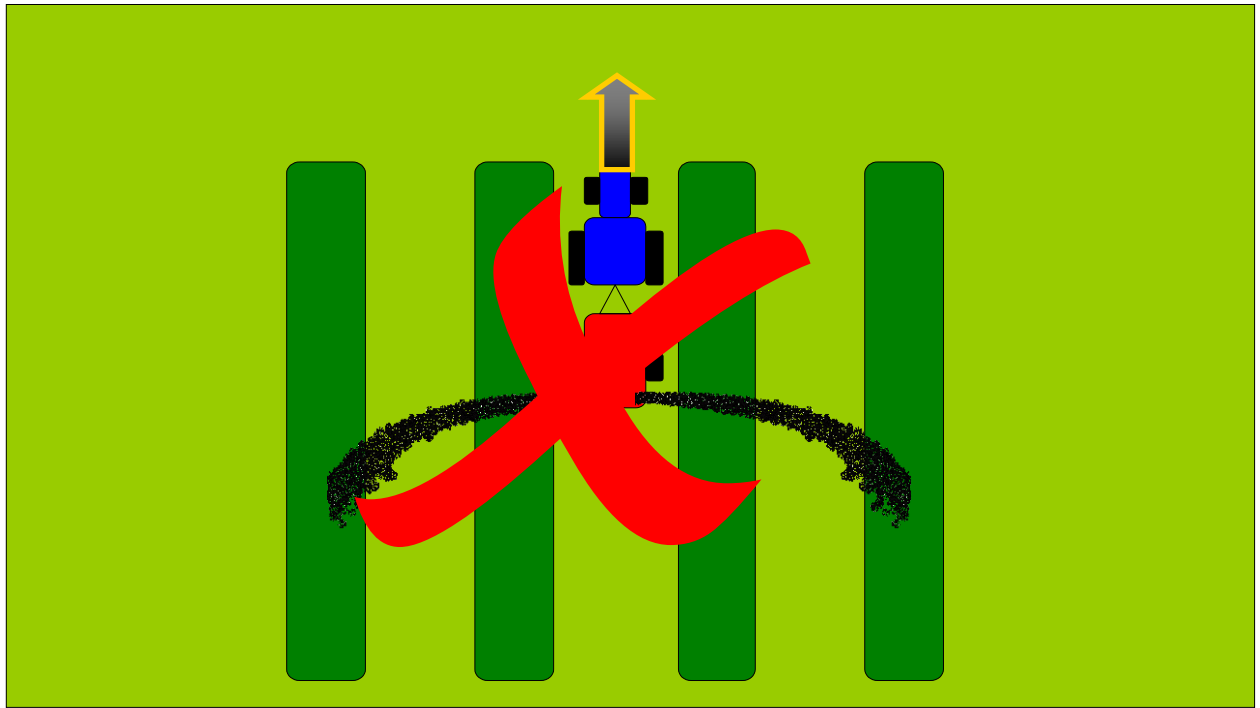
The task of the air flow is to transport the droplets from the nozzles into the target structure, but not to remove them from there!

The fan is not an air force!

All negative effects increase and all positive effects decrease with an increasing vertical angle of the air flow and increasingly excessive fan speed!

Quality of spray application is determined by

a) Fan type with a low angle of the air flow, air and liquid distribution adjusted
b) **Forward speed and fan speed**
c) Nozzle selection




Not like that!

Fan type: Wanner H63, α = 20°, 6,0 km h^{-1}, 540 min^{-1} II, ATR purple

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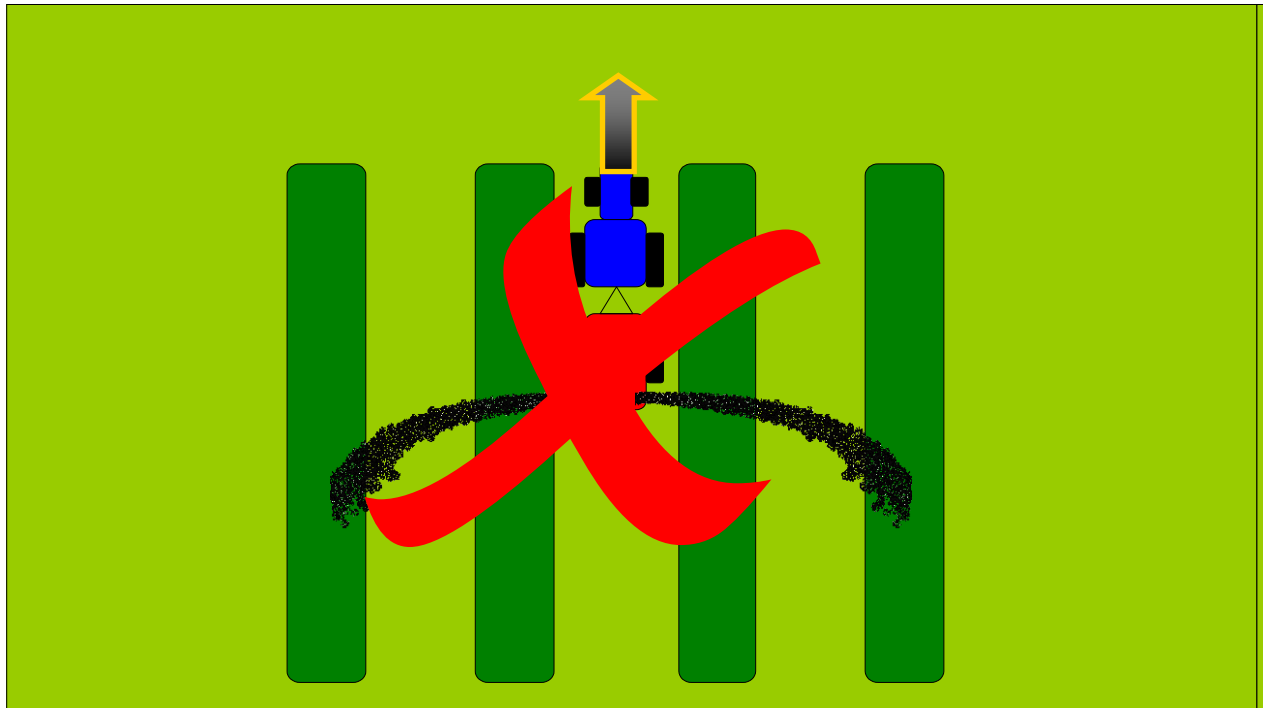
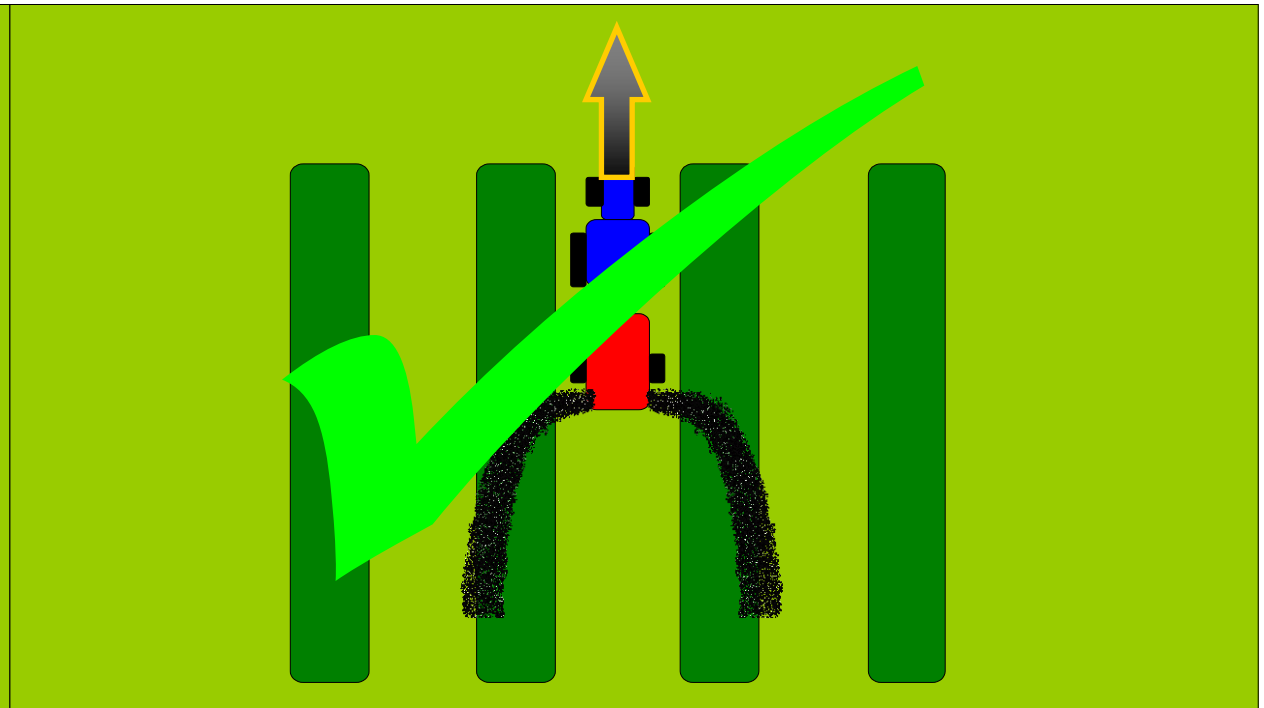




Fan type: Wanner H63, α = 20°, 12,8 km h^{-1}, 330 min^{-1} I, ATR purple

The AirCheck® General Certification: Suitability for Target Adapted Spray Application

AirCheck® Optimierung Luftverteilung für Sprühgeräte in Raumkulturen für Umweltschutz im Pflanzenschutz www.aircheck.eu

The AirCheck™-White List 2026

Fan Types for Highly Efficient and Resource Friendly Crop Protection in 3D-Crops

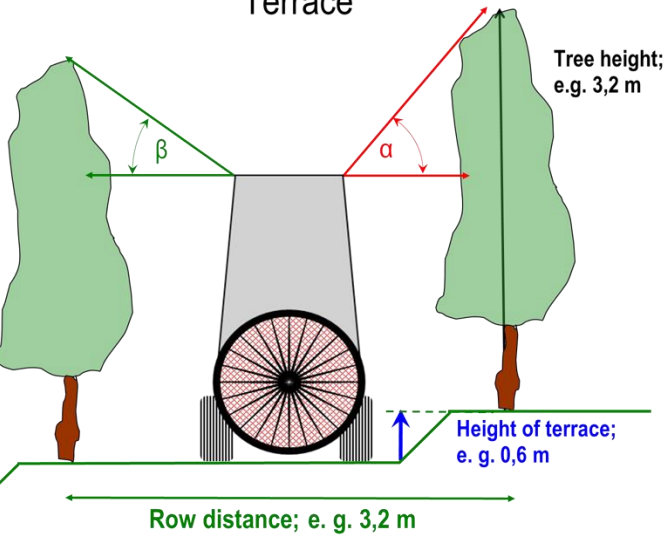
Constituted on February 24, 2026

Fan Type	Maximum working height at 3,0 m row distance m	Maximum angle of the air flow Degree	Usable air flow $m^3_{eff}\ h^{-1}$	Usable air flow per metre maximum working height $m^3_{eff}\ h^{-1}\ m^{-1}$	Power consumption at PTO kW	Diesel consumption at fuel tank $l\ h^{-1}$	CO_2-emissions $kg\ h^{-1}$	Energy efficiency Diesel consumption per m³ usable air flow per hour $ml\ m^{-3}_{eff}\ h^{-1}$	Noise emission dB (A)	Drift reduction classification (JKI)* %	AirCheck®-air distribution quality: Classification
Zupan DT-V	2,4	26	45.120	18.800	7,70	2,59	6,87	0,057	84	75	Air Distribution
Weber QU15 H	2,5	-1	31.181	12.472	5,35	1,80	4,77	0,058	79	90 / 75*	Low Loss Spray Application
Lochmann 80UQW 2	2,6	17	51.013	19.620	10,96	3,69	9,78	0,072	84	75	Air Distribution
Weber QU16 H	2,8	5	38.256	13.663	7,73	2,60	6,90	0,068	78	90	Low Loss Spray Application
Wanner ZA28	2,8	39	41.341	14.765	3,12	1,05	2,78	0,025	83	90	Low Loss Spray Application
Lochmann 80UQ2-A	3,3	-2	50.320	15.248	12,70	4,28	11,33	0,085	87	90	Air Distribution
Weber QU17 H	3,3	5	43.376	13.144	7,73	2,60	6,90	0,060	79	50	Low Loss Spray Application
Weber QU15,5-12 H	3,3	21	47.011	14.246	9,26	3,12	8,26	0,066	79	75	Low Loss Spray Application
Zupan DT CR-O	3,4	43	53.009	15.591	19,20	6,46	17,13	0,122	87	75	Air Distribution
Wanner H63	3,5	15	41.221	11.777	7,01	2,36	6,26	0,057	83	95	Low Loss Spray Application
Lochmann 90UQH2-A	3,5	41	68.904	19.687	16,70	5,62	14,90	0,082	90	95 / 75**	Low Loss Spray Application
Waibl Q / 09	3,5	45	61.482	17.566	11,00	3,70	9,81	0,060	87	75	Air Distribution
Wanner ZA32	3,5	49	59.197	16.913	8,56	2,88	7,64	0,049	84	90 / 75*	Low Loss Spray Application
Zupan DT MAXI-O	3,6	49	72.737	20.205	18,10	6,09	16,15	0,084	85	75	Air Distribution
Zupan DT-O	3,7	49	56.205	15.191	8,70	2,93	2,33	0,052	80	95 (AFC) / 75**	Low Loss Spray Application
Wanner 36GA nA	3,7	52	74.800	20.216	11,75	3,96	10,48	0,053	84	90	Low Loss Spray Application
Lochmann 80UQ 2	3,8	50	60.820	16.005	11,10	3,74	9,90	0,061	85	75	Air Distribution
Lochmann 90Q 2	3,9	55	69.774	17.891	17,30	5,82	15,44	0,083	86	90	Low Loss Spray Application
Lochmann 90UQ 2	3,9	56	81.449	20.884	17,30	5,82	15,44	0,072	86	75	Air Distribution
Wanner 36GA mhA	4,0	53	69.455	17.364	11,75	3,96	10,48	0,057	84	75	Air Distribution
Wanner 42GA	4,0	55	107.871	26.968	16,65	5,61	14,86	0,052	89	95	Low Loss Spray Application
Lochmann 90QB 2	4,0	59	75.184	18.796	19,60	6,60	17,49	0,088	87	75	Air Distribution
Lochmann 90UQH 2	4,1	53	74.521	18.176	16,40	5,52	14,63	0,074	87	75	Air Distribution

Please note that the listing of a fan type in the AirCheck®-white list only confirms the basic suitability of this fan **type** for target adapted spray application. This does not automatically apply to any individual fan from the series due to unavoidable

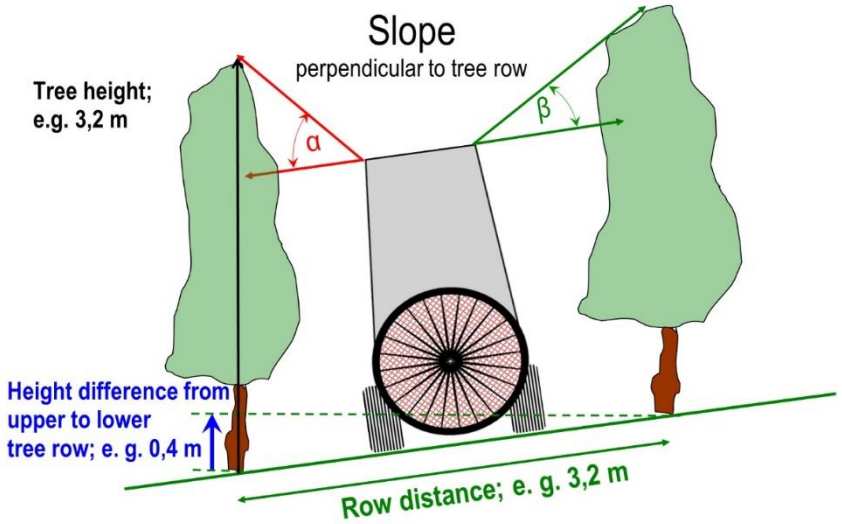
The AirCheck® Individual Certification: Parameters Affecting the Angle of the Air Flow

Terrace



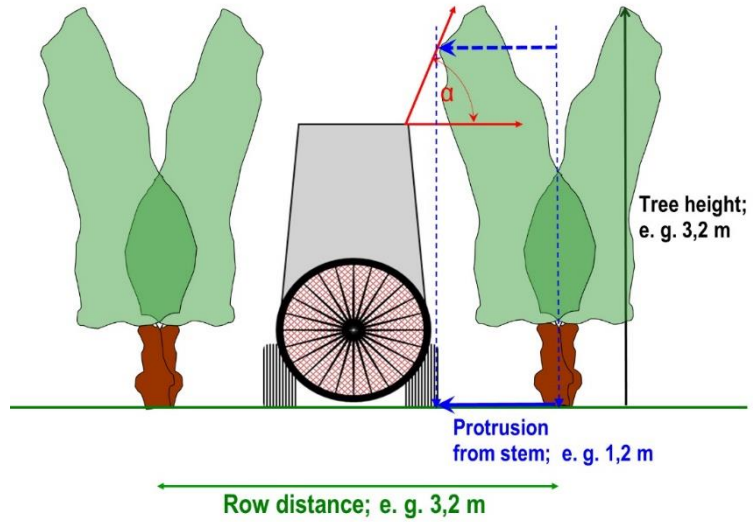
Slope

perpendicular to tree row



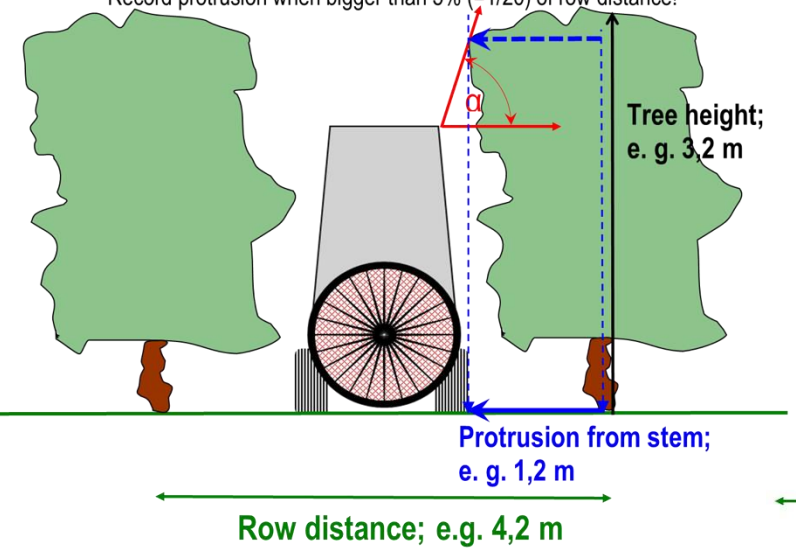
V-System

Record protrusion when bigger than 5% (=1/20) of row distance!



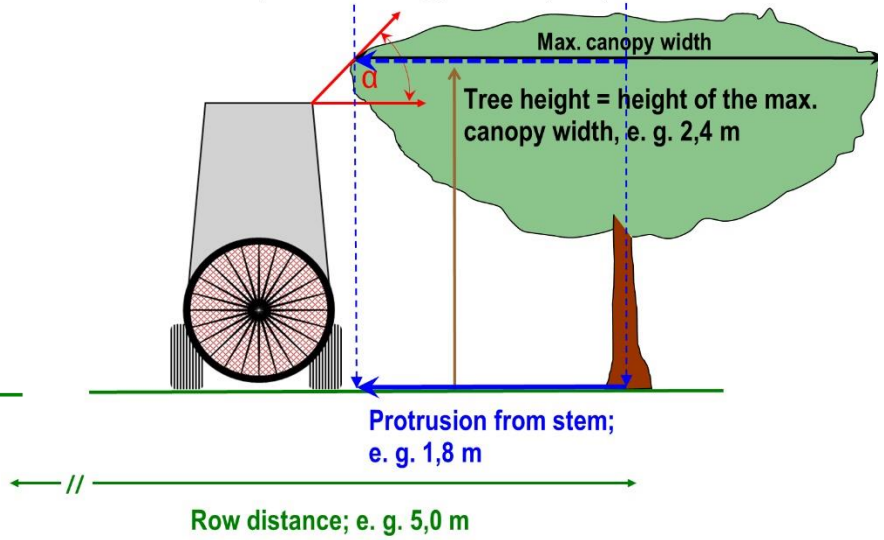
Hedge row

Record protrusion when bigger than 5% (=1/20) of row distance!



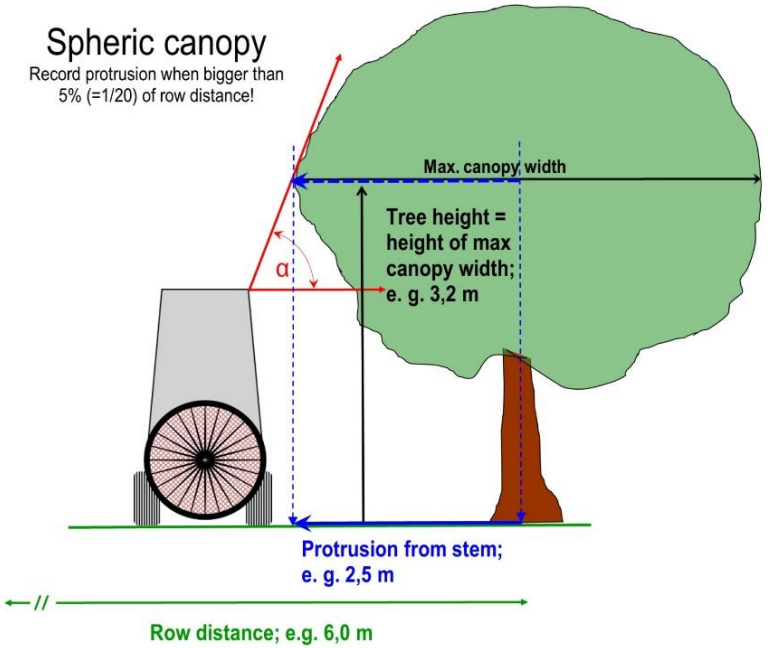
Flat canopy

Record protrusion when bigger than 5% (=1/20) of row distance!



Spheric canopy

Record protrusion when bigger than 5% (=1/20) of row distance!



The AirCheck® Individual Certification: The Data Set for Adjusting Distributions

Technical details of the order release from www.aircheck.eu for the adjustment of air and liquid vertical distribution, based on the orchards of an individual farm

Mandatory orchard and vineyard data		Special cases Terrace, slope, V-system, hedge, flat canopy, spheric canopy			For the adjustments at the air and liquid distribution test benches	
		Max. height difference between two neighbouring crop rows		Protrusion		
Row distance m	Crop height m	Terrace m	Slope (perpendicular) m	V-system, hedge, flat canopy, spheric canopy m	Angle of the air flow required for the orchard / vineyard	Working height required for the orchard / vineyard
3	3.4				37.2	3.3
3.3	3.6				39.4	3.4
4.5	4			0.4	44	3.6
3.5	3		0.4		25.6	3
3	2.2				-10.7	2.1
3.5	3			0.7	34.6	3.3
3	3				23.9	2.9
3	3.1				27.6	3

For printing please click on the following link: https://www.aircheck.eu/druck

The above listed combinations of row distance and crop height as well as any additional data concerning special cases result in the following parameters for the adjustment of vertical air distribution and vertical liquid distribution on the air and liquid test benches:

Fan type: Lochmann 90 UQH 2
Measuring distance (fruit): 1,5 m
Fan speed: 460 min^{-1} PTO, high fan gear

Be aware: The orchard with the tallest trees at the individual farm is *NOT* necessarely the one that requires the highest angle of the air flow!

The AirCheck® Individual Certification: Air & Liquid Distribution Successfully Adjusted!

Initiative "Optimierung Luftverteilung für Sprühgeräte in Raumkulturen"

Protokoll Gebläseprüfung

Aus Messwerten nach durchgeführten Änderungen

Prüfstelle
Marktgemeinschaft Bodenseeobst eG
Albert-Maier-Str. 6
88045 Friedrichshafen

Gebläse-Prüfung
Prüfdatum: 28.06.2018 14:44:13
Protokoll-ID: MABO_W 000005
Plaketten-Nr:
Prüfer: Triloff

Geräte-Eigentümer

Sprühgerät

Sprühgeräte-Typ:	Wanner N36 GA
Serien-Nummer:	10732
Baujahr:	2018
Gebläse-Typ:	A36 nA
Messabstand:	1.5 m
Prüfdrehzahl (Zapfwelle):	460 U/min
Prüfdrehzahl (Lüfter) *):	0 U/min
Luftverteilung berechnet mit:	v x (hor. Komponente)
Auswertebereich ab:	30 cm
Arbeitshöhe:	3.6 m
Strömungswinkel auf 3.6 m:	li 48°, re 47°
Luftvolumen gesamt:	79619 m³/h
Maximale Luftgeschwindigkeit:	14.3 m/s bei 0.5 m
Prüfergebnis:	**Bestanden**

Umweltdaten (Typenprüfung)

Energie-Verbrauch

Lüfterdrehzahl	Energieverbrauch		CO2-Emissionen	Spezifischer Energieverbrauch	
	Treibstoff	kWh/h		Wh/m³	Treibstoff
U/min	l/h		kg/h	eff/h	ml/m³eff/h
910	0.51	1.5	1.34	0.198	0.067
1915	3.96	11.75	10.48	0.157	0.053
2250	6.11	18.15	16.2	0.198	0.067

Lärm-Emissionen

Gebläse-Typ	Lüfterdrehzahl U/min		
	910	1915	2250
Emissionen (dbA)	73	84	93

*) Bitte beachten: Die Prüfdrehzahl entspricht nicht der Arbeitsdrehzahl in der Kultur. Arbeitsdrehzahl und Fahrgeschwindigkeit müssen an die jeweilige Kultur (Reihenabstand und Kronentiefe) angepasst werden.

Ergebnisse Gebläseprüfung

nach durchgeführten Änderungen

Lüfterdrehzahl (Prüfdrehzahl):	0 U/min
Maximal behandelbare Baumhöhe (Arbeitshöhe):	3.6 m
Strömungsrichtung auf Arbeitshöhe:	li: 48° re: 47°

Teilbreite (in Fahrtrichtung)	links	rechts	Grenzwerte	eingehalten	nicht eingehalten
Luftvolumen insgesamt:	39810 m³/h	39810 m³/h			
Nutzbares Luftvolumen bis zur Arbeitshöhe:	31769 m³/h 80%	33017 m³/h 83%	≥ 2 Messpositionen/Messhöhe bei > 4.0 m/s Luftgeschwindigkeit = Mindest-Luftvolumen		
Schwankungen des nutzbaren Luftvolumens	19.9 % VK	22.1 % VK	Höchstwert Schwankung: 35% VK (VK=Variationskoeffizient)		
Ausreißer bei dem mittleren nutzbaren Luftvolumen	14.7 %	14.7 %	Max. 30% der Messhöhen/Arbeitshöhe u. Teilbreite außerhalb Toleranzbereich von ± 25%		
Nicht-nutzbares Luftvolumen bis zur Arbeitshöhe	5957 m³/h 15%	5450 m³/h 13.7%	Aufgrund zu niedriger Luftgeschwindigkeit (< 4.0 m/s). Höchstwert: 20 %		
Nicht-nutzbares Luftvolumen von 3.6 m - 4.1 m Höhe	2083 m³/h 5.2%	1343 m³/h 3.4%	Höchstwert: 15 %	Beide Werte bestimmen im Wesentlichen das Abdriftrisiko!	
Nicht-nutzbares Luftvolumen über 4.1 m Höhe	0 m³/h 0%	0 m³/h 0%	Höchstwert: 5%		
Luftgeschwindigkeiten bis zur Arbeitshöhe	9.4 / 14.3 m/s	9.1 / 13.3 m/s	Durchschnitt und Maximum		
Schwankungen Luftgeschwindigkeit bis zur Arbeitshöhe	22.5 % VK	25.9 % VK	Höchstwert Schwankung: 35 % VK		

	gesamt	gesamt nicht nutzbar	gesamt nutzbar	Differenz (links/rechts) nutzbares Luftvolumen
Luftvolumen	79619 m³/h	14833 m³/h 18.6%	64786 m³/h 81.4%	3.8%
		Grenzwert: < 40 %	Grenzwert: > 60 %	Grenzwert: 15 %

Bild Sprühgerät

Kommentar Prüfpersonal

17 | 18 | 19 | 20 | 21 | 22

Luftverteilung individuell eingestellt und kontrolliert

Prüfnummer: XXXX

AirCheck® Optimierung Luftverteilung für Sprühgeräte in Raumkulturen für Umweltschutz im Pflanzenschutz www.aircheck.eu

Obstbau
Weinbau
HEAT-Technologie
Verlustarm Sprühen
Luftverteilung

Initiative "Optimierung Luftverteilung für Sprühgeräte in Raumkulturen"

Protokoll Gebläseprüfung

Aus Messwerten nach durchgeführten Änderungen

Prüfstelle
Marktgemeinschaft Bodenseeobst eG
Albert-Maier-Str. 6
88045 Friedrichshafen

Gebläse-Prüfung
Prüfdatum: 28.06.2018 14:44:13
Protokoll-ID: MABO_W 000005
Plaketten-Nr:
Prüfer: Triloff

Geräte-Eigentümer

Sprühgerät

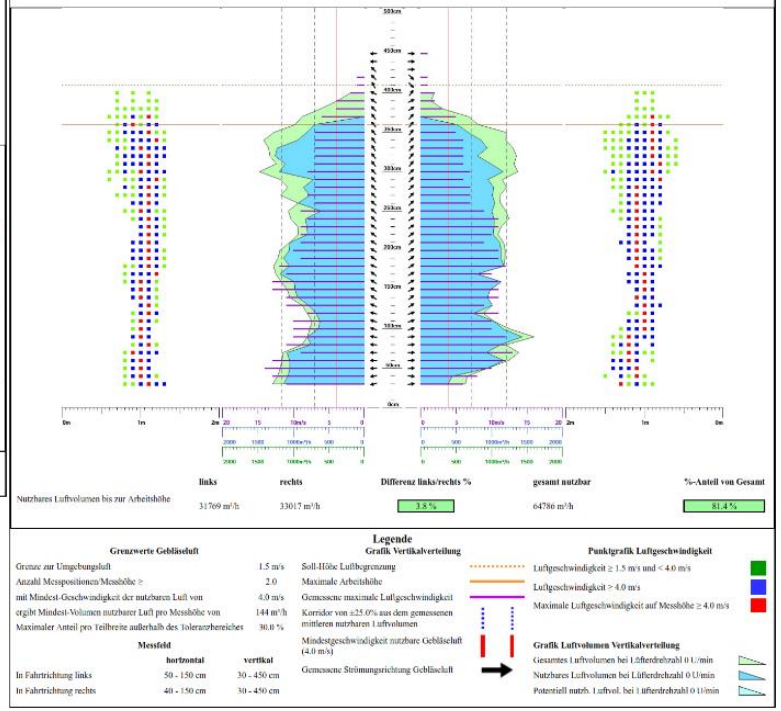
Sprühgeräte-Typ:	Wanner N36 GA
Serien-Nummer:	10732
Baujahr:	2018
Gebläse-Typ:	A36 nA
Berechnet mit:	v x (hor. Komponente)
Arbeitshöhe:	3.6 m (Grenzwert: 4.0 m/s)
Strömungswinkel auf 3.6 m:	48° links, 47° rechts
Prüfergebnis:	Bestanden

Gebläse-Einstellung

Zapfwellendrehzahl:	460 U/min
Gebläsestufe:	II
Prüfdrehzahl (Lüfter) *):	0 U/min
Messabstand:	1.5 m

*) Bitte beachten: Die Prüfdrehzahl entspricht nicht der Arbeitsdrehzahl in der Kultur. Arbeitsdrehzahl und Fahrgeschwindigkeit müssen an die jeweilige Kultur (Reihenabstand und Kronentiefe) angepasst werden.

← In Fahrtrichtung links — In Fahrtrichtung rechts →



	links	rechts	Differenz links/rechts %	gesamt nutzbar	%-Anteil von Gesamt
Nutzbares Luftvolumen bis zur Arbeitshöhe	31769 m³/h	33017 m³/h	3.8 %	64786 m³/h	81.4 %

Legende

Grenzwerte Gebläseluft

Grenze zur Umgebungsluft	1.5 m/s
Anzahl Messpositionen/Messhöhe ≥	2.0
mit Mindest-Geschwindigkeit der nutzbaren Luft von	4.0 m/s
ergibt Mindest-Volumen nutzbarer Luft pro Messhöhe von	144 m³/h
Maximaler Anteil pro Teilbreite außerhalb des Toleranzbereiches	30.0 %

Messfeld

	horizontal	vertikal
In Fahrtrichtung links	50 - 150 cm	30 - 450 cm
In Fahrtrichtung rechts	40 - 150 cm	30 - 450 cm

Grafik Vertikalverteilung

Soll-Höhe Luftbegrenzung
Maximale Arbeitshöhe
Gemessene maximale Luftgeschwindigkeit
Korridor von ±25.0% aus dem gemessenen mittleren nutzbaren Luftvolumen
Mindestgeschwindigkeit nutzbare Gebläseluft (4.0 m/s)
Gemessene Strömungsrichtung Gebläseluft

Punktgrafik Luftgeschwindigkeit

Luftgeschwindigkeit ≥ 1.5 m/s und < 4.0 m/s
Luftgeschwindigkeit > 4.0 m/s
Maximale Luftgeschwindigkeit auf Messhöhe ≥ 4.0 m/s

Grafik Luftvolumen Vertikalverteilung

Gesamtes Luftvolumen bei Lüfterdrehzahl 0 U/min
Nutzbares Luftvolumen bei Lüfterdrehzahl 0 U/min
Potentiell nutzb. Luftvol. bei Lüfterdrehzahl 0 U/min

Kontrollstelle	8244.15-20
Maschinenring Dienstleistungs GmbH Hopfengut 26 Siggenweiler 88069 Tettnang	
Name des Prüfers:	
Anschrift des Besitzers	

Prüfbericht Nr. **MASCH/01-2019-115**

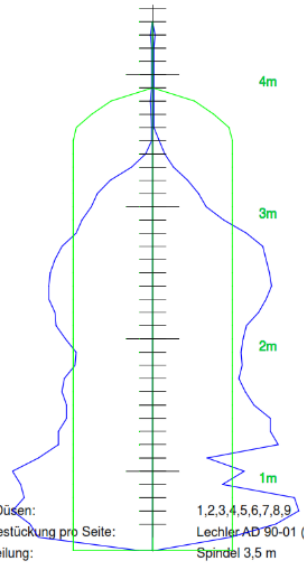
über die Prüfung eines Pflanzenschutzgerätes gem. § 16 Abs. 4 PflSchG nach Richtlinie 3-1.0 des JKI Kontrolliert nach der Richtlinie 2009/128/EG

- ☐ 1 Spritz- und Sprühgerät für Flächenkulturen
- ☐ 13 Streifenspritzgerät
- ☒ 2 Spritz- und Sprühgerät für Raumkulturen
- ☐ 14 Stationäres Flächenspritzgerät
- ☐ 7 Nebelgerät
- ☐ 11 Karrenspritzgerät
- ☐ 12 Schlauchspritzanlage

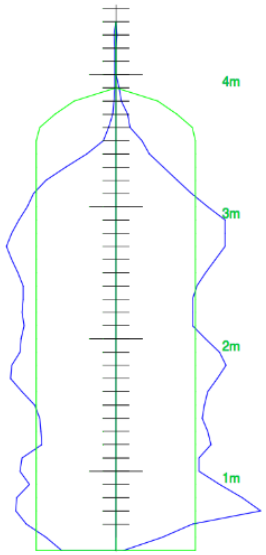
Fabrikat bzw. Hersteller und Typ: Wanner, S1500
Baujahr: 2018 Maschinen-Nr.: SZA32 10863
Behälter: Nennvolumen: 1500 l
Rührwerk: mechanisch: ☐ hydraulisch: ☒ Zusätzliche Rührpumpe: ☐
Pumpe: Typ: Comet IDS 1401 114 l/min bei 10 bar
Arbeitsbreite / Teilbreiten: 0 m / 1 Gebläse: Typ: Axial mit hohen Aufbau

Ergebnisse am Vertikalverteilungsprüfstand

Vor der Einstellung



Nach der Einstellung



Offene Düsen:	1,2,3,4,5,6,7,8,9
Düsenbestückung pro Seite:	Lechler AD 90-01 (9);
Sollverteilung:	Spindel 3,5 m
Abstand Traktor <-> Prüfstand:	3 m
Zapfwellendrehzahl:	0 U/min
Gebläsestufe:	
Flügeldrehzahl:	440 U/min
Abweichung links/rechts gesamt:	12,5 %
Max. Abweichung links/rechts pro Glas:	40,8 %
Bemerkung Vertikalprüfstand:	

Anforderungen erfüllt: ☒ Ja ☐ Nein Plakette erteilt: ☒ Ja 1 Nächste Prüfung: 1/2022

Baden Württemberg Tübingen	88699 Frickingen	10.04.2019
Land / zuständige Dienststelle	PLZ Kontrollort	Datum Unterschrift des Prüfers

AOS Target Adapted Spray Application: What About Spray Drift?

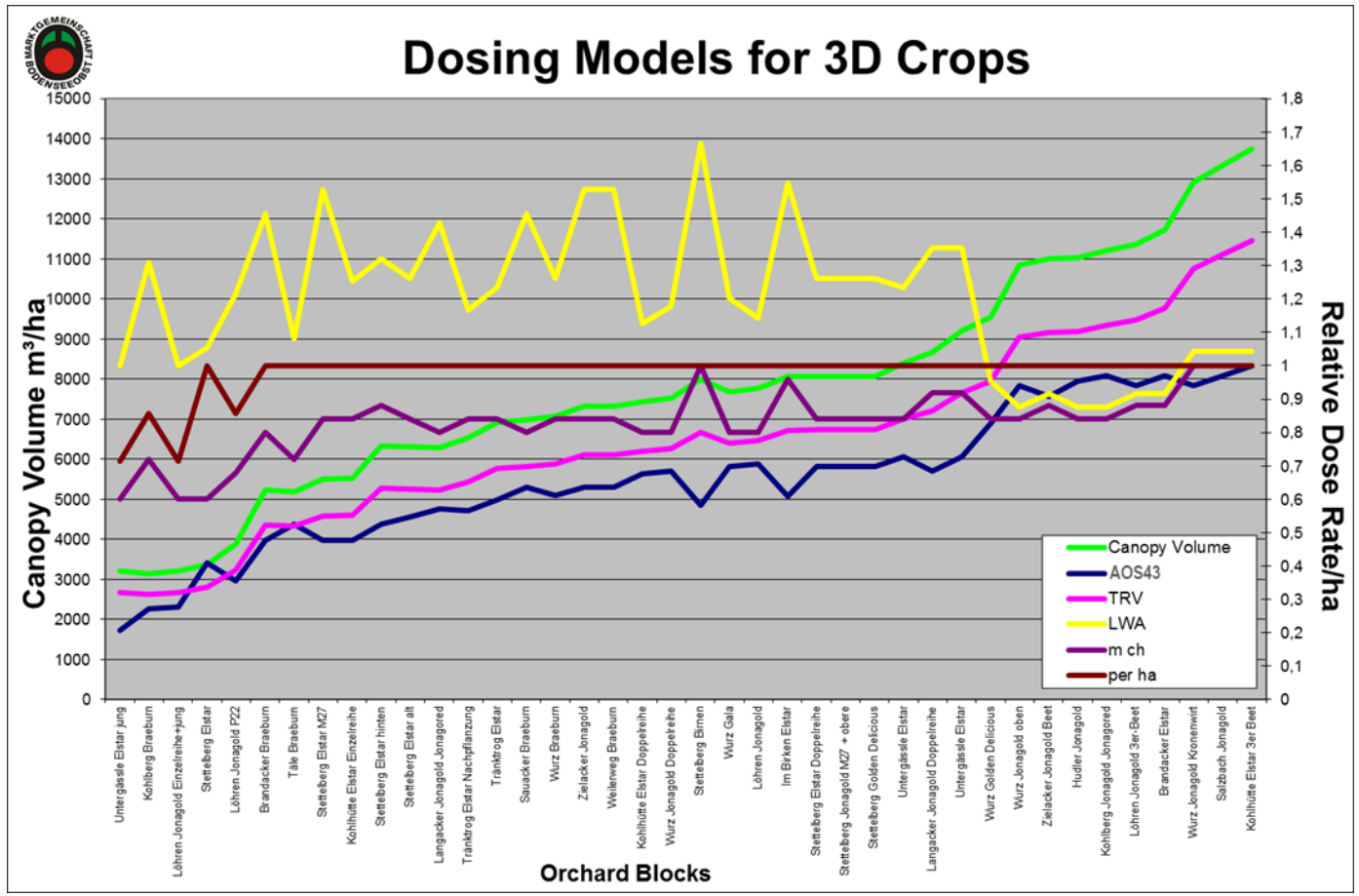
Spray Drift Reduction with Small Droplets

- **Fans with cross flow characteristics at any forward speed**
  + canopy adapted fan speed
  + mixed nozzle set (ATR purple + 2 x 2 AVI 80-01 / IDK 90-01)
  - **reduce spray drift by >80%*** (officially registered in the 75% drift reduction class, 90% in progress)
  + hail net
  - **reduce spray drift by >90%***

- **Fans with cross flow characteristics at any forward speed**
  + air flow control
  + active deflection air stream
  + canopy adapted fan speed
  + full set of hollow cone nozzles (ATR purple)
  - **reduce spray drift by ~95%***

*= Compared to german spray drift reference values

Pesticide Dosing: The Active Volcano Since Decades! What is the Correct Dose Rate?



Parameters affecting the absolute efficacy of crop protection:

- **Inoculum:** attack in the previous season, sanitation
- **Host plant:** geometry, susceptibility, growth status, growth speed
- **Climatic conditions:** temperature, rain fall, leaf wetness
- **Pesticide deposition efficiency (quantity):** = fan type, air distribution, forward speed, fan speed, crop parameters
- **Pesticide deposition efficiency (quality):** droplet size, droplet spectrum, crop parameters
- **Operator:** Machinery, maintenance, product, dosing, weather, etc.

The conclusion: dose rates required for a good result depend on many parameters, changing from orchard to orchard and year to year; and on quality of spray application: often even the highest dose rate yields poor results!

Increased spray deposition efficiency and reduced pesticide use through canopy adapted spray application demand for a new dosing model. The „Leaf Wall Area“ model behaves inversely to any other mode: Hands off from this model!!

AOS-Canopy Adapted Spray Application: How to Dose and Spray?

The „AOS43“-dosing model behaves contrary to all classic models: Spray liquid pressure is the preset value, while water volume, pesticide dose rate, forward speed and fan speed are determined by the target.

An example:

Canopy width m	Target value forward speed km h^{-1}	Guiding value fan speed* PTO min^{-1}	Relative dose rate %	Crossflow fan „Wanner ZA32“ Net time consumption min ha^{-1} at a row distance of 2,75 m	3,0 m	3,25 m	3,5 m	4,0 m	4,5 m	5,0 m
1,0	12,0	290	54 | 50	**18**	**16**					
1,25	9,7	310	63	23	**21**	19				
1,5	8,1	330	69	27	25	**23**	21			
1,75	6,9	350	81	32	29	**27**	25			
2,0	6,1	369	86		33	30	**28**	25		
2,25	5,4	388	96			33	**31**	28		
2,5	4,8	406	94				33	**31**	28	
2,75	4,4	424	92					33	**30**	
3,0	4,0	442	90						33	**30**
3,25	3,7	460	98							**32**
3,5	3,5	477	100							**33**

* = low gear

In slim canopy structures on flat land „AOS43“-results in an enormous reduction of time consumption for spraying by increasing work rate up to ~4 ha hr^{-1}

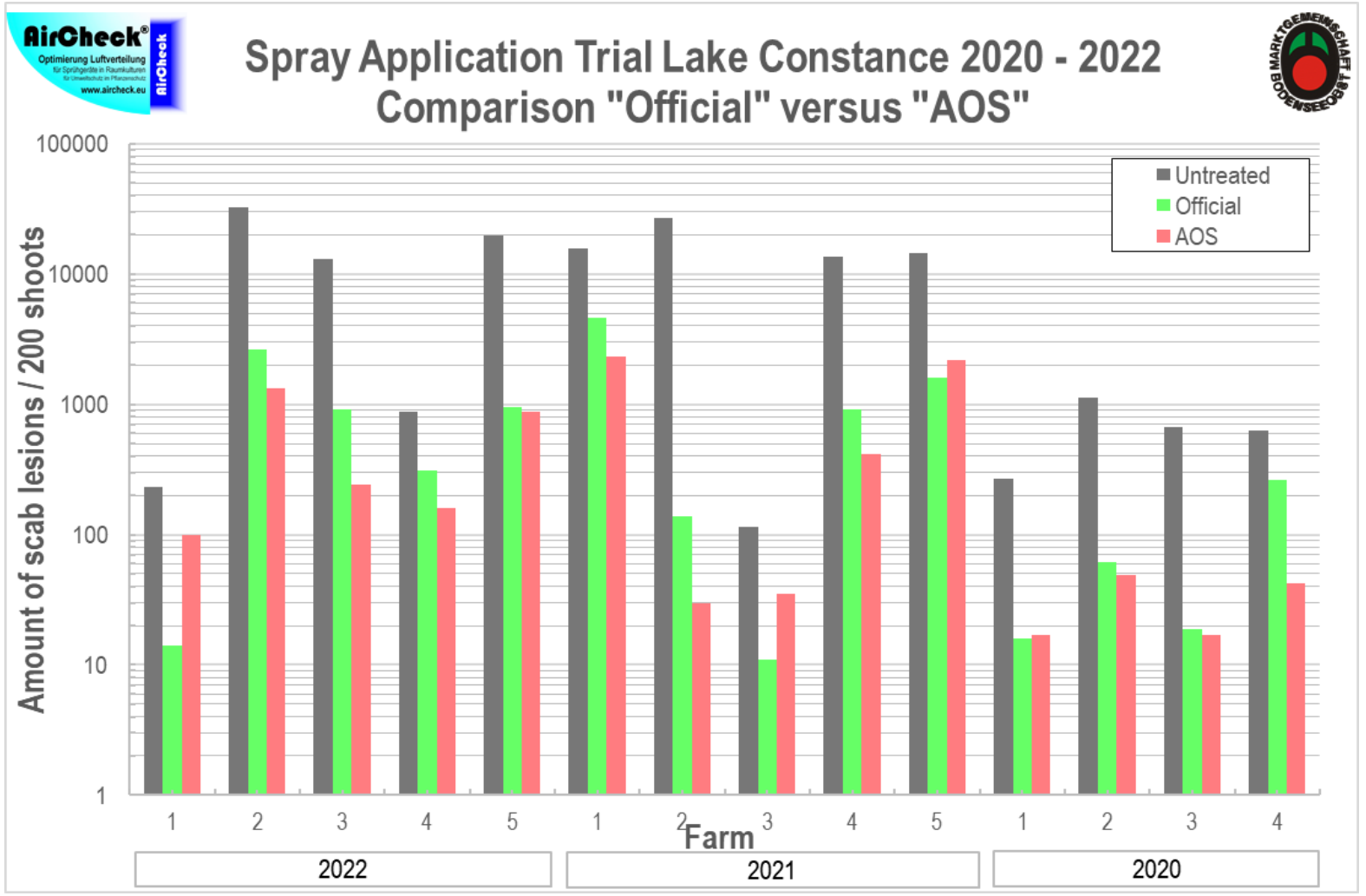
Optimizing Spray Application in 3D-Crops: Make Use of the Potentials!

Activities for an optimization of pesticide use and reduction of spray drift

1. Look for cross flow fan types with an angle of the air flow of max. ~30°
2. Find the fan types from the white list that can treat your orchards at the lowest angle of the air flow
3. Consider energy efficiency and noise emission before making your choice for a new fan type
4. Adjust air and liquid distribution to the farm specific orchard requiring the highest angle of the air flow
5. Buy the sprayer only after both adjustments have been passed successfully (positive protocols)
6. Use hollow cone nozzles (ATR purple) for quantitatively and qualitively efficient deposition
7. Add 2 x 2 „01“- ISO anti drift nozzles at the two top most nozzle positions for drift reduction
8. Use a dosing model for canopy adapted dosing and spray application in 3D crops
9. Train the operators theoretically and practically (advisory services)
10. Innovative sprayer manufacturers may become members of the AirCheck®-Initiative (advisory services)

Comparing Official Dosing & Spraying with AOS Target-Adapted Spray Application

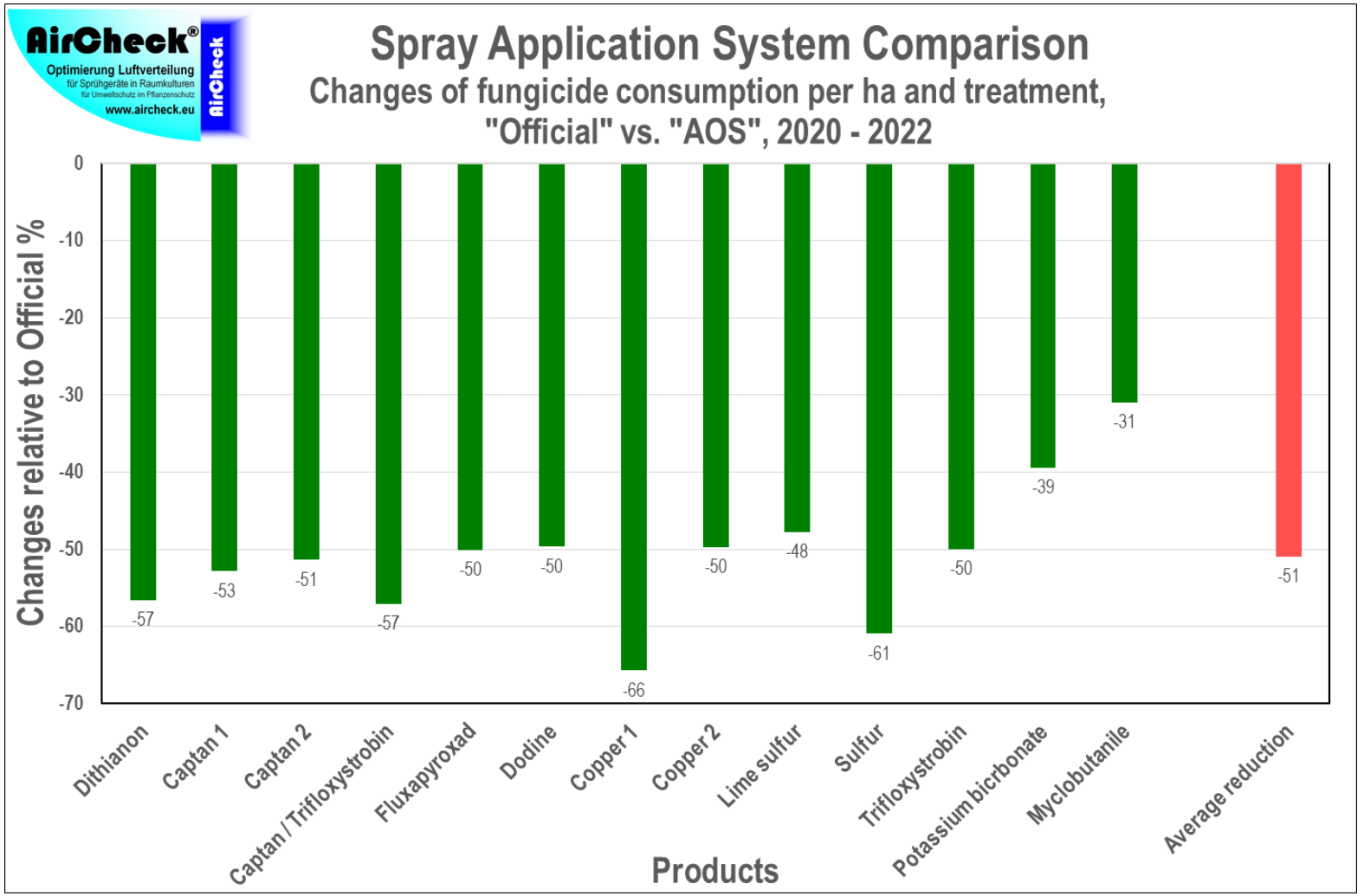
The results: Number of leasons on 200 shoots



The effect of the year on the general attack is clearly visible: low in 2020, high in 2021 and 2022.
Comparison: In 75% of trials AOS is equal or better; in 12,5% less than 10% worse and in 12,5% more than 10% worse than „Official“

Comparing Official Dosing & Spraying with AOS Target-Adapted Spray Application

The results: Changes in consumption of fungicides



In orchards with slim canopy systems (slender spindle, super spindle) „AOS“ on average consumed 51% less product per ha and treatment compared to „Official“

AOS Canopy Adapted Spray Application: The Benefits

1. **Allows an adaptation of pesticide dose rates to the target through improved deposition**
   by improved and adjusted air distribution, a mixed nozzle set, AOS43
2. **Increases work rate significantly**
   by low water volumes (more ha per vat filling), AOS43®, improved sprayer cleaning
3. **Reduces risk for contamination of the operator**
   by low water volumes (less vat fillings per spray trip), optimized vat volume
4. **Reduces relative spray drift > 80%**
   by mixed nozzle set, improved and adjusted air distribution, AOS43
5. **Reduces absolute spray drift > 90%**
   by mixed nozzle set, improved and adjusted air distribution, AOS43
6. **Reduces fuel consumption ≤ ~80%**
   by low water volume, energy efficient fans, improved and adjusted air distribution, AOS43
7. **Reduces noise emission ≤ ~80%**
   by silent fan types, improved and adjusted air distribution, AOS43
8. **Reduces conflicts with bystanders and neighbours**
   by silent fan types, improved and adjusted air distribution, AOS43, reduced dose rates
9. **Reduces labour and costs**
   by low water volumes, improved and adjusted air distribution, AOS43, reduced dose rates

AOS Canopy Adapted Spray Application: The Benefits

1. **Allows an adaptation of pesticide dose rates to the target through improved deposition** (≤ ~50%, potential ≤ ~67%)
   by improved and adjusted air distribution, a mixed nozzle set, AOS43
2. **Increases work rate significantly** (potential ≤ ~38%)
   by low water volumes (more ha per vat filling), AOS43®, improved sprayer cleaning
3. **Reduces risk for contamination of the operator** (potential ≤ ~33%)
   by low water volumes (less vat fillings per spray trip), optimized vat volume
4. **Reduces relative spray drift > 80%** (75% registered, 90% in progress, potential > 95%)
   by mixed nozzle set, improved and adjusted air distribution, AOS43
5. **Reduces absolute spray drift > 90%** (potential ≤ ~97%)
   by mixed nozzle set, improved and adjusted air distribution, AOS43
6. **Reduces fuel consumption ≤ ~80%** (potential ≤ ~97%)
   by low water volume, energy efficient fans, improved and adjusted air distribution, AOS43
7. **Reduces noise emission ≤ ~80%** (potential ≤ ~99,8%)
   by silent fan types, improved and adjusted air distribution, AOS43
8. **Reduces conflicts with bystanders and neighbours** (invaluable asset)
   by silent fan types, improved and adjusted air distribution, AOS43, reduced dose rates
9. **Reduces labour and costs** (potential ≤ ~40%)
   by low water volumes, improved and adjusted air distribution, AOS43, reduced dose rates

Target Adapted Dosing and Spray Application in 3D Crops in Relation with the Official German System

Thank You very much for Your attention!

Target Adapted Dosing and Spray Application in Orchards in Relation to the Official German System

Dr. Peter Triloff
Marktgemeinschaft Bodenseeobst eG
Friedrichshafen

Hortgro Technical Symposium 2026, Somerset West, South Africa, May 25 - 29, 2026