Importance of a correct and specific sprayer's adjustment

Whatever dose expression method, sprayer's calibration is a key point for success

Prof. Emilio Gil

Universitat Politècnica de Catalunya

Dose expression workshop – UPC (Castelldefels, November 6-7 2018)

- Canopy and sprayers: variability
- How to apply: information in PPP label
- Sprayer's adjustments: Who, what, when…
- General comments

- **Canopy and sprayers: variability**
- How to apply: information in PPP label
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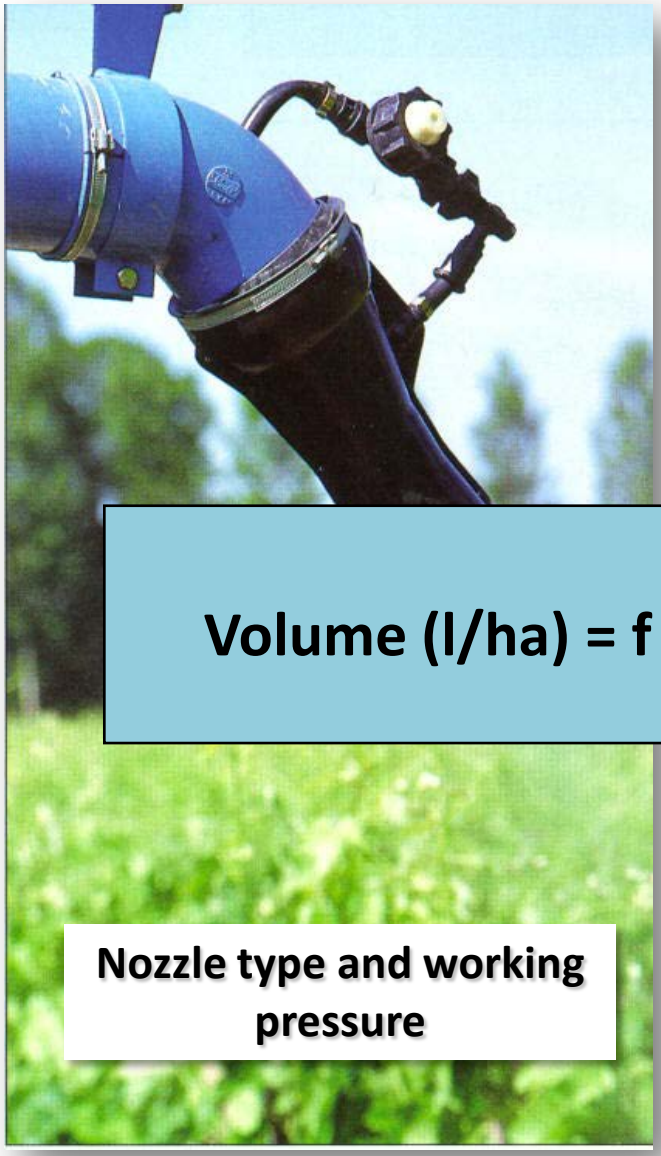
Variation factor in LAI **from 1 to 15** (Codis et al, 2012)



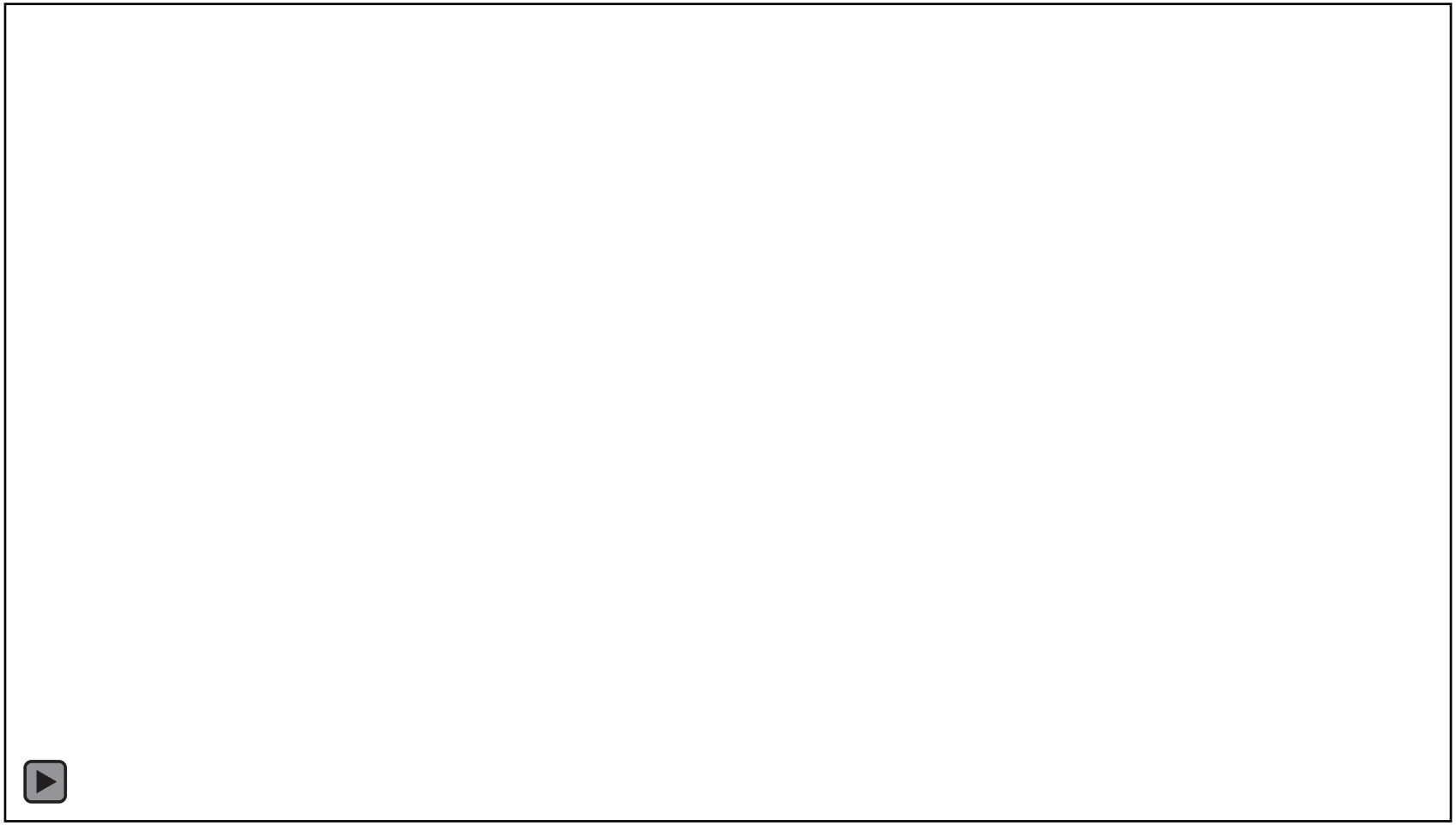
Nozzle type and working pressure

Air flow, air direction,…

$$\text{Volume (l/ha)} = f\left[\text{(Q (l/min), V (km/h), A (m)}\right]$$

Working width

Doesn't matter the dose expression method applied !!!!!



- Canopy and sprayers: variability
- **How to apply: information in PPP label**
- Sprayer's adjustments: Who, what, when…
- General comments

From regulatory aspects …. To the field

Crop and/ or situation (a)	Zone	Product code	F G or I (b)	Pests or Group of pests controlled (c)	Formulation	
					Type (d-f)	Conc. of as (i)

High investment / time consuming /good experience

Poor experience / unclear information / need to be improved

(a) For crops, the EU and Codex classifications (both) should be used; where relevant, the use situation should be described (*e.g.* fumigation of a structure)
(b) Outdoor or field use (F), glasshouse application (G) or indoor application (I)
(c) e.g. biting and suckling insects, soil born insects, foliar fungi, weeds
(d) e.g. wettable powder (WP), emulsifiable concentrate (EC), granule (GR)
(e) GCPF Codes - GIFAP Technical Monograph No 2, 1989
(f) All abbreviations used must be explained
(g) Method, e.g. high volume spraying, low volume spraying, spreading, dusting, drench
(h) Kind, e.g. overall, broadcast, aerial spraying, row, individual plant, between the plants - type of equipment used must be indicated
(i) g/kg or g/l
(j) Growth stage at last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application
(k) The minimum and maximum number of application possible under practical conditions of use must be provided
(l) PHI - minimum pre-harvest interval
(m) Remarks may include: Extent of use/economic importance/restrictions
* Do not apply the product during flowering, because it is dangerous to bees. In orchards with problems of Iceria purchasii, applied in mixture with oil summer, only from July. Do not apply in lemon trees, because they bloom continuously and the product is dangerous to bees

Application				Application rate per treatment			PHI (days)	Remarks:
method kind (f-h)	growth stage & season (j)	number min max (k)	interval between applications (min)	kg as/hL min max	water L/ha min max	kg as/ha min max	(l)	(m)
Foliar spraying	BBCH15-73	1	n.a.	0.01	1000	0.1	14	For lower spray volumes, ensure a dose of 0.07 kg a.s./ha
Foliar spraying	BBCH15-85	1	NA	0.01 – 0.015	1000	0.1 0.15	30	-
Foliar spraying	BBCH15-85	1	NA	0.015	1000	0.15	14	-
Foliar spraying	BBCH15-85	1	NA	0.015	1000	0.15	21	-

method kind (f-h)	on			Application rate per treatment			PHI (days) (l)	Remarks: (m)
	growth stage & season (j)	number min max (k)	interval between applications (min)	kg as/hL min max	water L/ha min max	kg as/ha min max		
Foliar spraying	BBCH15-73	1	n.a.	0.01	1000	0.1	14	For lower spray volumes, ensure a dose of 0.07 kg a.s./ha
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Foliar spraying	BBCH15-85	1	NA	0.015	1000	0.15	14	-
Foliar spraying	BBCH15-85	1	NA	0.015	1000	0.15	21	-

Foliar spraying

Type of sprayer

Nozzle type

Coverage

Droplets size

VMD
NMD
XC,C,L,M,S

Application				Applicatio kg as/hL min max	te per treatment		PHI (days) (l)	Remarks: (m)
method kind (f-h)	growth stage & season (j)	number min max (k)	interval between applications (min)		er a x	kg as/ha min max		
Foliar spraying	BBCH15-73	1	n.a.	0.01	00	0.1	14	For lower spray volumes, ensure a dose of 0.07 kg a.s./ha
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Foliar spraying	BBCH15-85	1	NA	0.015	00	0.15	14	-
Foliar spraying	BBCH15-85	1	NA	0.015	00	0.15	21	-

Application rate per treatment

Kg as/HL

Water L/Ha

Kg as/Ha

400 L/Ha

200 L/Ha

150 L/Ha

100 L/Ha

Application				Application		ment	PHI (days)	Remarks:
method kind (f-h)	growth stage & season (j)	number min max (k)	interval between applications (min)	kg as/hL min max	water L/ha min max	ha max	(l)	(m)
Foliar spraying	BBCH15-73	1	n.a.	0.01	1000	1	14	For lower spray volumes, ensure a dose of 0.07 kg a.s./ha
Foliar spraying	BBCH15-85	1	NA	0.01 – 0.015		.1 15	30	-
Foliar spraying	BBCH15-85	1	NA	0.015	1000	15	14	-
Foliar spraying	BBCH15-85	1	NA	0.015	1000	15	21	-
					1000			

- Canopy and sprayers: variability
- How to apply: information in PPP label
- **Sprayer's adjustments: Who, what, when…**
- General comments

DIRECTIVE 2009/128/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 21 October 2009

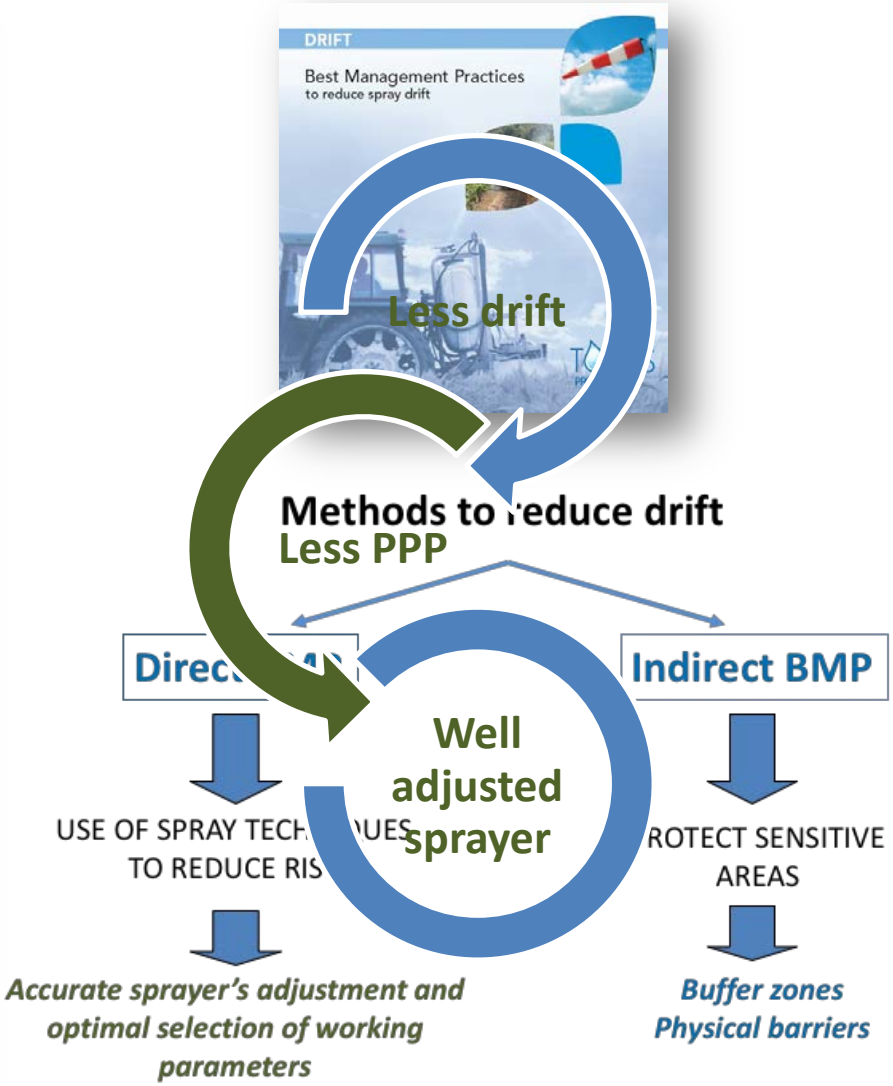
establishing a framework for Community action to achieve the sustainable use of pesticides

5. Professional users shall conduct regular calibrations and technical checks of the pesticide application equipment in accordance with the appropriate training received as provided for in Article 5.

Article 5

Training

1. Member States shall ensure that all professional users, distributors and advisors have access to appropriate training by bodies designated by the competent authorities. This shall consist of both initial and additional training to acquire and update knowledge as appropriate.

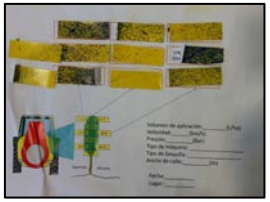

DRIFT
Best Management Practices
to reduce spray drift
Less drift
Methods to reduce drift
Less PPP
Direct BMP
Indirect BMP
Well adjusted sprayer
USE OF SPRAY TECH UES TO REDUCE RIS
ROTECT SENSITIVE AREAS
Accurate sprayer's adjustment and optimal selection of working parameters
Buffer zones
Physical barriers

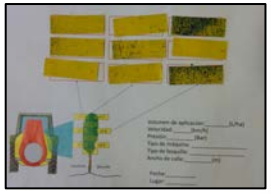
Alternative Dose Expression method

- Recommended PPP dose
- Recommended volume rate

Reduction in PPP and water

Sprayer's adjustment is CRUCIAL





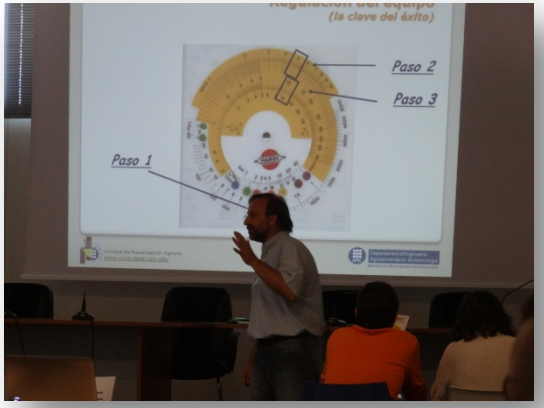
After more than 12.000 stakeholders trained in Spain, the experience says that…

ALWAYS, when a dose expression method other than volume/ha is applied, it goes to a reduction of total amount of PPP

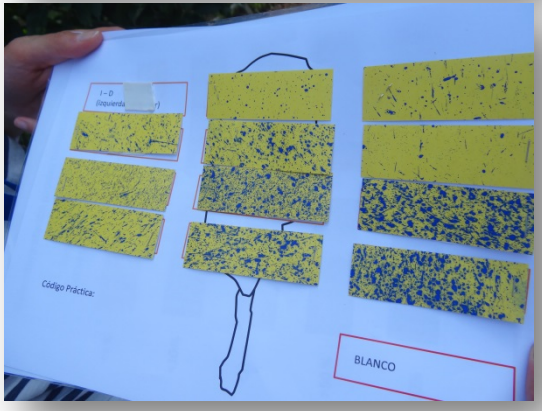
&

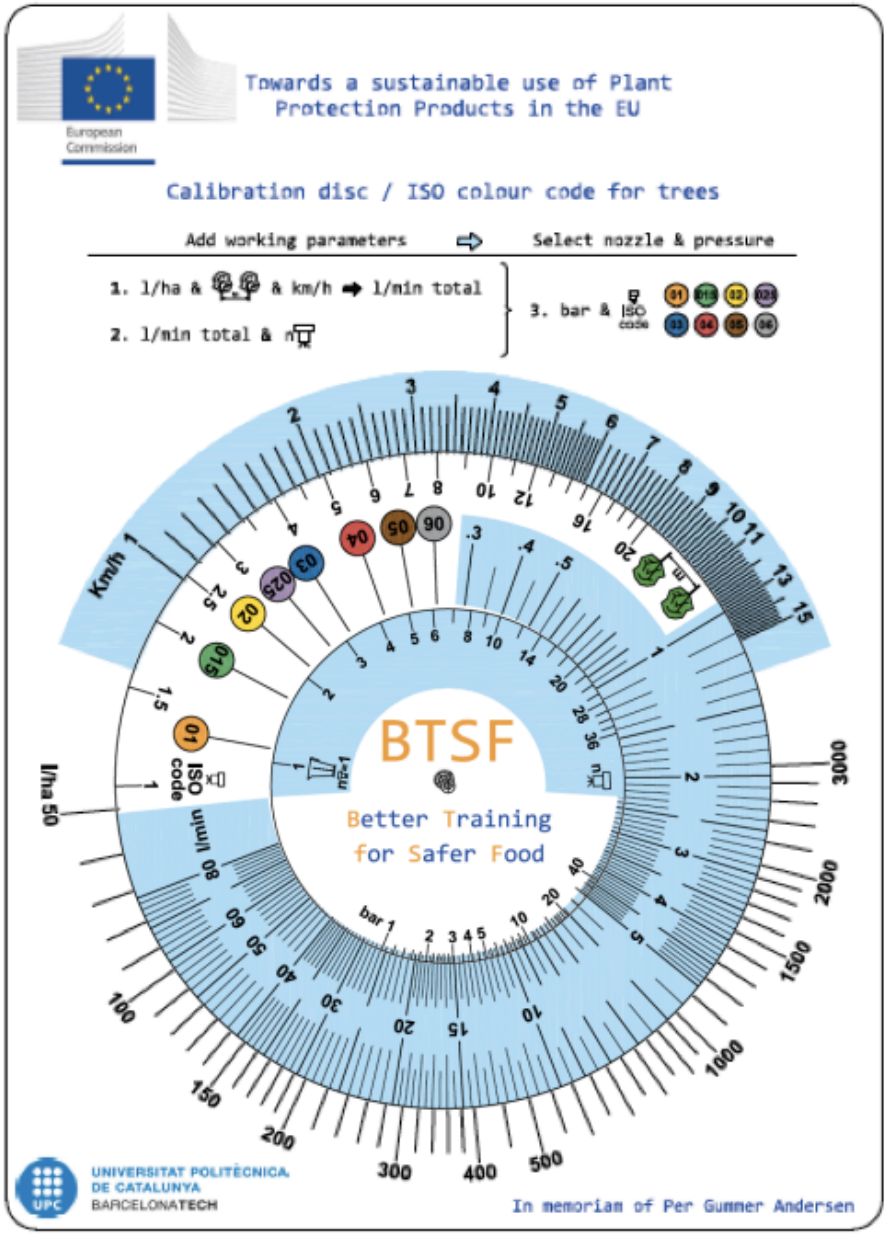
ALWAYS, after an accurate calibration process, volume/ha is reduced while spray efficiency is improved (coverage, deposition, drift losses…)


TOPPS

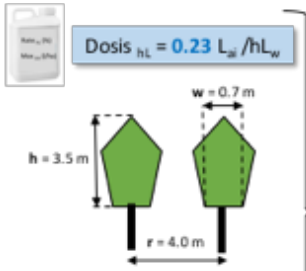

Paso 2
Paso 3
Paso 1


E 7164
E 0935


Código Práctica:
BLANCO



Alternativas a la expresión de dosis (ejemplo)



Dosis $_{hL}$ = 0.23 L_{ai} /hL_w

$$LWA = \frac{3.5\ m \times 2 \times 10{,}000}{4.0\ m} = 17{,}500\ \frac{m^2\ LWA}{ha}$$

$$TRV = \frac{3.5\ m \times 0.7\ m \times 10{,}000}{4.0\ m} = 6{,}125\ \frac{m^3\ TRV}{ha}$$

L_{ai} = *litros de producto fitosanitario (a.i.)*

L_w = *litros de agua*

Dosis $_{hL}$ = *Concentración de producto (%)*

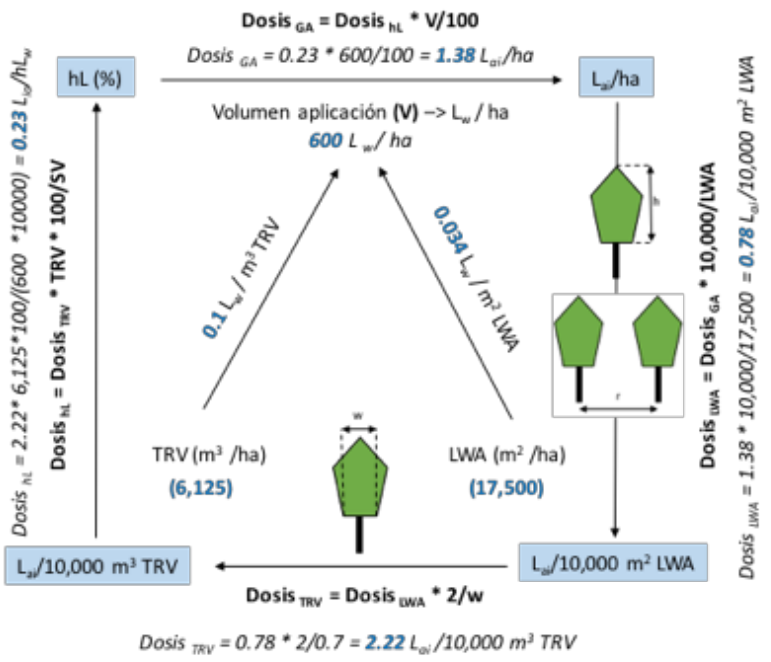
Dosis $_{GA}$ = *Cantidad producto por superficie (ha)*

Dosis $_{LWA}$ = *Cantidad producto por pared árbol (LWA)*

Dosis $_{TRV}$ = *Cantidad producto por volumen árbol (TRV)*

w = *anchura media vegetación (m)*
h = *altura media vegetación (m)*
r = *distancia entre filas (m)*

Volumen **(V)** = 600 L_w /ha



QUESTIONS
Fwd. Speed?
Working pressure?
Volume rate?
Nozzle type?

Initial spray application process
(no intervention)

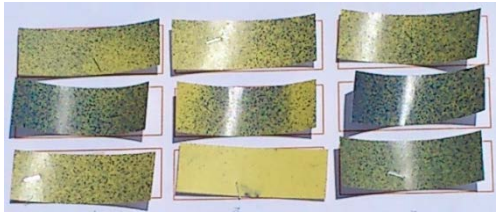
COMMENTS
Deposition
Uniformity
Drift

NEED TO
Calculate
Select nozzles
Adjust pressure
Measurements

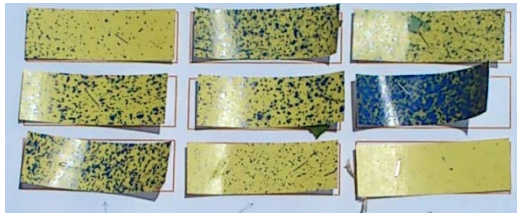
NEED TO
Evaluate weather cond.
Select AI nozzles
Adjust air
Measure canopy

Selection proper parameters
(according recommendations)

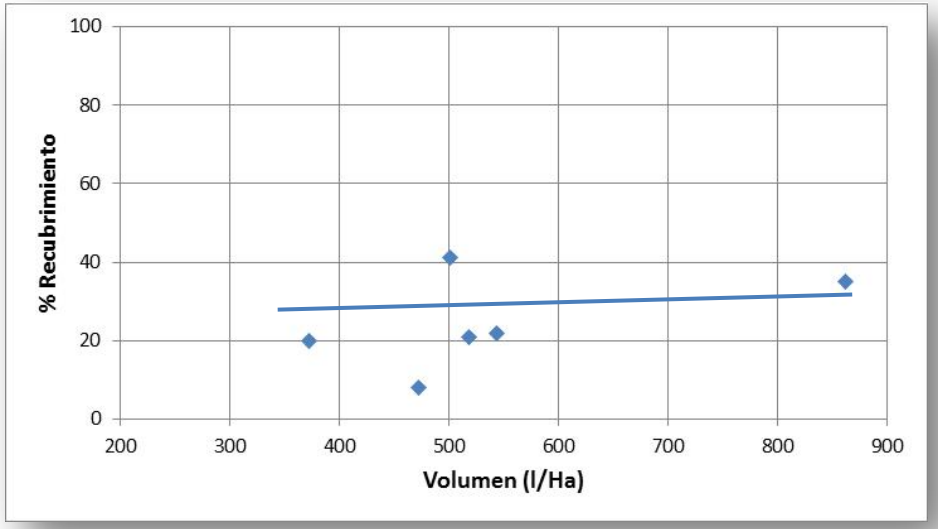
Adjustment to reduce drift
(canopy structure, environmental cond.)



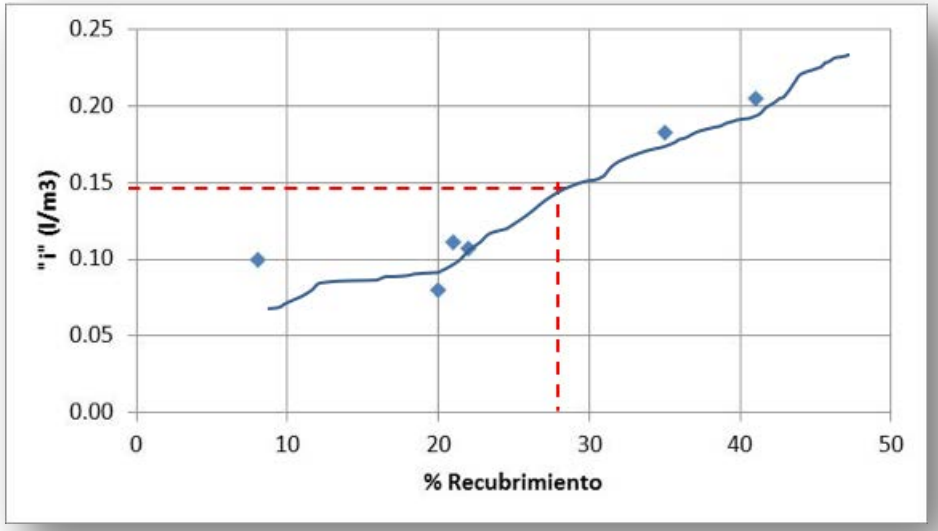
REDUCED VOLUME RATE
REDUCED PPP AMOUNT
REDUCED DRIFT
(convinced about influence of training)

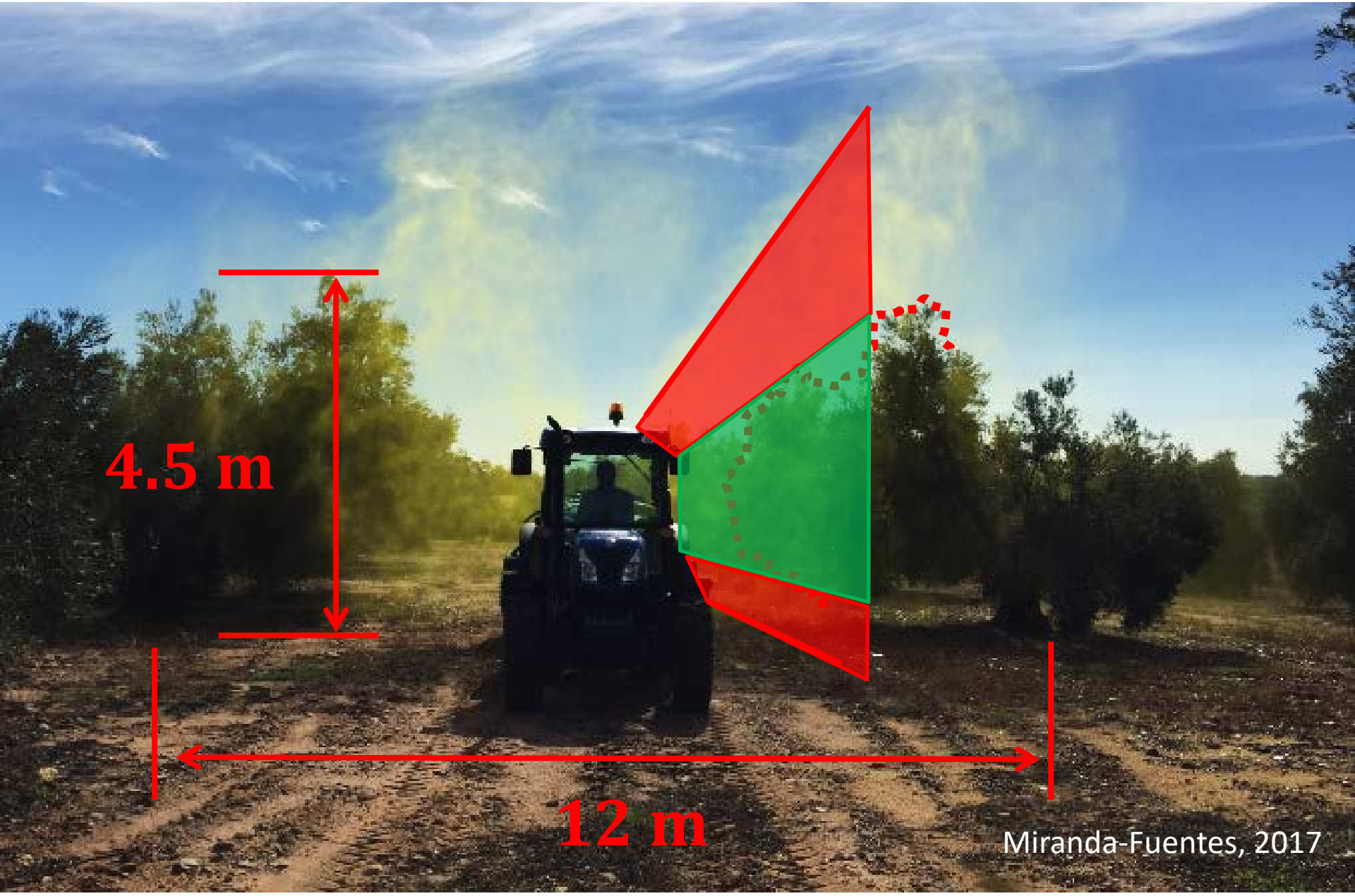


In olive trees, increasing **volume/ha** doesn't implies improvement in coverage (%)



On the opposite, increasing **TRV (l/m³)** results in an proportional improvement of coverage (%)

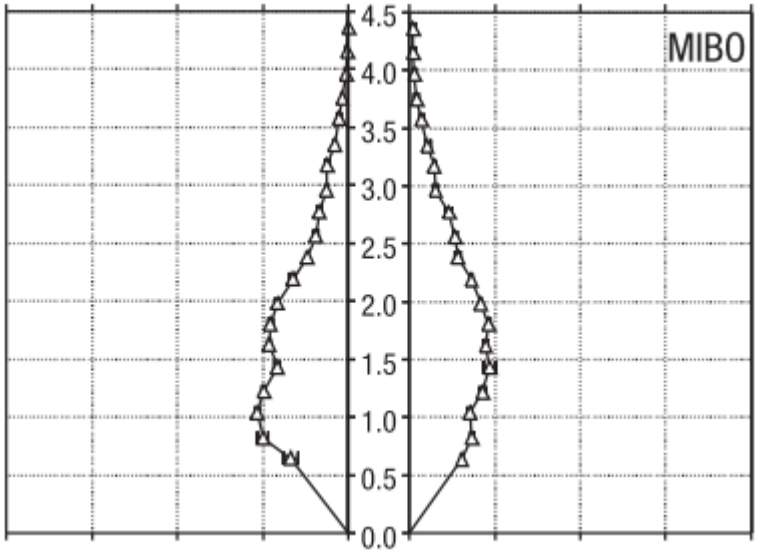


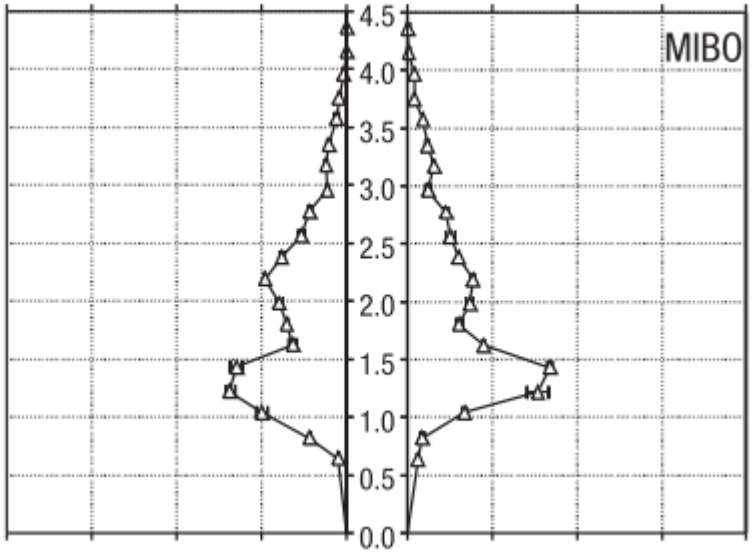

4.5 m
12 m
Miranda-Fuentes, 2017

Main factors for a safe and efficient spray application

Calibration/adjustment of the sprayer is crucial for success

To achieve a good liquid/air distribution is not an easy goal…


MIBO
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0


MIBO
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Adjustment according canopy structure implies:

Adequate selection of air flow characteristics (velocity, air flow rate,…)

Precise orientation of air outlets

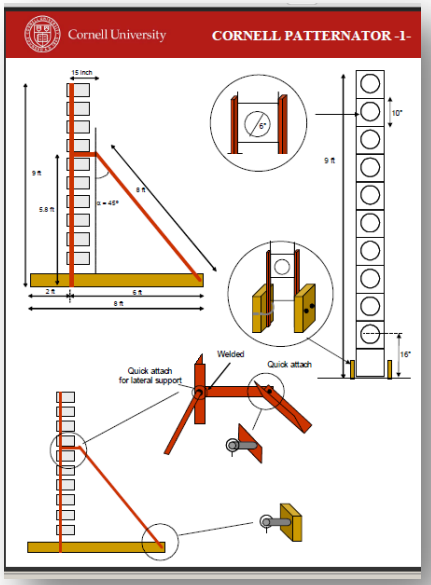

Setting


Test


Evaluation/comments


Drift measurements

The user's opinion… the most important "impact factor"



Using Simple Technology To Improve Spray Deposition and Reduce Drift at Dalrymple Vineyards

Bill Dalrymple
Dalrymple Farms, Ovid, NY

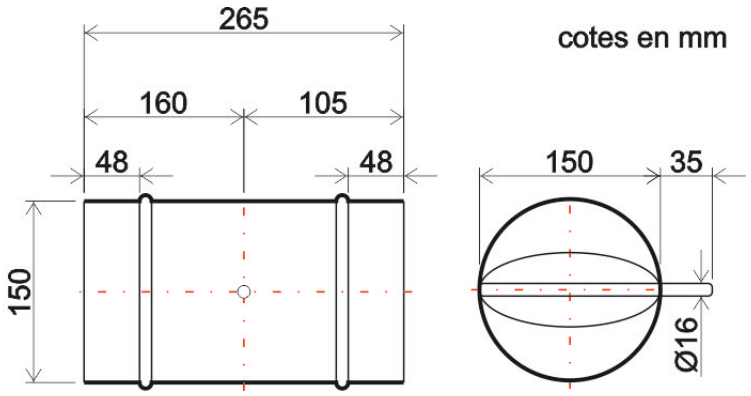
Reprinted from Sustainable Viticulture in the Northeast, Issue 5

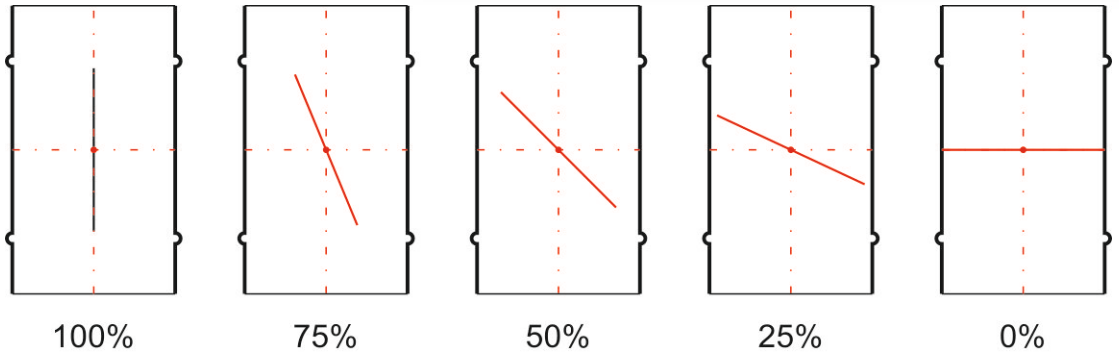
I first saw Andrew Landers demonstrate his spray patternator at a field day demonstration in 2004. It inspired me to build my own. The unit I built cost me less than $50, and as you can see is made mostly out of old window screens I had laying around. Each screen has a channel in the bottom that funnels the water into the seven gallon-sized jugs, so I can run my sprayer for 15 minutes and find out how evenly the water is being distributed in the canopy.

When I first tried it out with my standard sprayer settings, it was throwing spray way up to the top, which obviously wasn't making it into the vine canopy. I was able to change the direction that nozzles were pointing to adjust for the direction of air coming out of the fan - downward canopy, instead of having half of it shoot into the air. It greatly reduced drift.

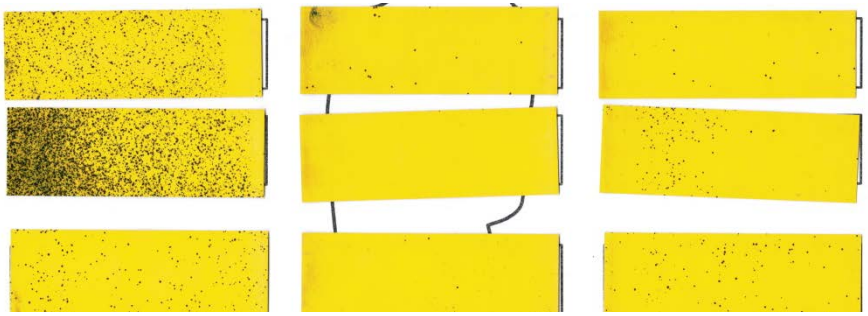
I worked with Andrew and Emilio Gil on using the "Dosavina" program on my farm. It uses vine dimensions, growth stage, spray material, variety, and spray conditions to calculate an optimum amount of water to deliver per acre. Early in the season, I was able to mix my fungicides in the appropriate concentration for 50 GPA, but actually apply much lower volume - down to as low as 17 GPA in some cases. I feel we got the same coverage while applying much less material per acre. We didn't need so much water to cover the relatively small leaf area present before bloom, and we figure we've saved around $2000 - $3000 on spray materials annually on our farm.

Gil, E., Badiola, J. 2007. Design and verification of a portable vertical patternator for vineyard sprayers calibration. *Applied Engineering in Agriculture*, 23(1):35-42
Gil, E. Landers, A. Gallart, M., Llorens, J. 2013. Development of two portable patternators to improve drift control and operator training in the operation of vineyard sprayers. *Spanish Journal of Agricultural Research*, 2013 11(3): 615-625

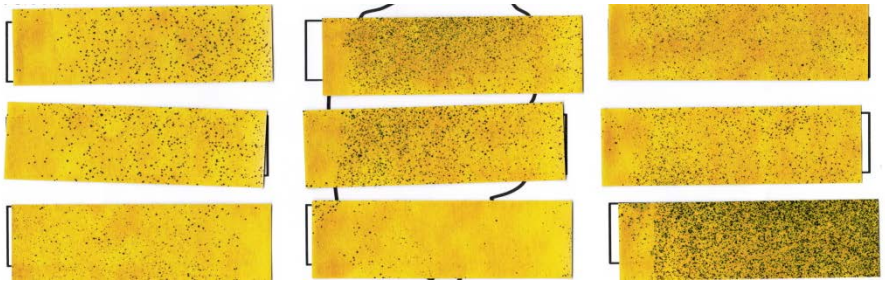

265
160
105
48
48
150
cotes en mm
150
35
Ø16


100%
75%
50%
25%
0%

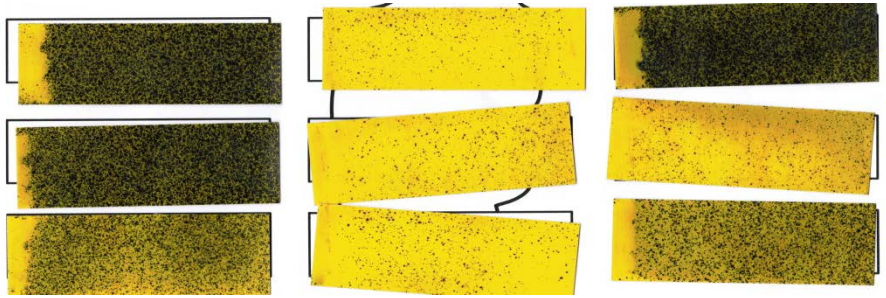
0% Air assistance



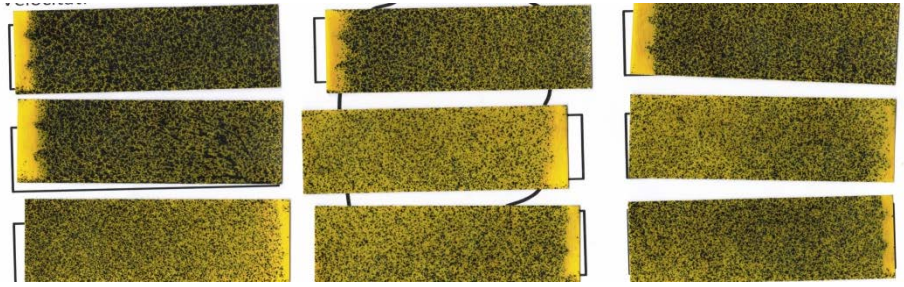
25% Air assistance



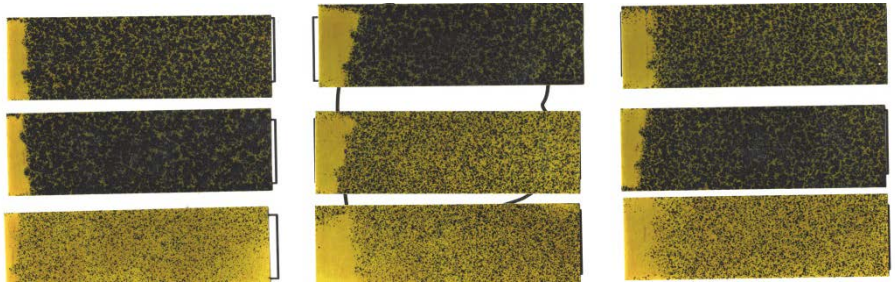
50% Air assistance



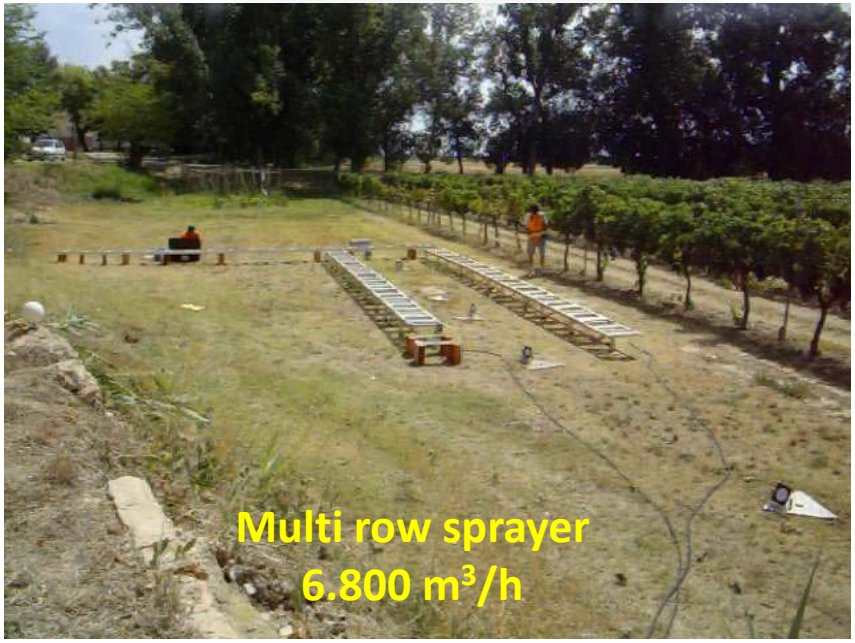
75% Air assistance



100% Air assistance

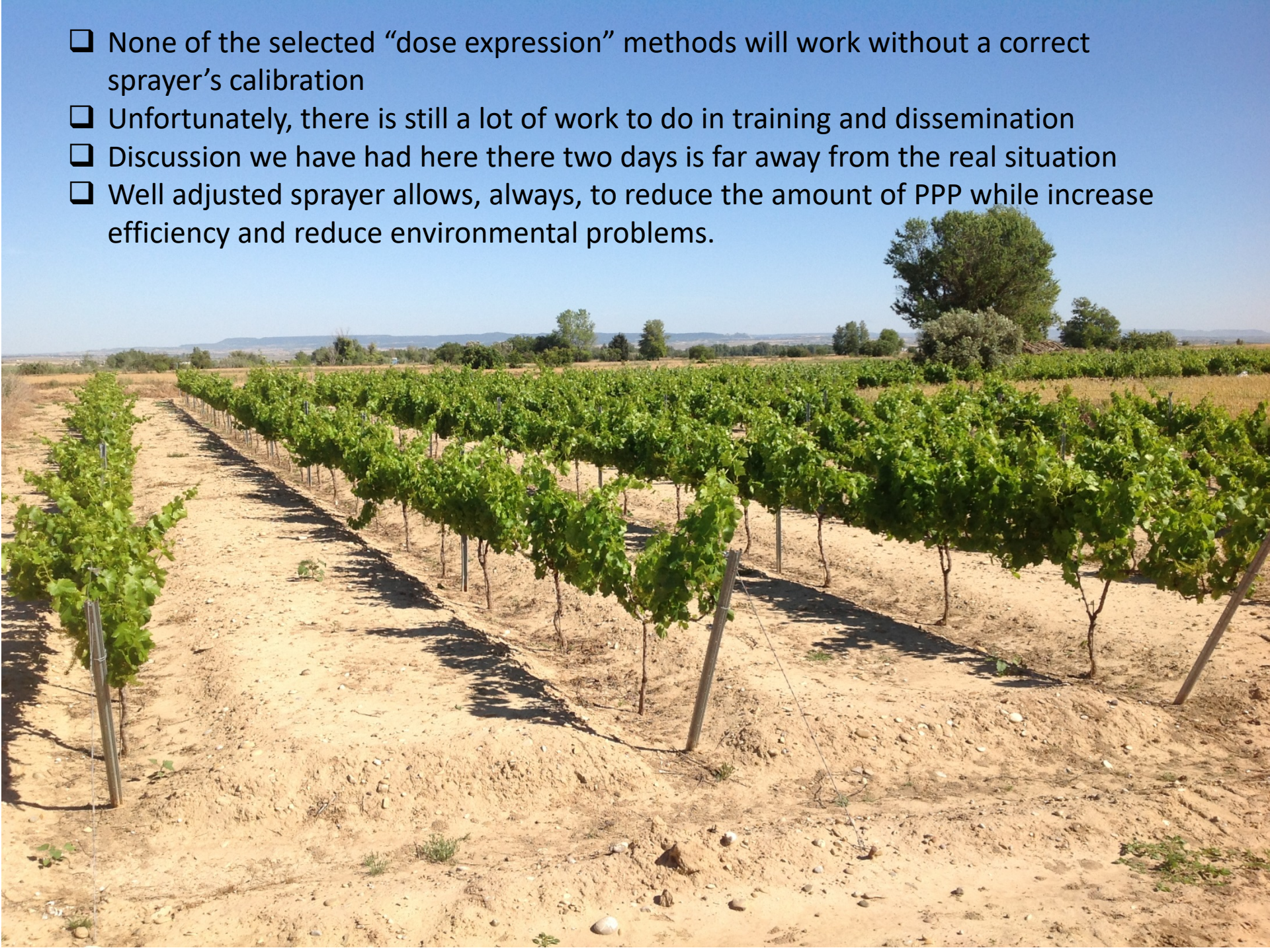



Conventional mistblower
38.000 m³/h


Multi row sprayer
6.800 m³/h

- ❑ Canopy and sprayers: variability
- ❑ How to apply: information in PPP label
- ❑ Sprayer's adjustments: Who, what, when…
- ❑ **General comments**

- None of the selected “dose expression” methods will work without a correct sprayer’s calibration
- Unfortunately, there is still a lot of work to do in training and dissemination
- Discussion we have had here there two days is far away from the real situation
- Well adjusted sprayer allows, always, to reduce the amount of PPP while increase efficiency and reduce environmental problems.




Thank you very much for your attention