New technologies for a sustainable pesticide application

Training & technology together

Prof. Emilio Gil

Department of Agri Food Engineering and Biotechnology
Polytechnic University of Catalonia

European Commission — TAIEX
Technical Assistance Information Exchange Instrument (TAIEX), DG Enlargement

Workshop on Pesticide application equipment — Novi Sad (Serbia) June 2012

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- Dose reduction according EU Directive
- Environmentally use of PPP
- Operator' s safety
- Other developments for a better use

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Canopy characteristics: key point

All the recommended procedures, for both dose expression and volume rate, are based in some canopy characteristic or dimensions:

Canopy height (LWA)
Canopy width (TRV)
Canopy density
Leaf surface
…

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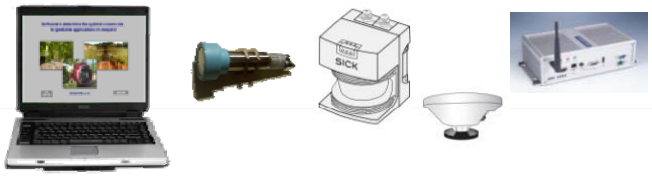
Two options for canopy measurements

Simple & Easy	Complex & Difficult
$V\ (l/ha) = \frac{Q\ (l/min)\ x\ 600}{a\ (m)\ x\ v\ (km/h)}$	TRV (m^3/ha)
$V\ (l/10.000\ m^2) = \frac{Q\ (l/min)\ x\ 600}{h\ (m)\ x\ v\ (km/h)}$	TRD (m^2/m^3)
	LAI (m^2/m^2)

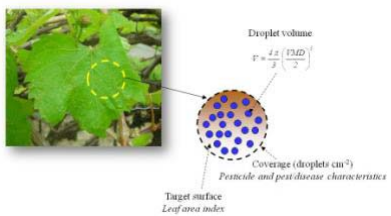


Whatever adopted method must be "realistic and directly applicable" by the user

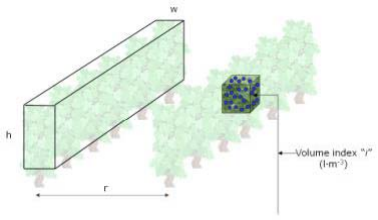
Canopy characterization

Two different methods have been developed for automatic/electronic canopy characterization in order to adapt the volume rate according canopy dimensions

The Optimal Coverage Method



The Wine Row Volume Method



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Two methods proposed

The Optimal Coverage Method

DOSAVIÑA, software developed including a wide database on canopy characteristics (Leaf Area), spray typology, pesticide type and weather conditions

The Wine Row Volume Method

A **VARIABLE RATE PROTOTYPE** has been developed for a selective application according canopy structure.

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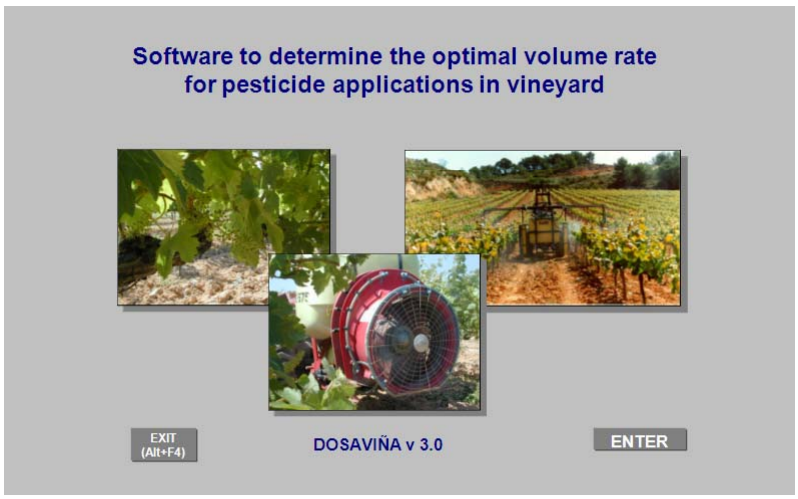

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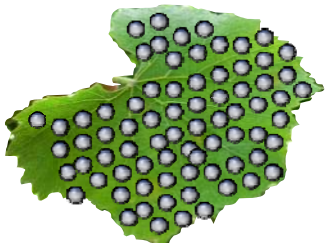
DOSAVIÑA principle

Efficiency
sprayer equipment

Efficiency
weather conditions



Target: ***leaf surface***

Pest/disease

Pesticide

Objective: ***impacts/cm²***

$$V_T = 2 \cdot LAI \cdot D_i \cdot \frac{4}{3} \cdot \pi \cdot \left(\frac{VMD}{2}\right)^3 \cdot 10^{-7} \cdot K$$

Data base
Varieties
Crop stages
Zones

$$V_R = \frac{V_T}{E}$$

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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 paternator 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.

http://www.cals.cornell.edu/cals/grapesandwine/appellation-cornell/issue-5/upload/Landers-Research-Focus-2011-1.pdf

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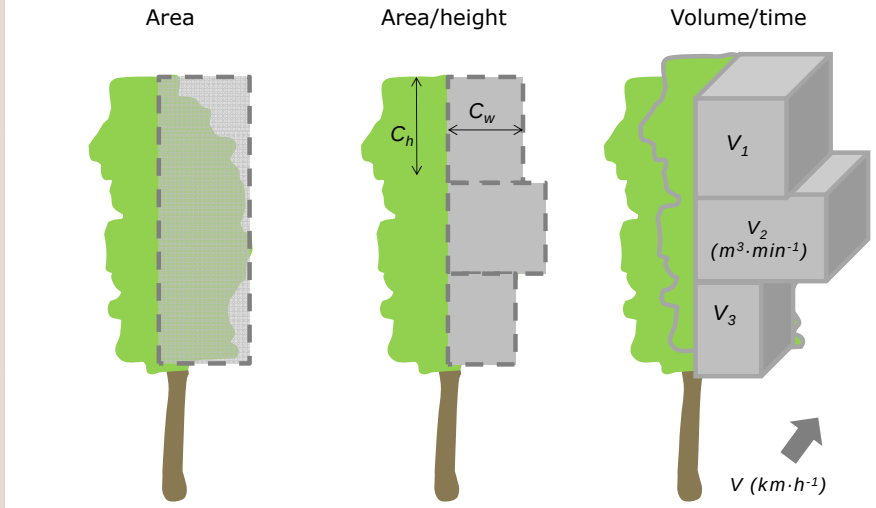
The concept of WRV



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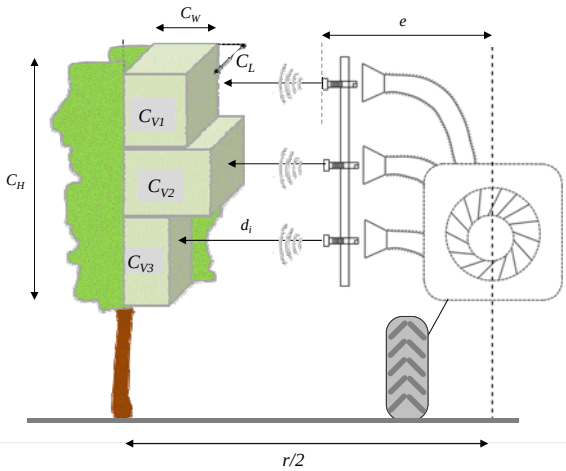

$$q\ (l\ min^{-1}) = \frac{[D - d_i - e_i](m) \times h/3\ (m) \times v(km\ h^{-1}) \times i(l\ m^{-1}) \times 1000}{60}$$

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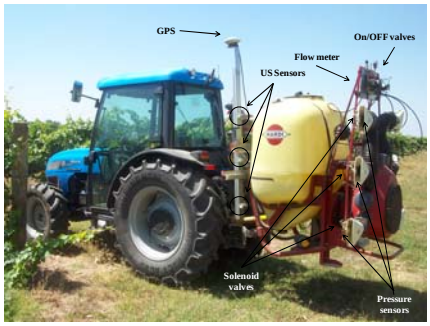
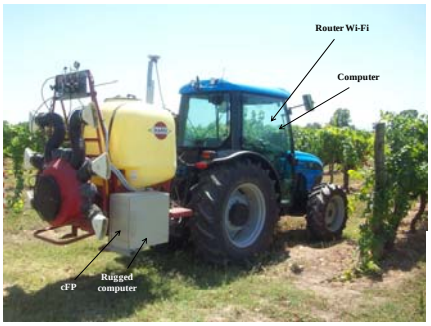
Variable Rate Application in vineyard

(Research project funded by Ministry of Science, Spain)





Based on the **Vine Row Volume** concept

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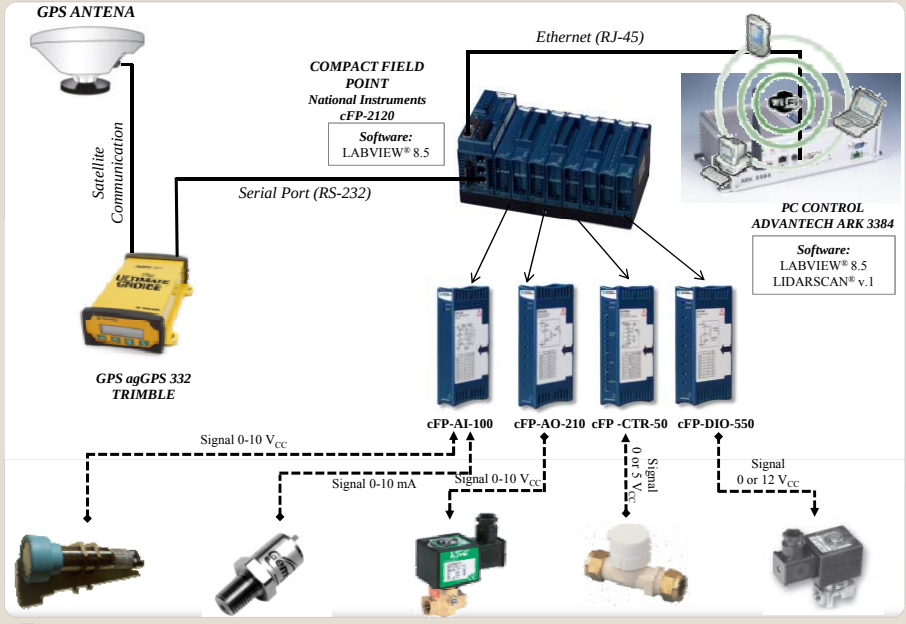

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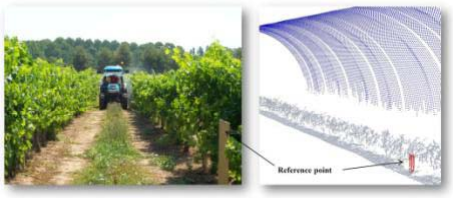
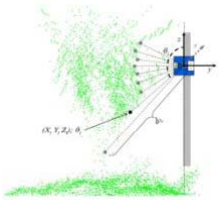
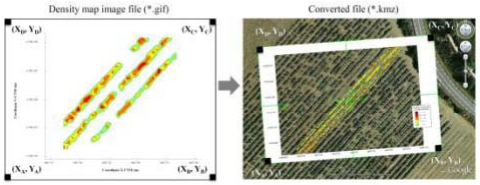
Canopy measurements using LIDAR



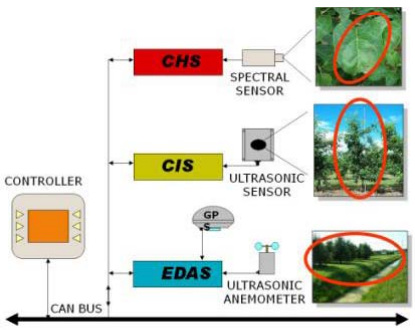




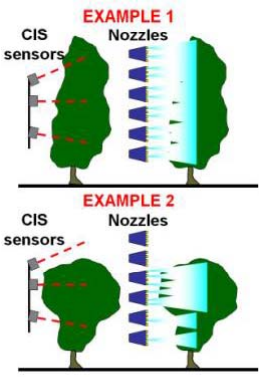
Ultrasonic and LIDAR Sensors for Electronic Canopy Characterization in Vineyards: Advances to Improve Pesticide: Application Methods ***Sensors*** 2011, 11, 2177-2194; doi:10.3390/s110202177

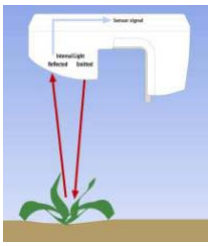
ISAFRUIT Project

INCREASING FRUIT CONSUMPTION THROUGH A TRANS-DISCIPLINARY APPROACH DELIVERING HIGH QUALITY PRODUCE FROM ENVIRONMENTALLY FRIENDLY, SUSTAINABLE PRODUCTION METHODS



Crop Identification System





Important pesticide reduction in spray applications in public gardens in The Netherlands
(University of Wageningen)

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GPS for identify sensible areas

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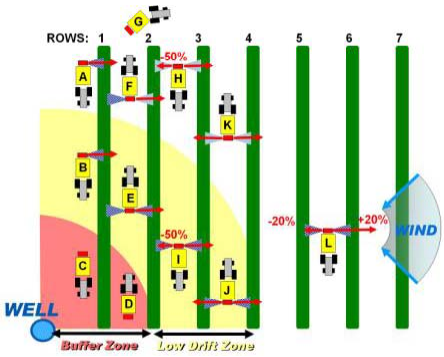
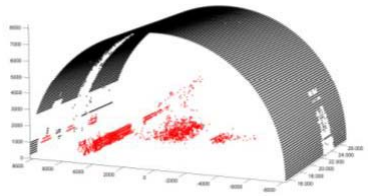
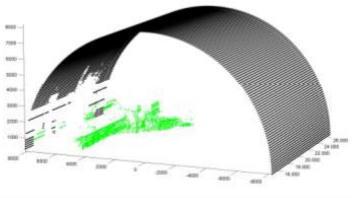
EDAS - Environmentally Dependent Application System



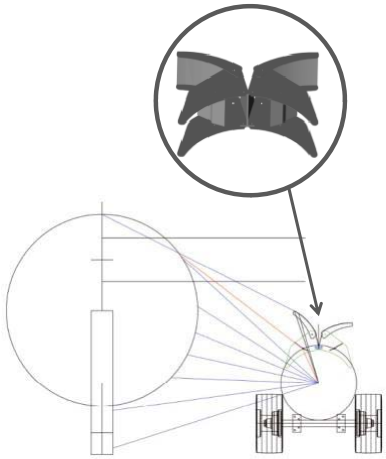
www.isafruit.org

Control drift in orchard sprayers





Air deflectors – Drift control improvements



FEDE

Variation or air section

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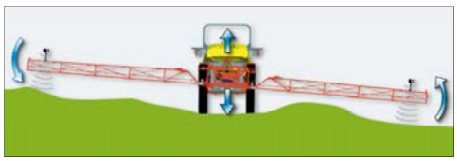
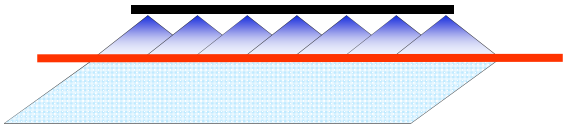
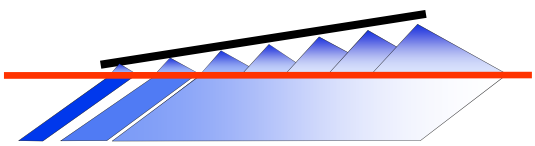
Sprayers cleaning system – key for environment protection

Developments for boom control

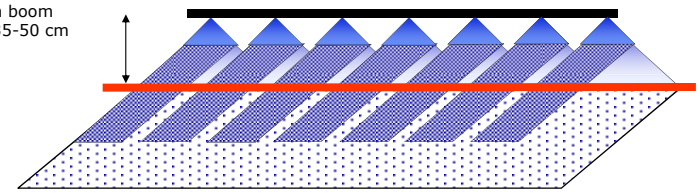




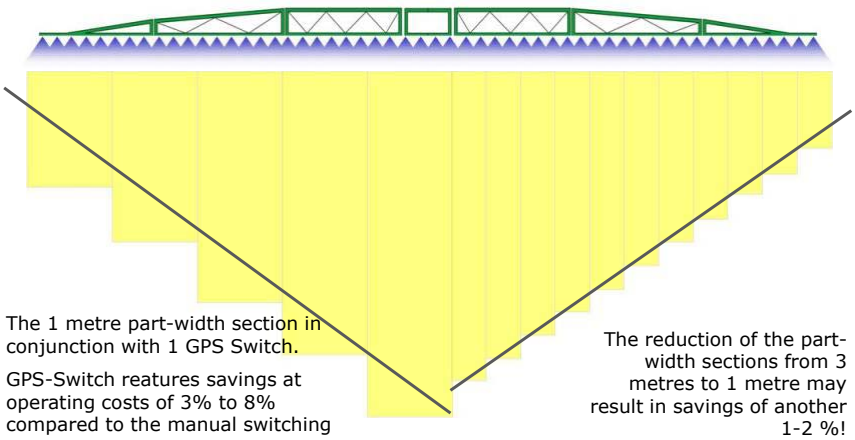


Influence of boom height

Optimum boom height: 35-50 cm



Individual nozzle control – avoid overlapping

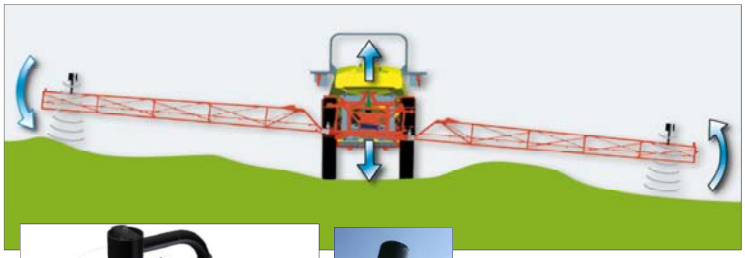


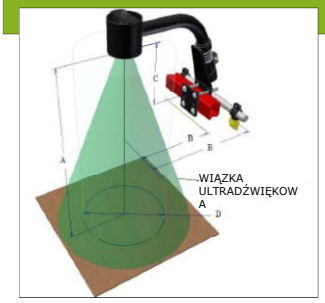
The 1 metre part-width section in conjunction with 1 GPS Switch.

GPS-Switch reatures savings at operating costs of 3% to 8% compared to the manual switching

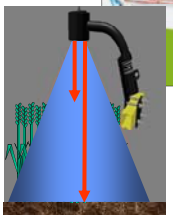
The reduction of the part-width sections from 3 metres to 1 metre may result in savings of another 1-2 %!

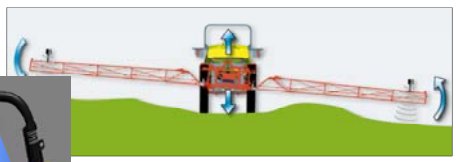
Automatic regulation of boom heigth and stability



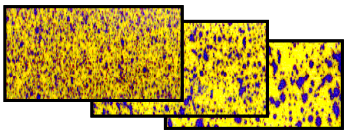


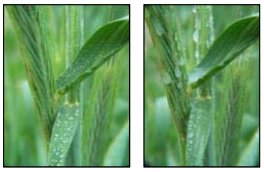
Automatic control of boom sections and boom heigth





Nozzle development
Continuous changes and improvements

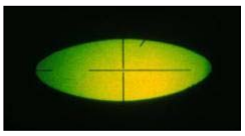


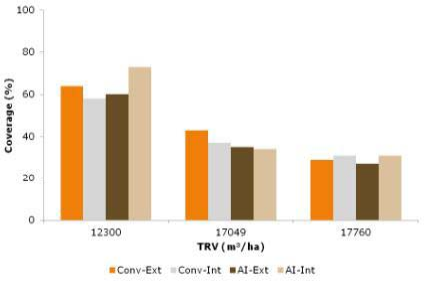


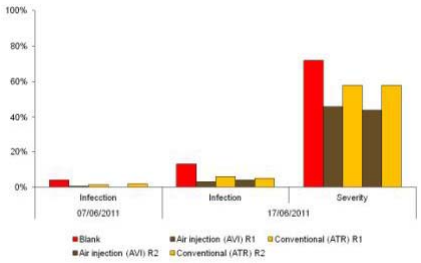
Nozzle is responsible of most of the spray quality pattern. In the last years many new developments have been presented in order to improve efficacy and efficiency

Air injection nozzles

Bigger droplets with the same efficacy







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Doble flat fan nozzles

Well adapted for dense canopy to increase penetration (horticulture). Good filter maintenance is required

¡HIGH RISK OF DRIFT due to small droplet size

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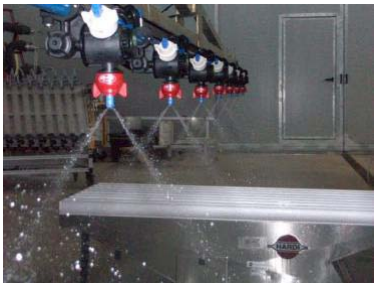

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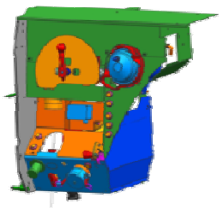
Sprayers cleaning system – key for environment protection



Automatic control for sprayer cleaner
Independent cleaner pump
Less water consume
Easy to use

Reduced dead volume
Easy mixing tank
Ergonomic design

Extra boom height for maize (Amazone)

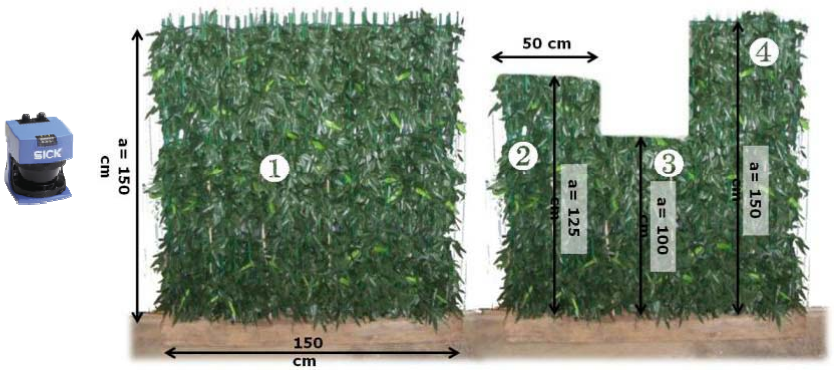
Less operator's contamination






Improvement spray technologies in greenhouses





Analysis of artificial vegetation (LWA & TRV)

Vegetación	LWA	TRV
❶	15.000 m^2/Ha	2.250 m^3/Ha
❷	12.500 m^2/Ha	1875 m^3/Ha
❸	10.000 m^2/Ha	1500 m^3/Ha
❹	15.000 m^2/Ha	2.250 m^3/Ha
Promedio de ❷❸❹	12.500 m^2/Ha	1875 m^3/Ha

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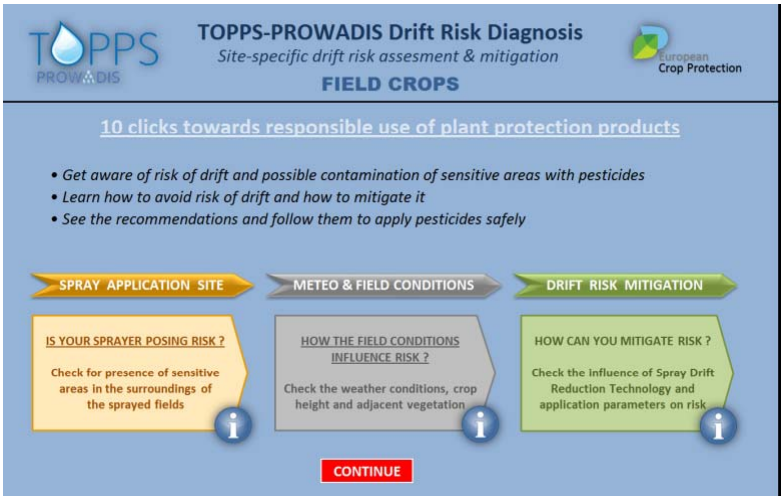
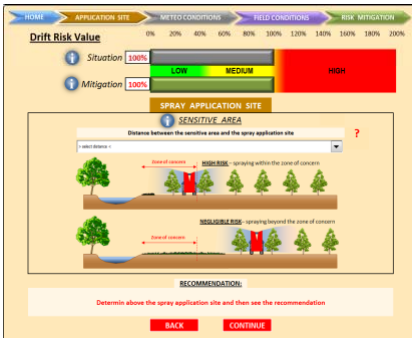
Environmentally safe sprayers

http://prototype.topps-eos.org/?LANG=EN

Drift diagnosis tool – TOPPS PROWADIS



Drift diagnosis tool – TOPPS PROWADIS



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