Role of spray application in IPM pome fruit crops

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Spray technique and IPM

- Spray technique influences:
- Effective use of PPP:
  - Spray deposition in canopy
  - Biological efficacy
  - Residue on fruits
- Environment:
  - Spray drift
  - Spray deposition on soil surface underneath trees
- Therefore spray technique of relevance for IPM

Spray drift in orchard spraying reference sprayer in full leaf stage apple

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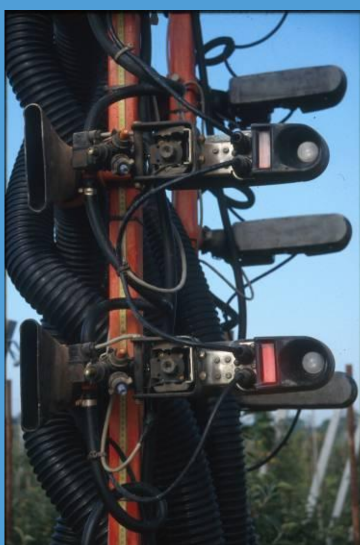
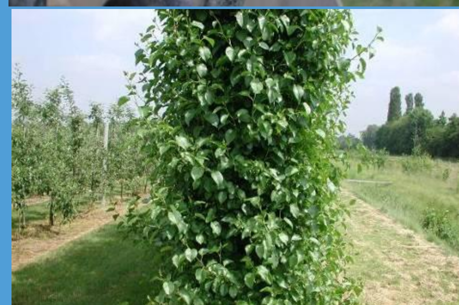
drift reducing technology in fruit growing





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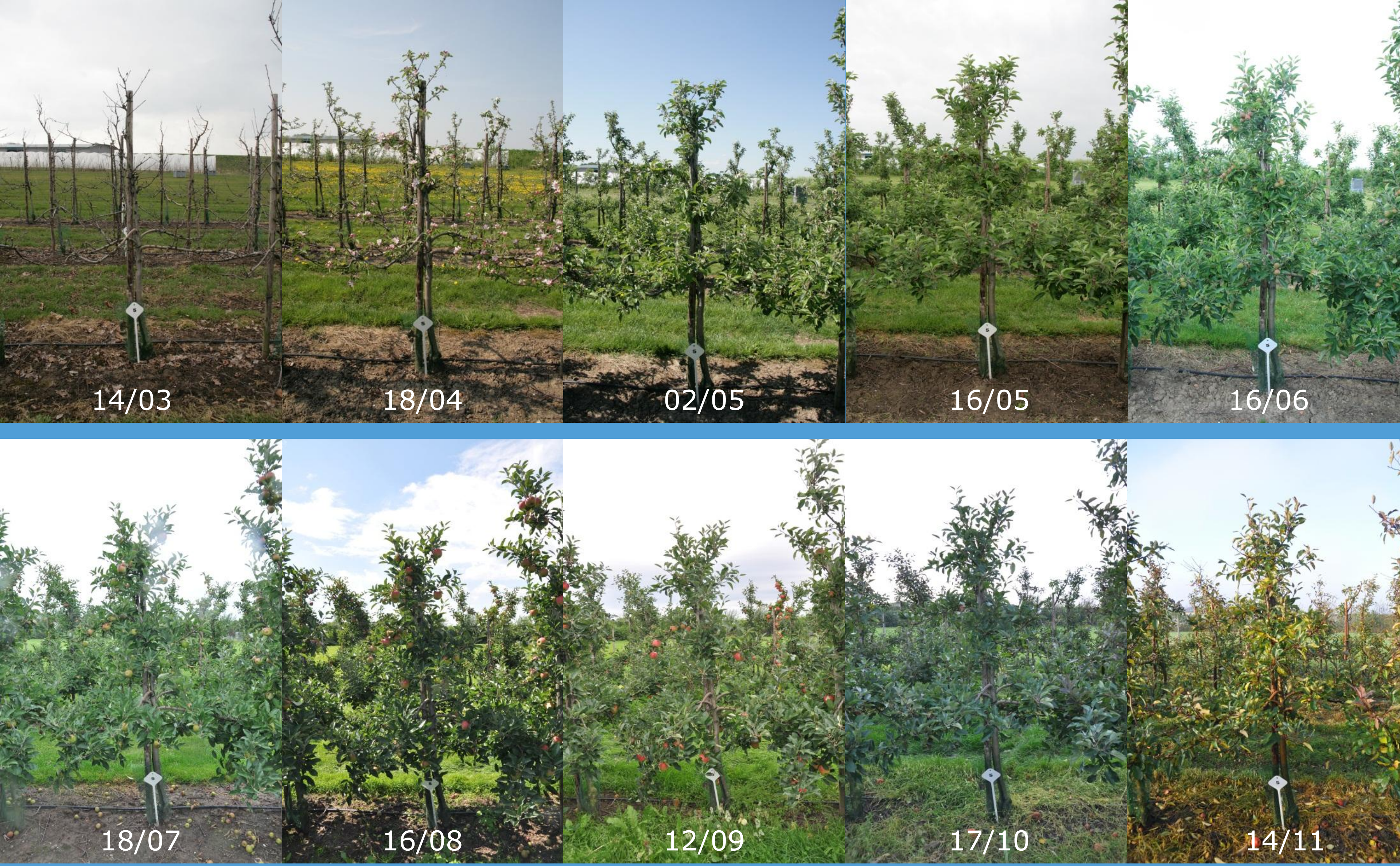

Apple 2011
View through outside 3 rows

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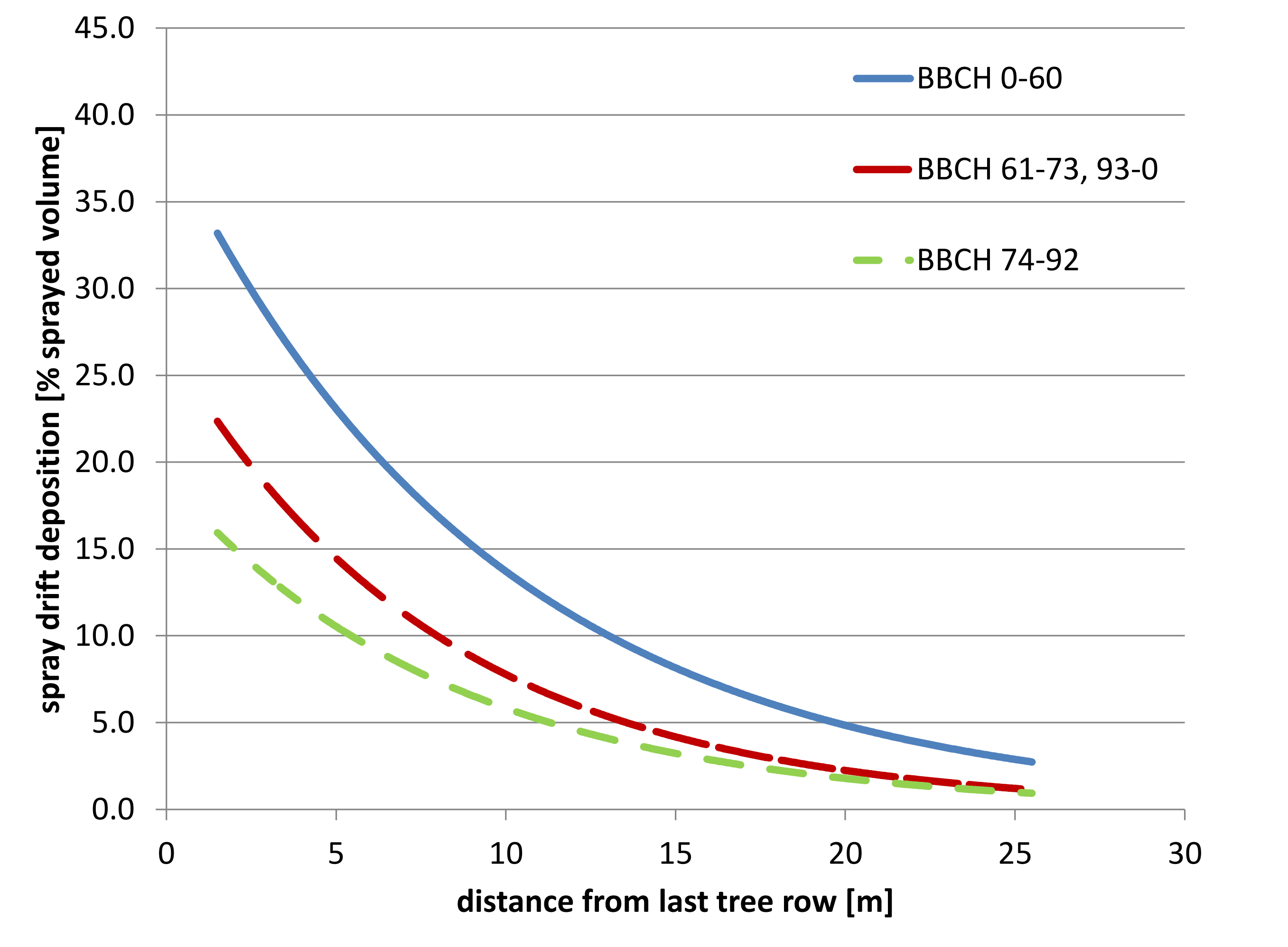
Standard spray drift curves for three growth stages (BBCH) in apple in NL



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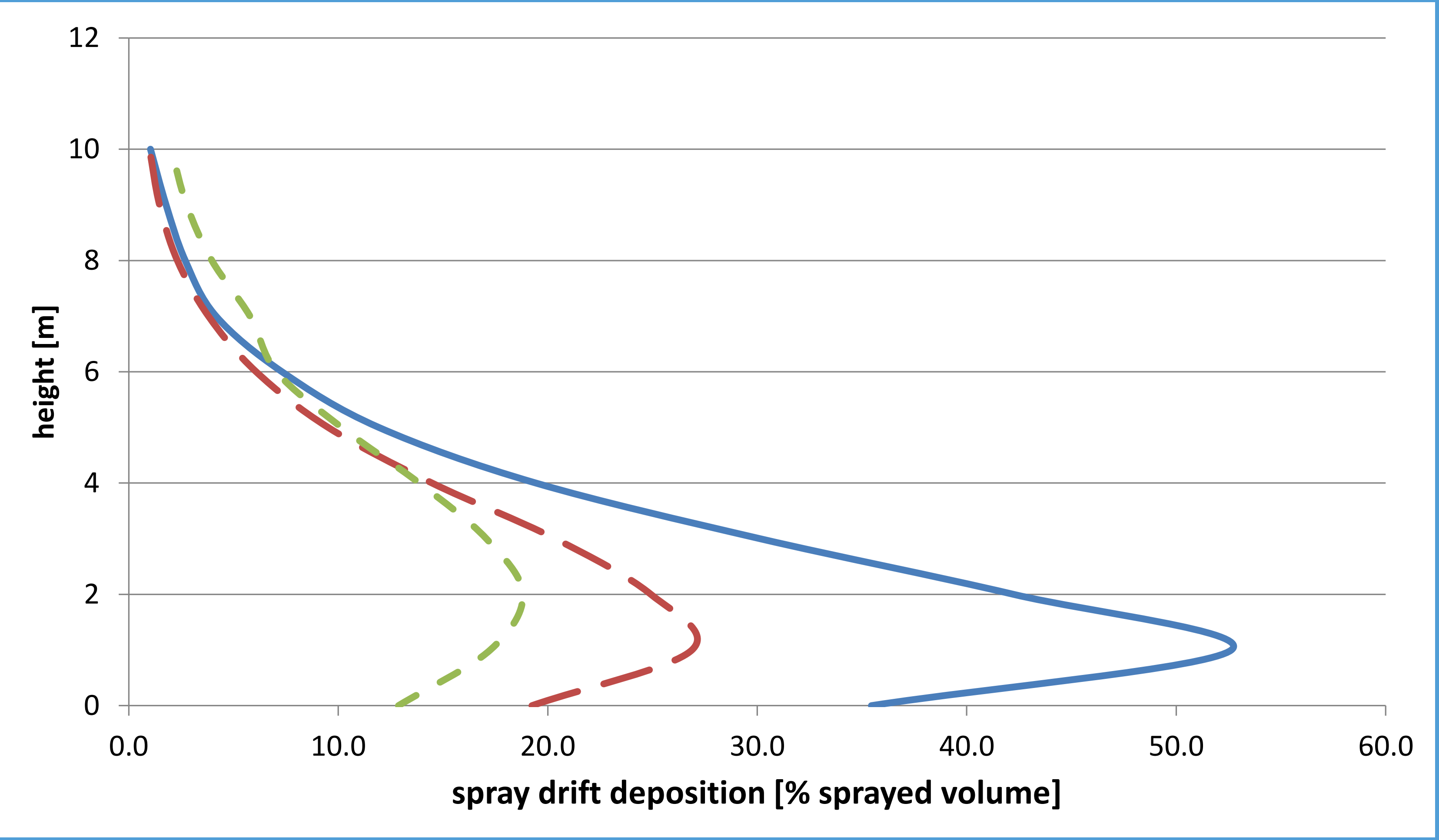
airborne spray drift for three growth stages (BBCH) in apples at 7.5 m from last tree row



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Classified drift reducing technology NL- orchard (3 m crop-free zone)

Drift reduction classes	Spray drift reducing technology in drift reduction class
50%	50% drift reducing nozzle types + one-sided outside row; sensor sprayer + standard nozzles; reflection shield sprayer + standard nozzles; Wanner cross-flow +reflection shield + standard nozzles;
75%	75% drift reducing nozzle types+ one-sided outside row; tunnel sprayer + standard nozzles; KWH 3-row sprayer + standard nozzles;

Classified drift reducing technology NL- orchard (3 m crop-free zone)

Drift reduction classes	Spray drift reducing technology in drift reduction class
90%	90% drift reducing nozzle types + one-sided outside row; cross-flow + venturi nozzles + one-sided outside row; axial fan sprayer + venturi nozzles + one-sided outside row;
95%	90% drift reducing nozzle types + one-sided outside row + low air assistance; 95% drift reducing nozzle types+ one-sided outside row + 4.5 m crop-free zone; Wanner cross-flow +reflection shield + venturi nozzles; KWH 3-row sprayer + 90% drift reducing nozzles; KWH 3-row sprayer + 90% drift reducing nozzles + variable air assistance; KWH 3-row sprayer + 90% drift reducing nozzles + reduced variable air assistance

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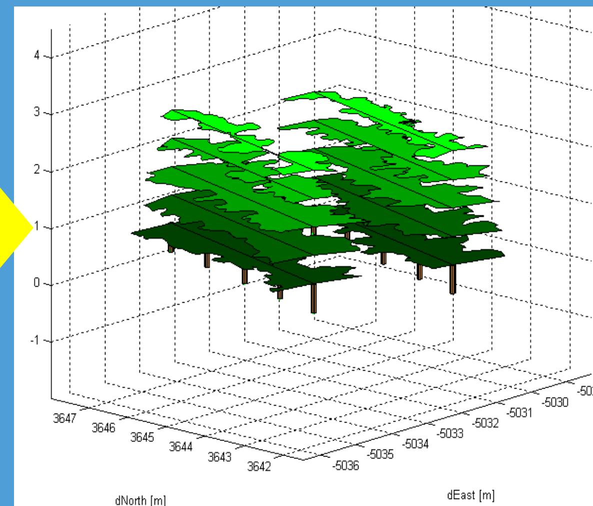
New developments; Crop protection – fruit crops

dose related to development stage and biomass crop

1



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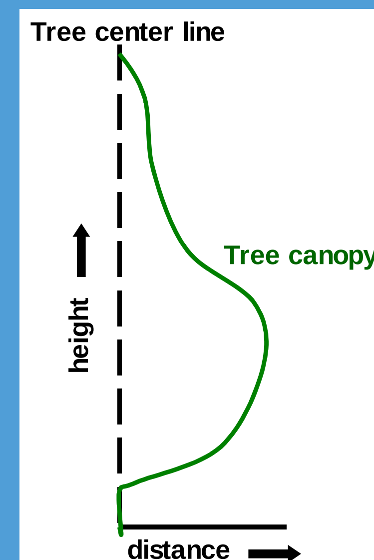

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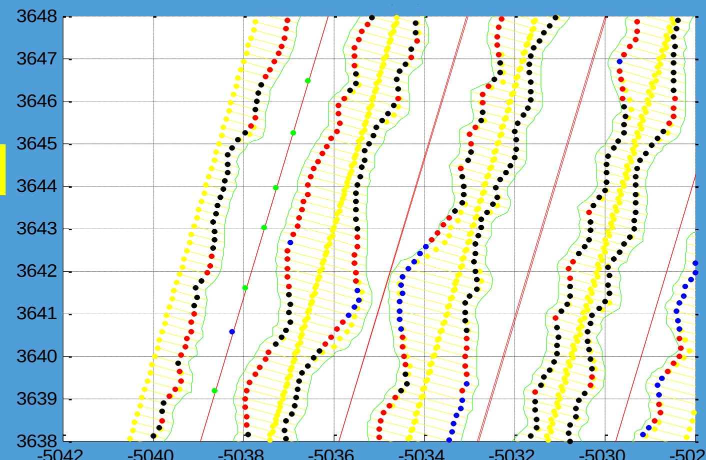

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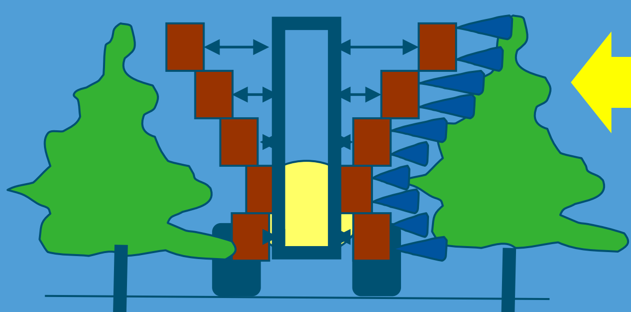

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14/03


18/04


02/05


16/05


16/06


18/07


16/08


12/09


17/10


14/11

Apple 2011 development

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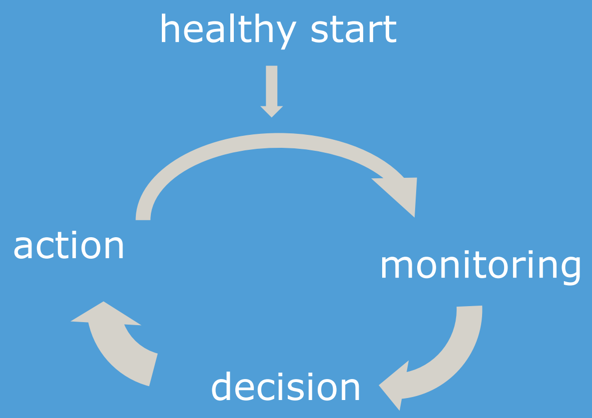
Ideas behind targeted application

- Reduce environmental load
- Keep a high efficacy
- Reduce risk of residue



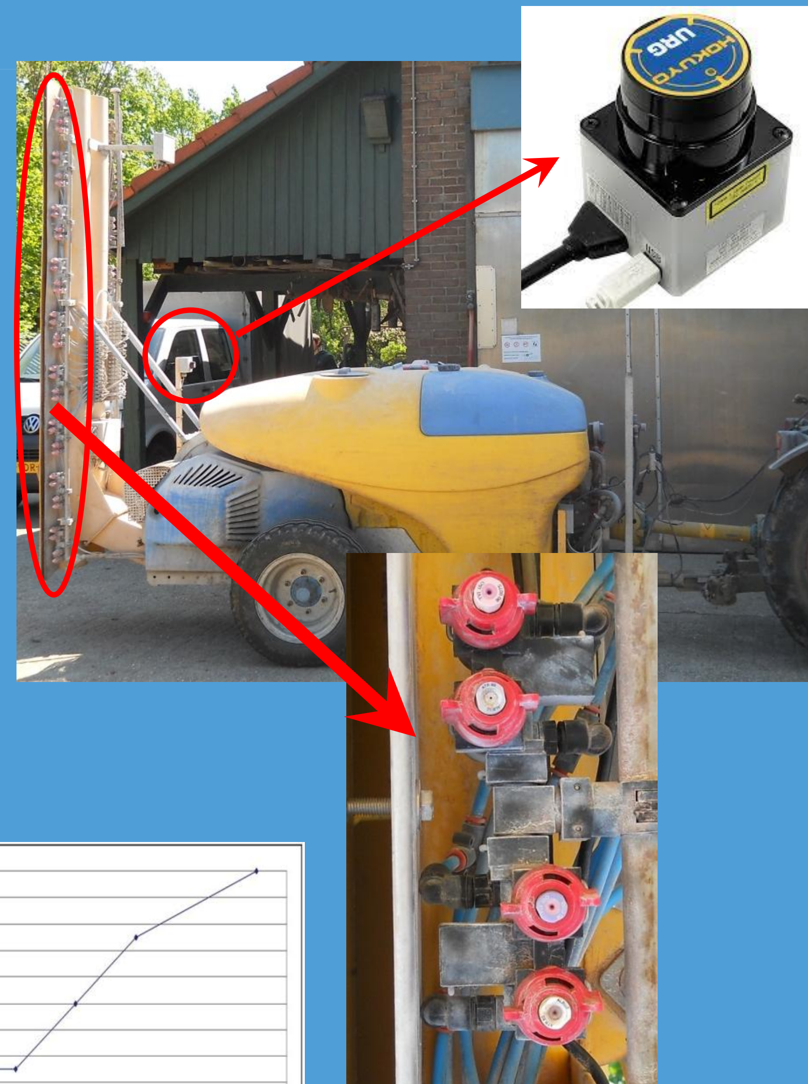
- Apply only there where it is needed and with the amount adjusted for the crop canopy size and structure

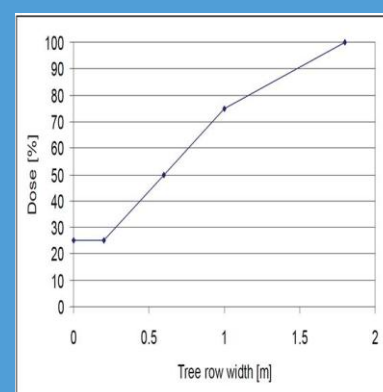
Introduction of Canopy Density Spraying

- Sensing of the crop status / density
- Decision taking on the spray volume
- Actuating for the right application rate
- Based upon the knowledge of
  - Precispray *1999-2003*
  - SensiSpray project within potatoes *2007-2008*
  - Variable rate spraying in flower bulbs *2006-2009*
  - CASA sprayer from EU project ISAFRUIT *2006-2010*

Canopy Density Spraying (CDS) in apple and pear

- Laser ranger scanner measures distance and density of leaves
- Decision algorithms adjust number of nozzles spraying
- Varioselect nozzle bodies activate one or more nozzles
- Variable air amount depending on wind speed, wind direction driving speed and direction



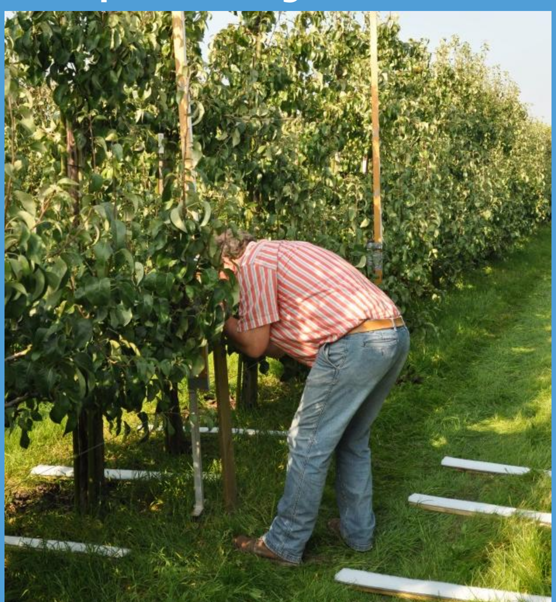


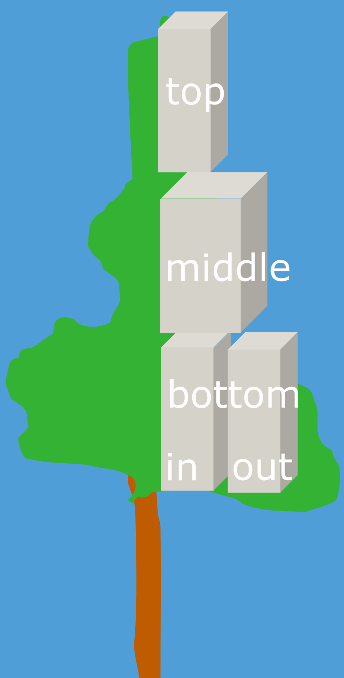
Canopy Density Spraying (CDS) in orchards

Automatic and **real-time** adjustment of an orchard sprayer based on measurement of **canopy characteristics**

Spray deposition measurements - tree

- Tracer BSF + Agral Gold
- Measurement on **leaves** and at collector on ground
- Following ISO -22522 (2007)
- Sampling every 10th leaf picked per sample zone
- Sampling 3 trees per object





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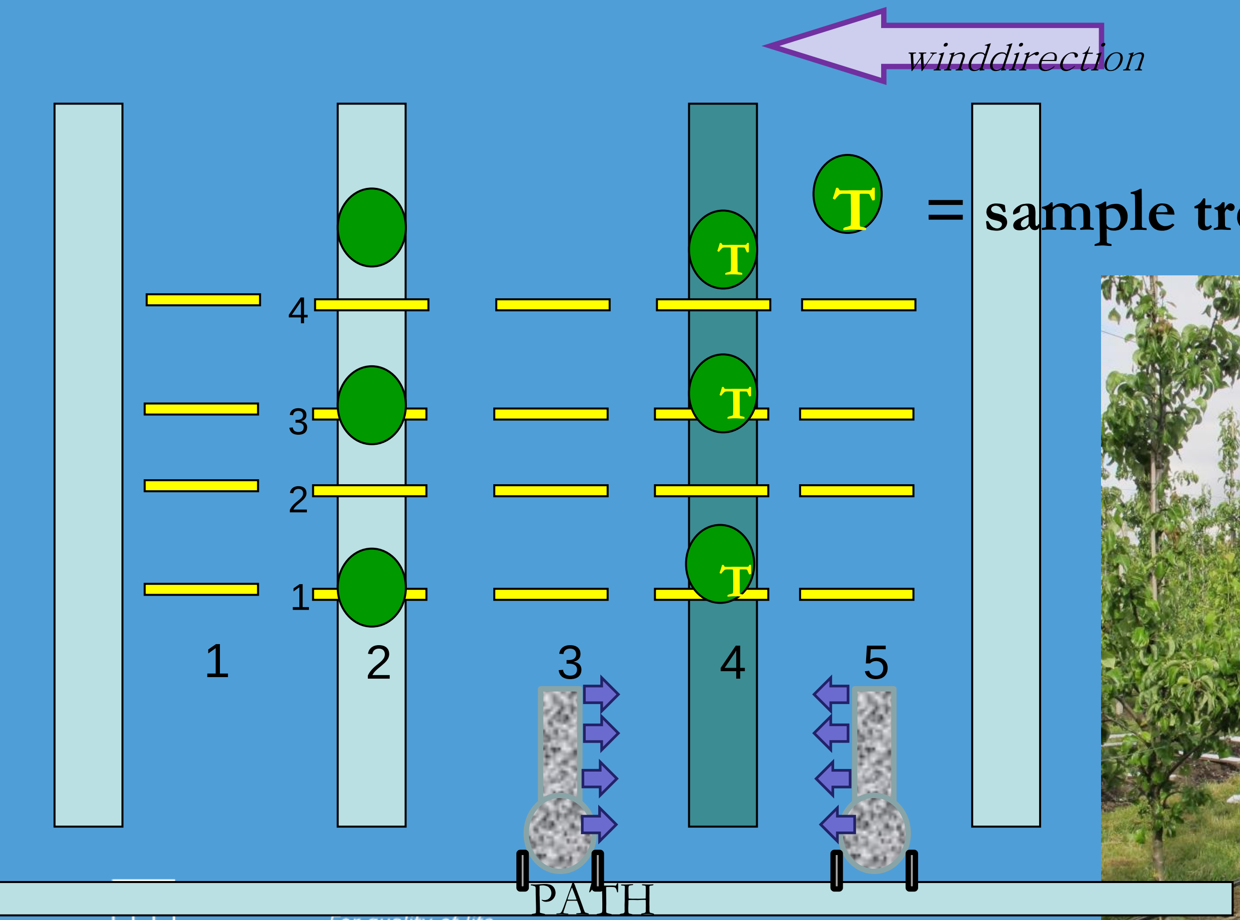
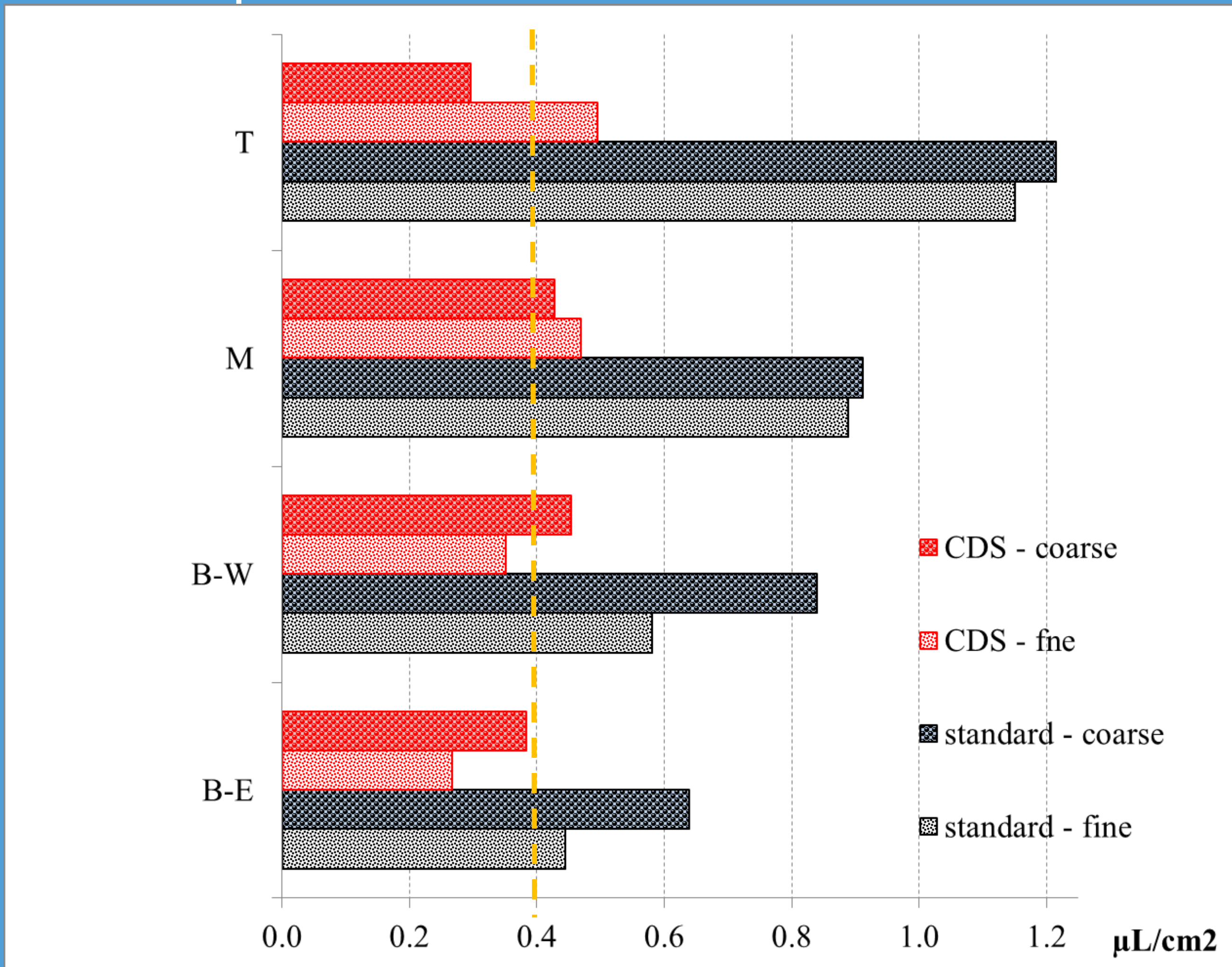
Spray deposition measurements - ground

- Tracer BSF 0,7 g/L + Agral Gold
- Measurement on leaves and on collector on the **soil**



Results 2012 – deposition measurements

- Pear spindle



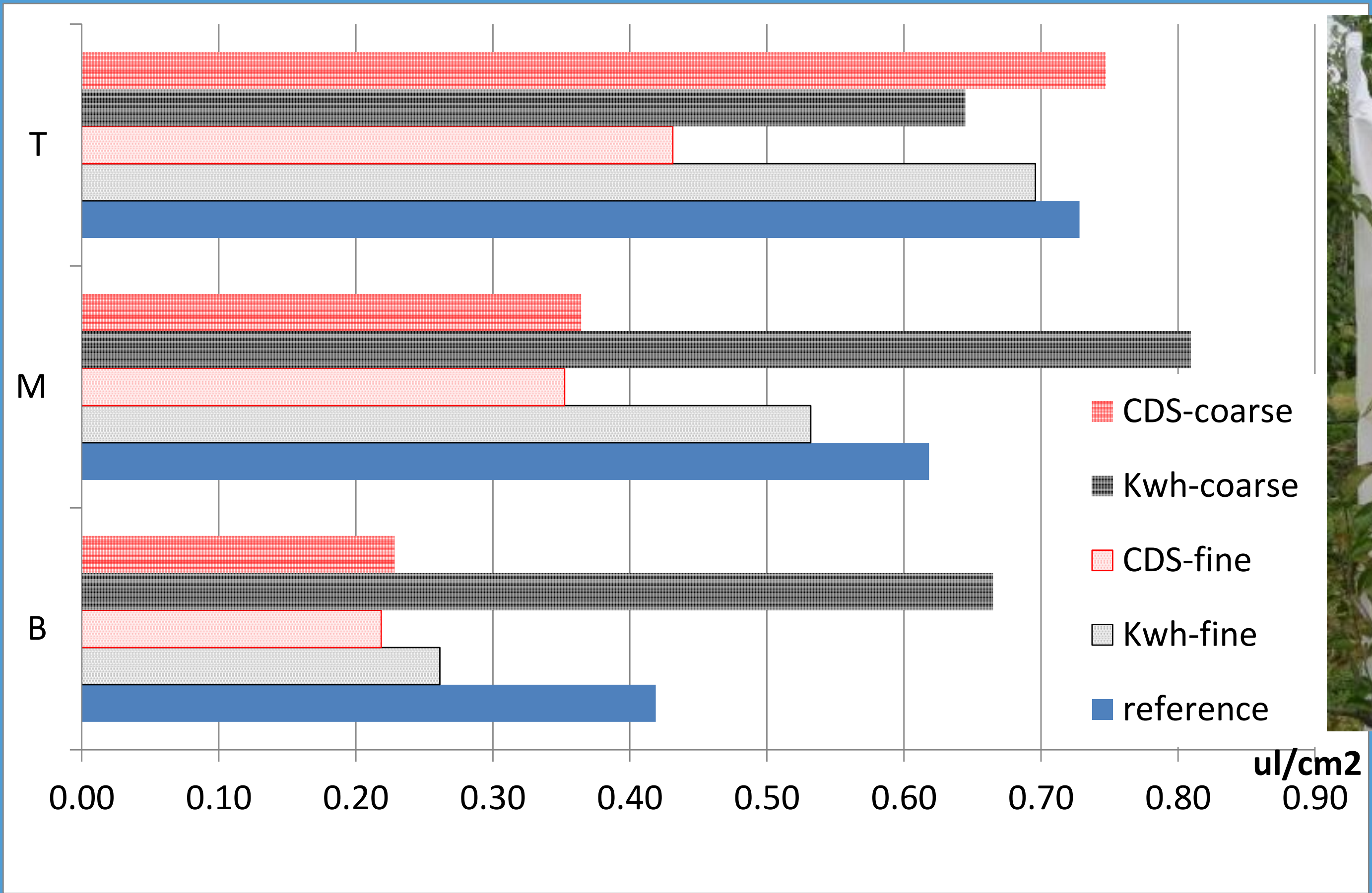
Reference 0.4 µl/cm²

Results 2012 – deposition measurements

- Deposition of CDS comparable to Munckhof reference = 0.40 µL/cm^2
- Deposition of the CDS was lower than of the KWH crossflow sprayer (0,80 µL/cm^2)
- Deposition of CDS was more homogeneous
- Spray volume reduction was 46% (BBCH 71)

Results 2014 – deposition measurement

apple spindle



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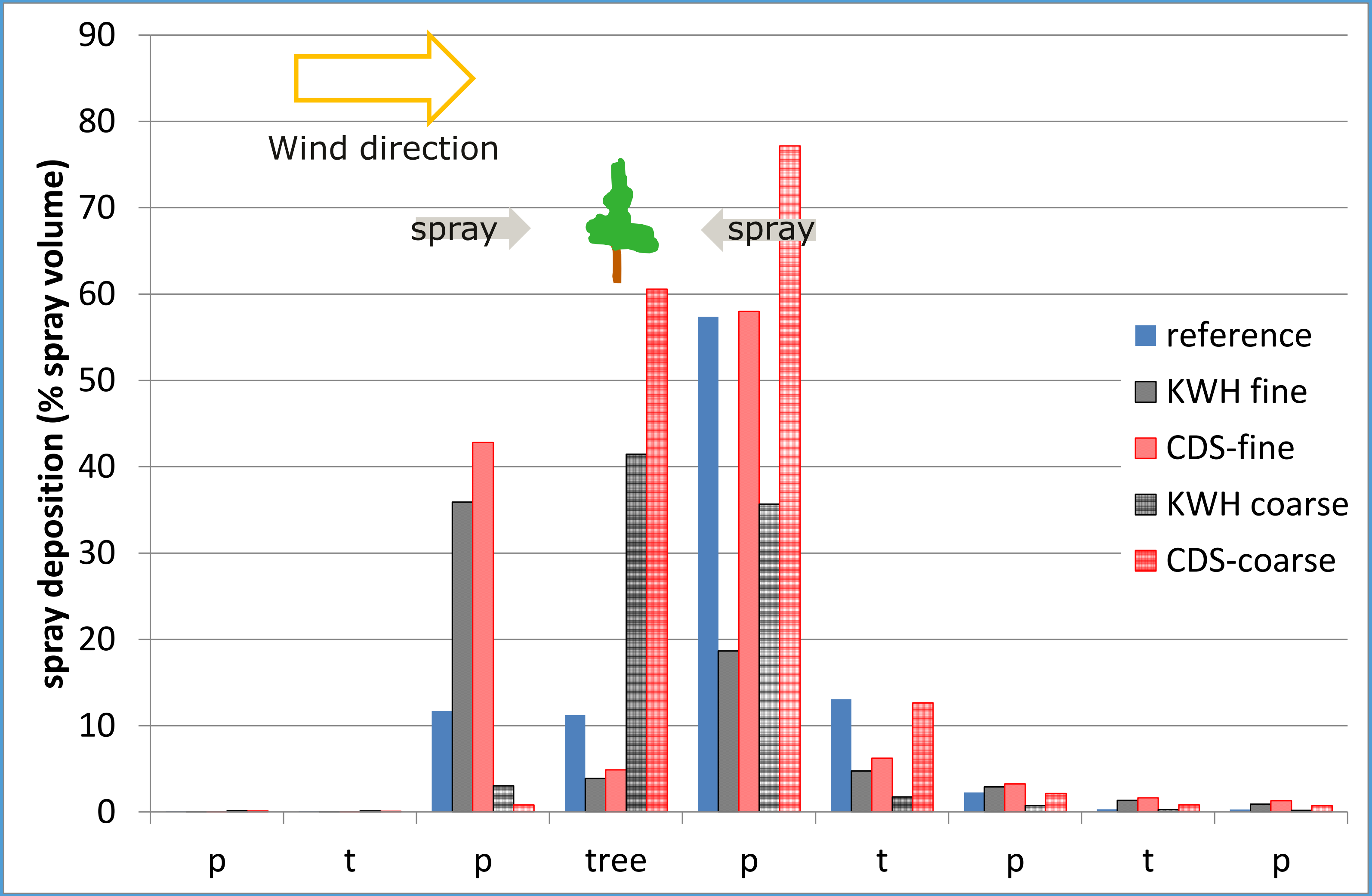
Spray deposition on soil surface – single tree row spraying from both sides



Results 2014 – deposition measurements

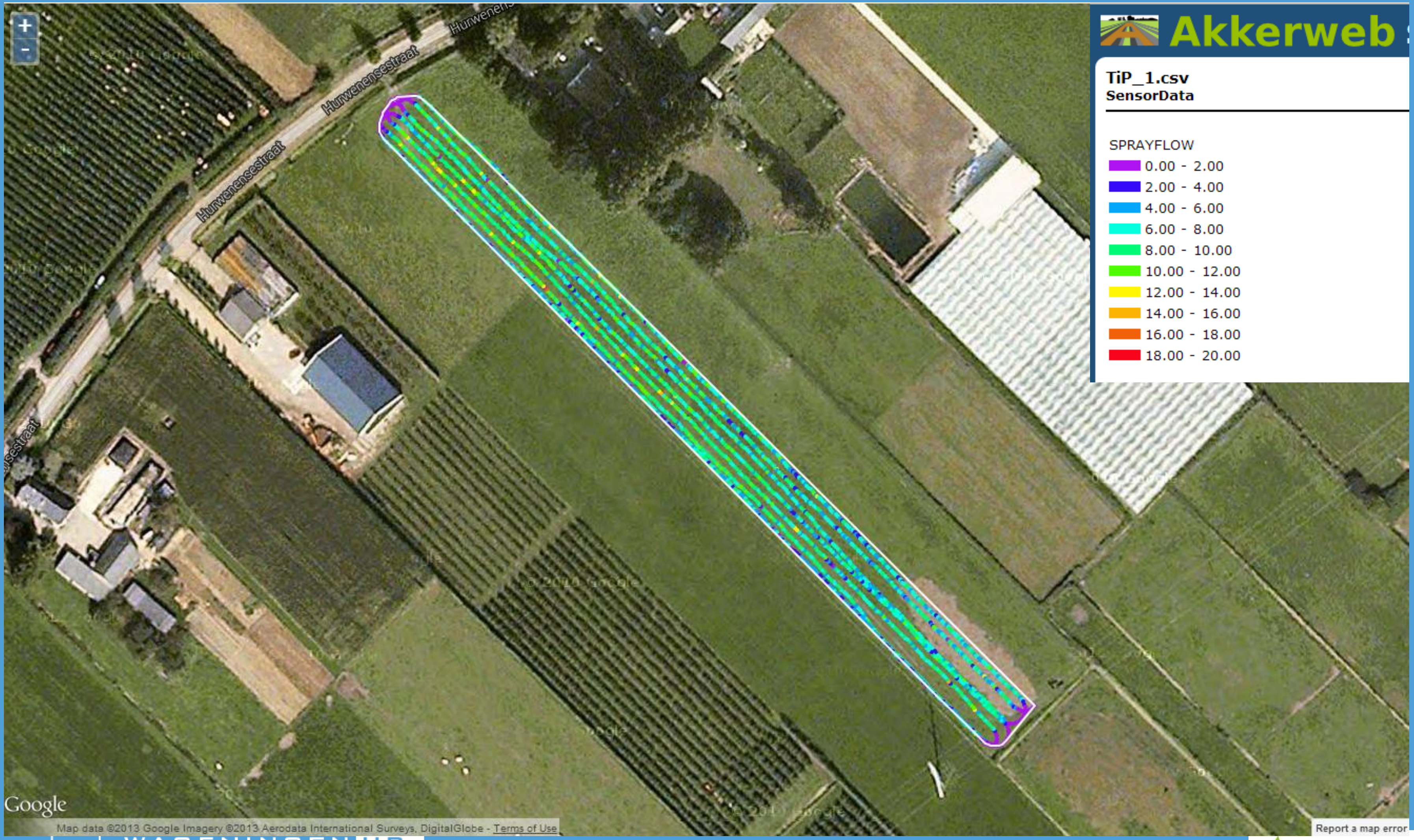
- Deposition of CDS lower than reference = 0.60 µL/cm^2
- Deposition of the CDS was lower than the KWH crossflow sprayer (fine 0.50 µL/cm^2 - coarse 0.70 µL/cm^2)
- Deposition of CDS was more homogeneous

- Forward speed 7.5 km/h to high for sensor resolution
- Open structure tree – adaptation of dose algorithm

- Very high spray deposition under treated tree row and paths alongside with coarse spray applications 35%-75%
- High spray deposition on downwind path for reference

Tested in practice by the grower - 2012

sprayflow [*L/min*]



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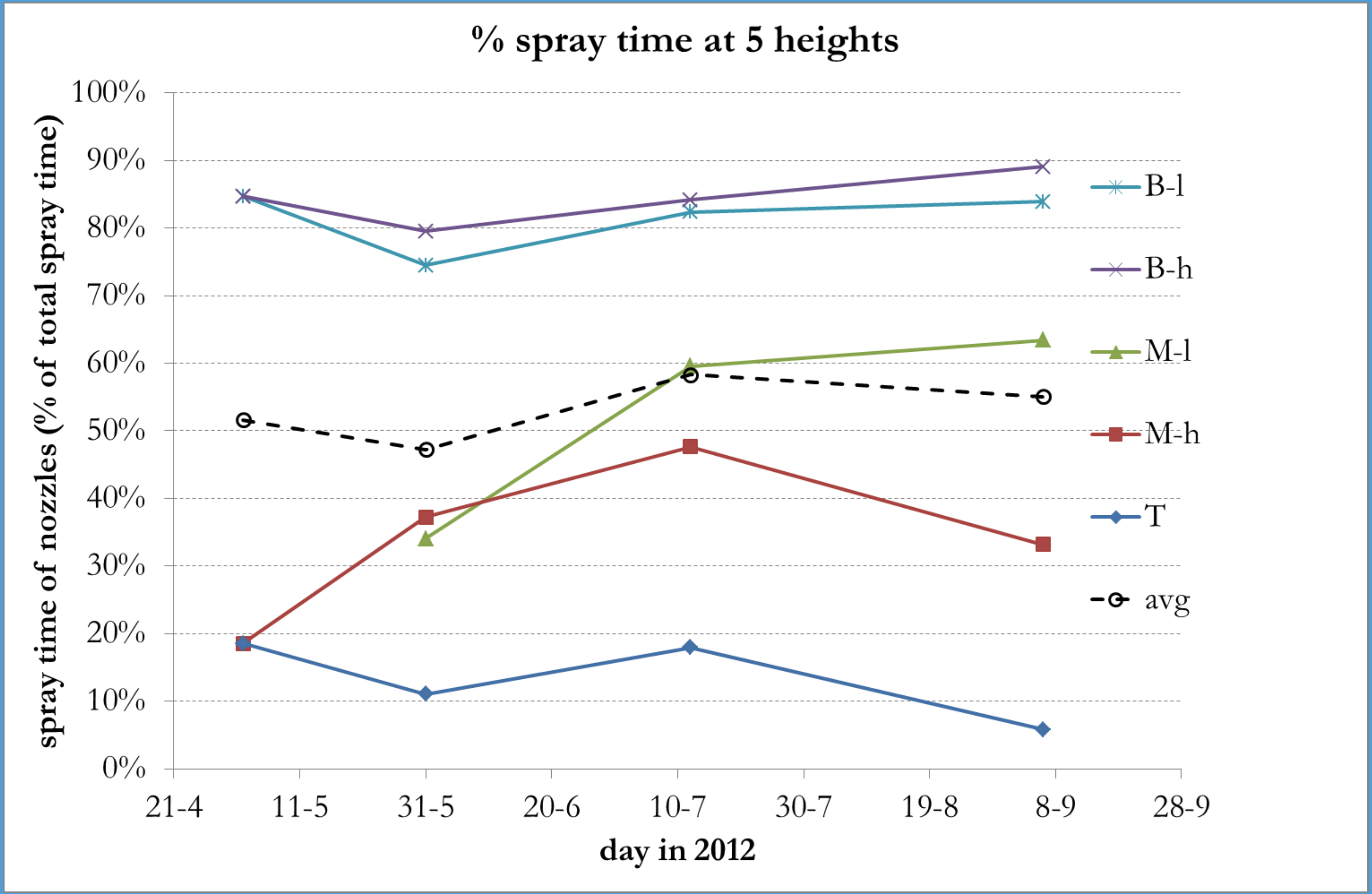
Results 2012 - CDS data



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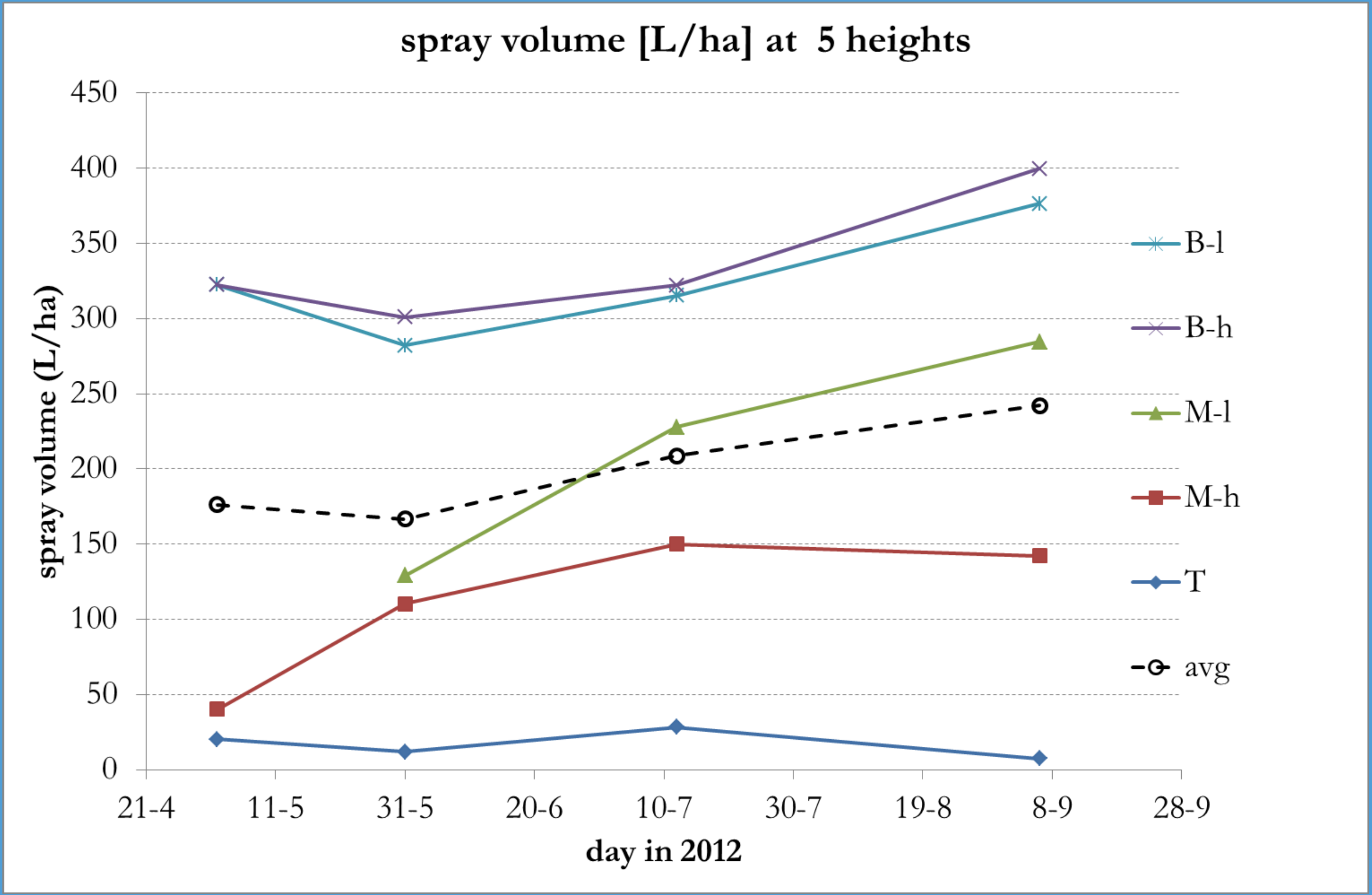
Results 2012 - CDS data



Use reduction 49% - 65%

Adapted spray deposition from new developments e.g. multi-row sprayers

Verified spray deposition in trees show:
Increase of 25%, and more even distribution over different parts of the tree (CV 40%-60%)

More attention for nozzle type and air assistance settings

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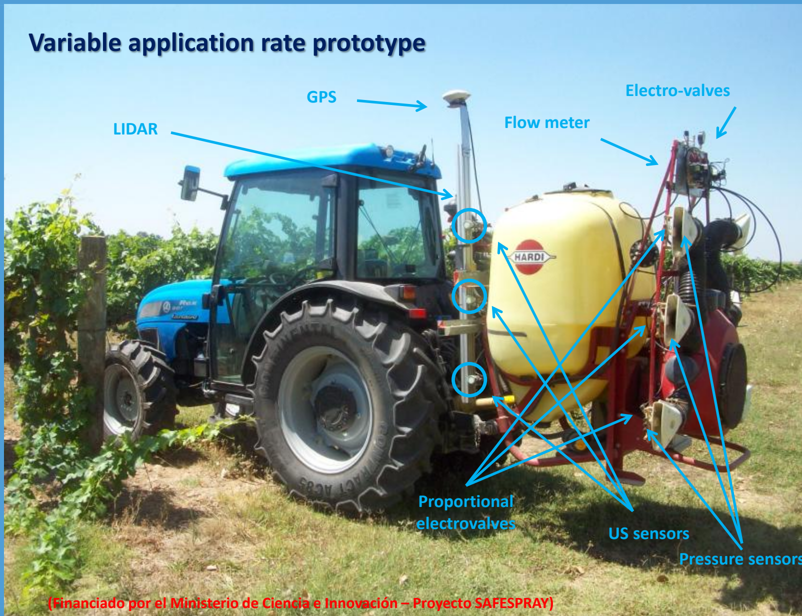
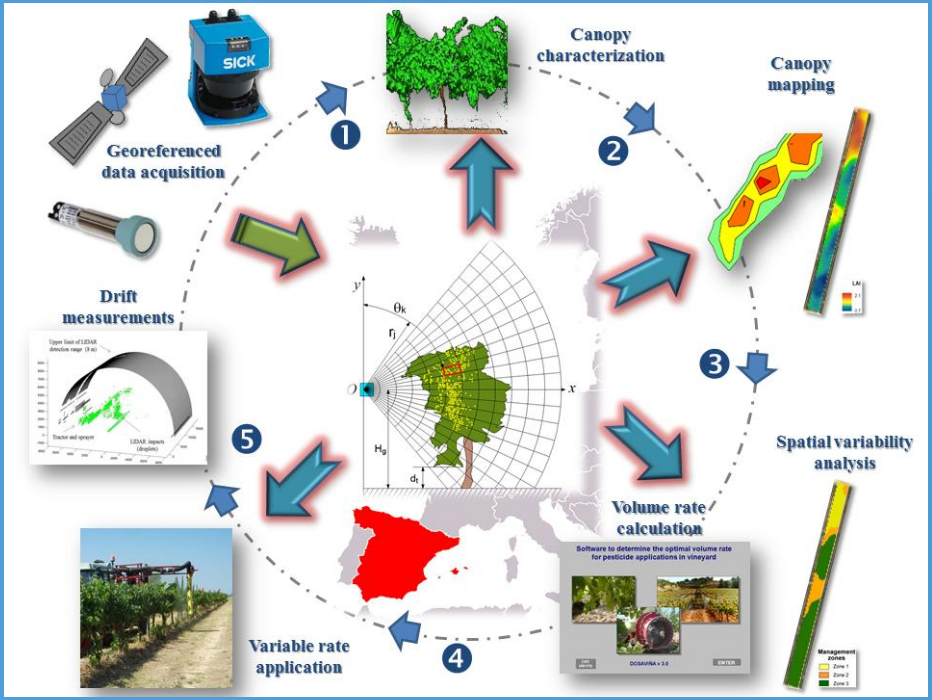
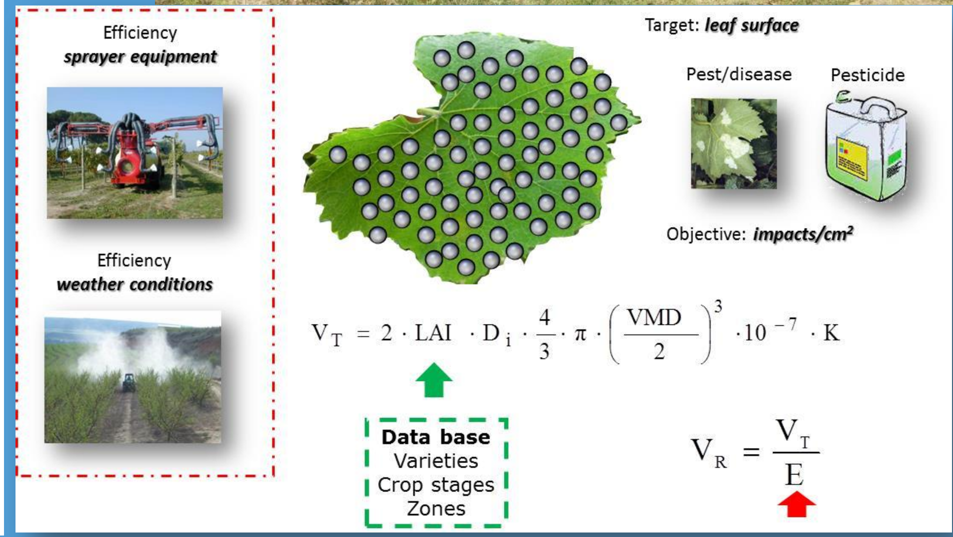
Similar developments in other countries

- Spain – CAS, DosaVina (40%)
- Italy – revival of tunnel sprayers (30%)
- Germany – effect of sprayer air speed and forward speed







Conclusions and recommendations

- Spray technique:
  - Plays an important role in crop protection
  - Important to measure spray deposition
  - Need for re-evaluating dose-response algorithms
  - is important for IPM
    - Reduces spray drift
    - Reduces PPP input
    - Reduces level of MRL
- Need for better understanding spray deposition process
- Need for a classification and certification system

Use reduction + drift reduction = emission reduction

Thank you for your attention !

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The future?

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