Experimental determination of a foliar wash-off coefficient – development of a laboratory procedure

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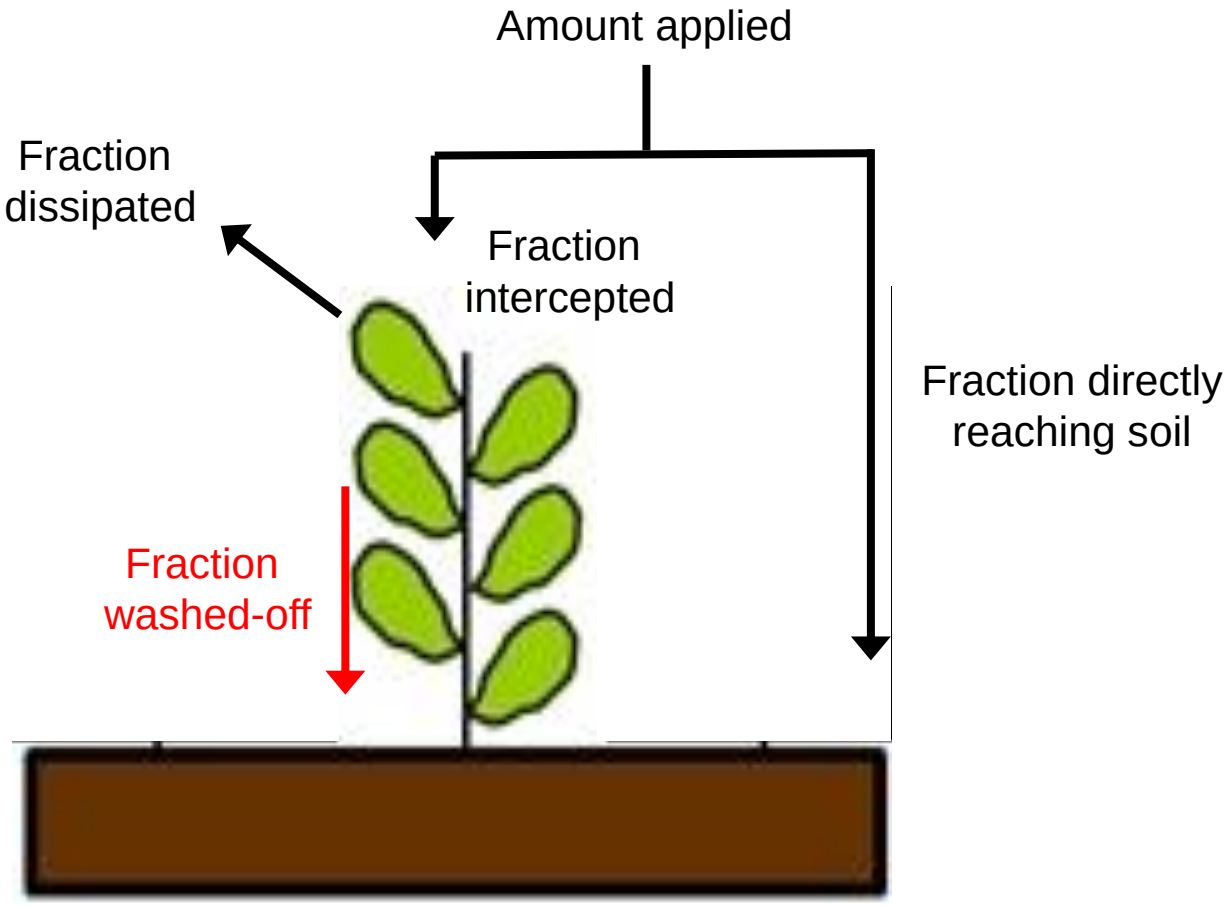
Foliar wash-off



Foliar wash-off introduced in the FOCUS scenario only by a default coefficient of 0.1 mm^{-1}

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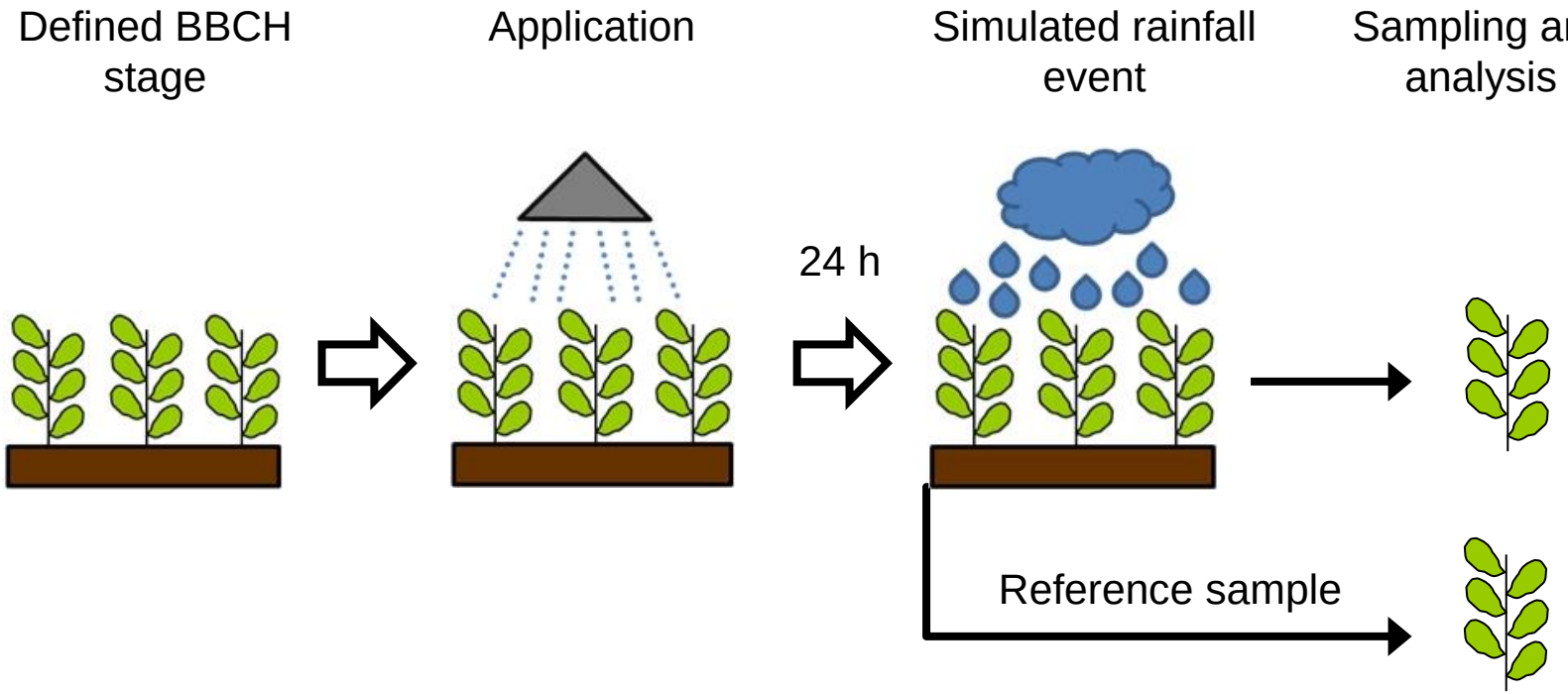
General experimental set-up



Generation of a reproducible simulated rainfall event with wash-off effect comparable to natural rain.

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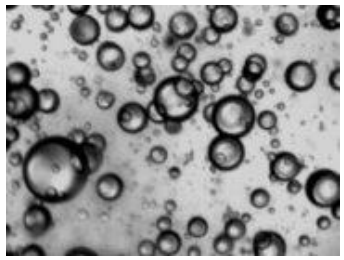
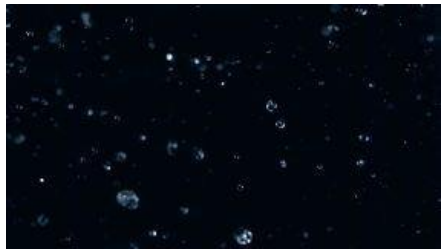
Determination of rain parameters – traditional methods

- Main rainfall parameters
  - Intensity
  - Amount
  - Droplet size distribution
- Traditional measurement methods
  - Absorbent paper method
  - Flour method
  - Silicon oil method
  - Photo method





Time consuming and not delivering all parameters at one time. No online measurement possible.

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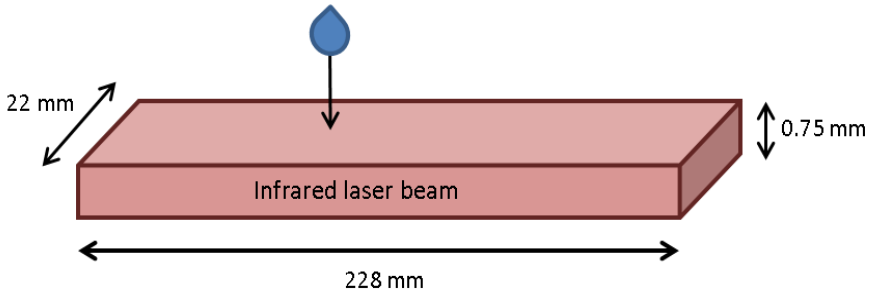
Determination of rain parameters - LPM

- The Laser Precipitation Monitor (LPM) determines all relevant parameters (intensity, amount and droplet size distribution) online



Pictures: Adolf Thies GmbH & Co. KG

Fast, delivering comprehensive data and easy to use device

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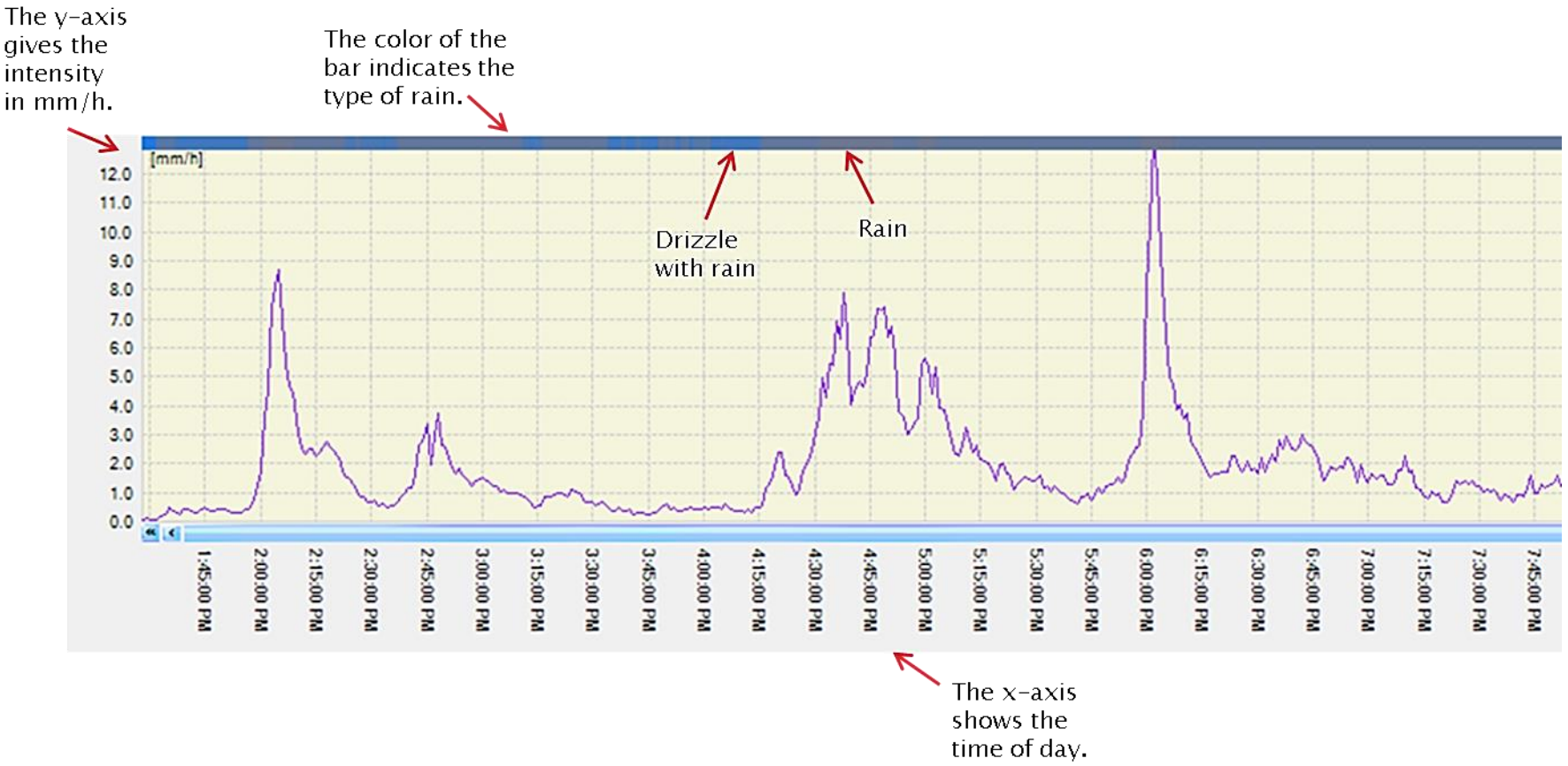
LPM Output: Intensity

- The output of the intensity measurement shows data values over a definite time interval



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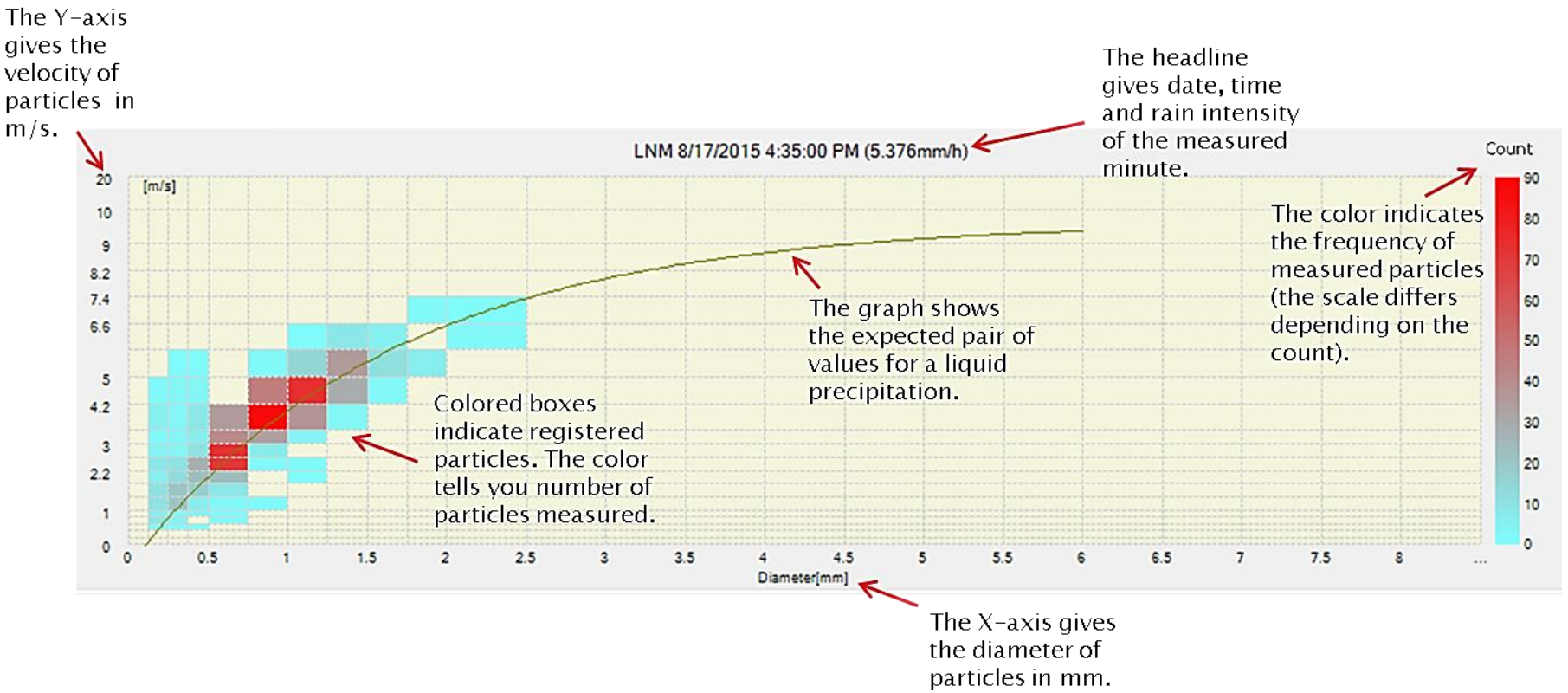
LPM Output: Droplet size and speed distribution

- Every minute, diameter and velocity of droplets are measured and the number is counted



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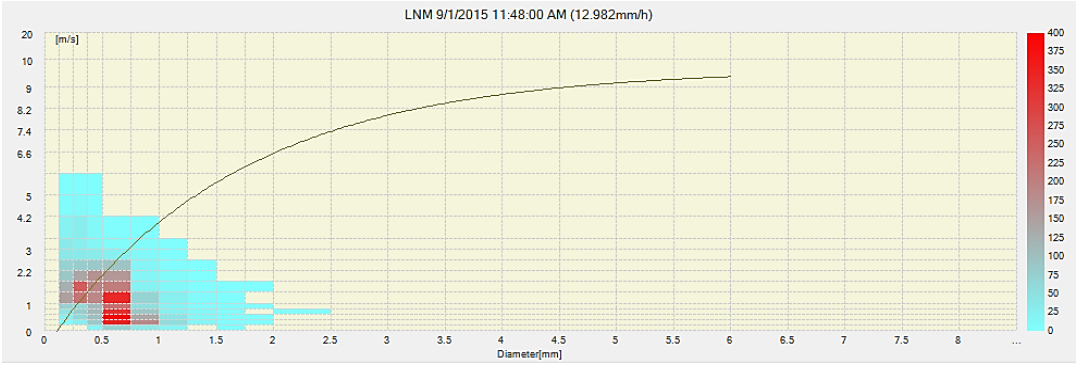
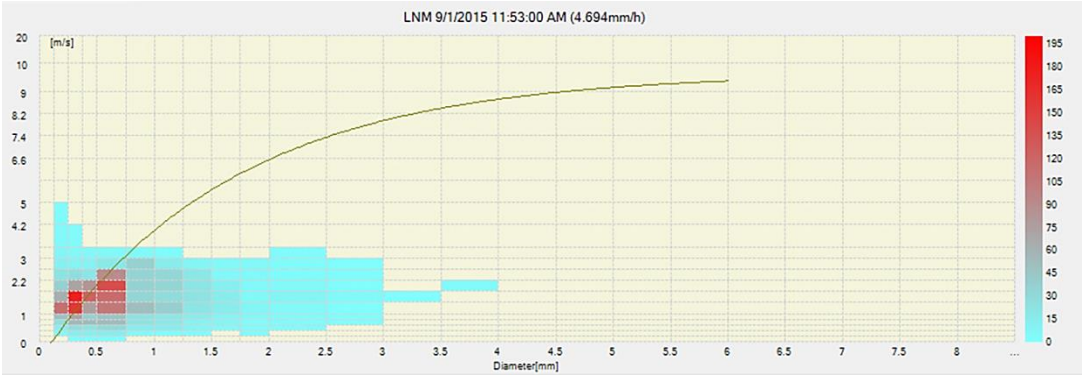
Rainfall simulated by a track sprayer



Small droplet size, too high spray pressure



Best result compared to natural rain

What is the relevant parameter for reproducible wash-off experiments

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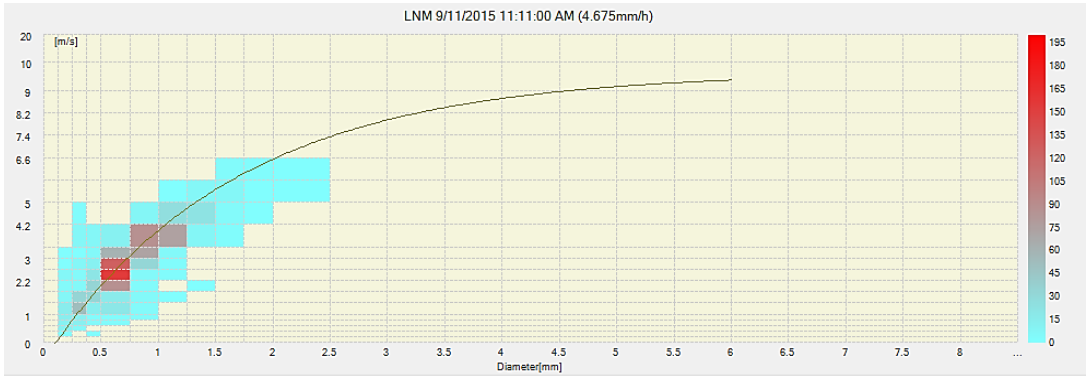
Rainfall simulated by a height test



Parameters similar to natural rain
at height > 5 m

Is a natural size and speed distribution
of the droplets necessary

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Rainfall simulated by a track sprayer – kinetic energies

- Kinetic energy of the rain as a parameter to compare rainfall events

$$E_{kin} = \frac{1}{2} m v^2 \times \text{drop number}$$

v: directly measured by LPM
m: calculated assuming spherical droplets

	Intensity [mm/h]	Kinetic energy [mJ/min]
Light rain	0.4 ± 0.06	0.1 ± 0.04
Moderate rain	2.1 ± 0.03	1.5 ± 0.1
Heavy rain	5.8 ± 0.8	4.5 ± 1.3
Capacity size 5 Nozzle	3.5 to 8.0	1.5 to 6.5
Capacity size 10 Nozzle	17.6 to 19.9	10 to 15
Wash-off experiment	4.8 ± 0.4	2.1 ± 0.3

Kinetic energies of common rain events can be simulated easily

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Determination of foliar wash-off coefficient

- Experimental setup
  - Wheat as representative crop at BBCH 41-43
  - Radioactive (^{14}C) labelled plant protection product (PPP) applied by a track sprayer according to good agricultural practice
  - Simulated rainfall event 24 h after PPP application
  - Sampling after different rain amounts
  - Determination of PPP remaining on the foliar surface by radioactivity monitoring

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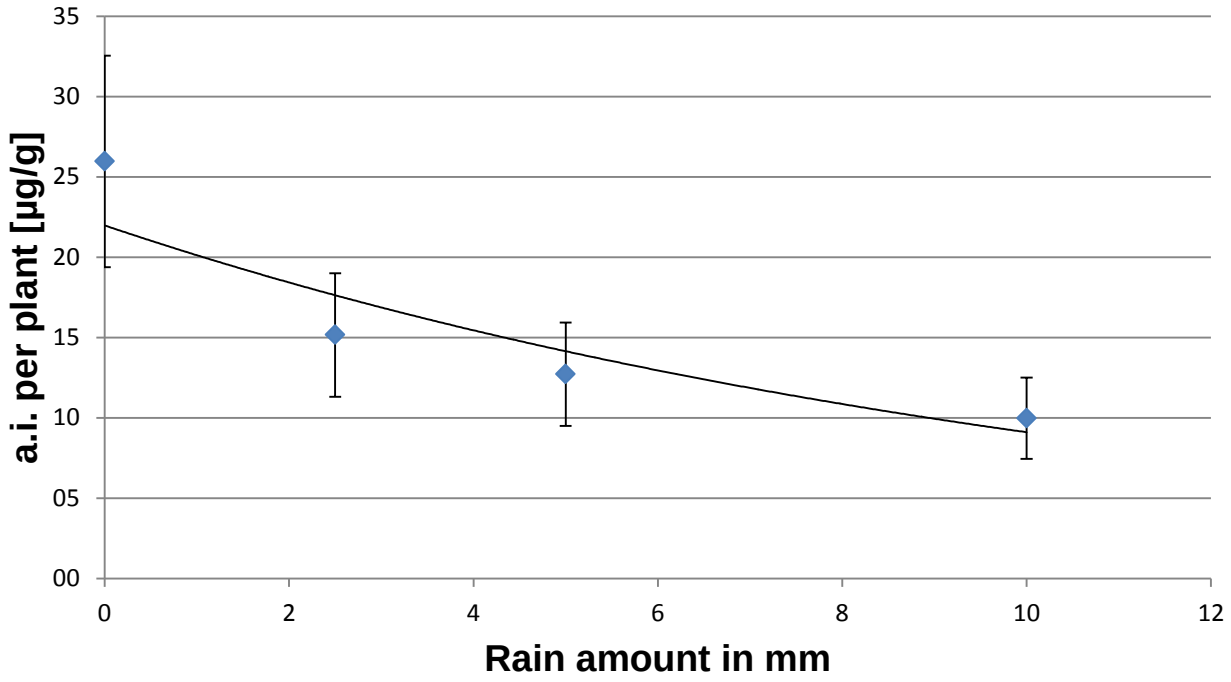
Determination of foliar wash-off coefficient



Exponential regression: $y = 21.975e^{-0.088x}$

Wash-off coefficient: 0.088 mm^{-1}

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Summary and outlook

- Foliar wash-off already included into FOCUS scenario
  - Increasing PECsoil values
  - Default wash-off coefficient 0.1 mm^{-1}
- Suitable experimental procedure for wash-off determination developed
  - Determination of rain parameters as key step
  - Kinetic energy of rain as proposed parameter to compare rain events
- Procedure successfully tested using a ^{14}C labelled PPP
- Next step: verification of the method by other labs
  - Ring test is in preparation
  - Is kinetic energy of rain sufficient as parameter to compare rain events?

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Thank you for your attention

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