BEST PRACTICES TO AVOID POINT SOURCES

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May 2019

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- Key risk areas for point sources
- Point sources and sprayers
- Residual volumes
- Internal sprayer cleaning
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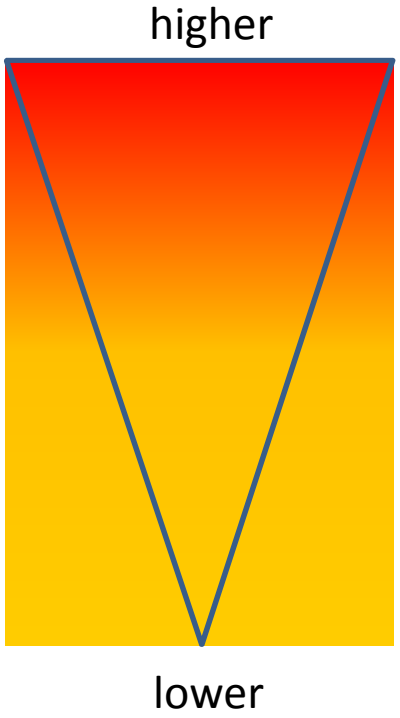
Avoid PPP losses from point sources
Awareness of key risks helps focus on prevention



Key Risks

- **Sprayer cleaning**
- **Mixing and loading**
- **Remnant management**
- **Empty container disposal**
- Transport to the field
- Farm pesticide storage
- Transport to the farm

POINT SOURCE MITIGATION IS STRONGLY RELATED TO SPRAYER TECHNOLOGY

Risks for PPP entries	Risk - evaluation	Mitigation potentials Sprayers
POINT SOURCES		
CLEANING	**+++**	**+++**
FILLING	**++**	**++**
REMNANT MANAGEMENT	**++**	**++**
STORAGE	**+**	**-**
TRANSPORT FIELD	**+**	**+++**
DIFFUSE SOURCES		
RUN - OFF	**+++**	**-**
DRAINAGE	**+(+)**	**-**
DRIFT	**+ (+)**	**++(+)**

+++ high, + low risk reduction potential

Cleaning - inside : field sprayer

Total technical residual volume

Spray mixture which remains in the sprayer, which cannot be delivered with the intended application rate
Indicater: 25% drop of pressure shown at manometer

→ Definition of empty sprayer (EN12761/ISO 16119)

Current standards for Fieldsprayers

Total residual volume in l (EN 12761-2)				
Tank		Boom		
Tank volume	0, 5 %	length m	2l / m	Total litres
800	4	15	30	34
3000	15	21	42	57
4200	21	36	72	93

If the cleaning is not done properly some of these residual volumes may end up in the water

Arable Farmers clean their sprayers 7 to 10 times / season*

*TOPPS farmer survey 2007

Cleaning Inside: Bush & Tree Crop Sprayer
Residual volume

Residual volume in l (ISO 16119-3)		
Tank volume	%	Liter total
400	4	**16**
800	3	**24**
1 500	2	**30**

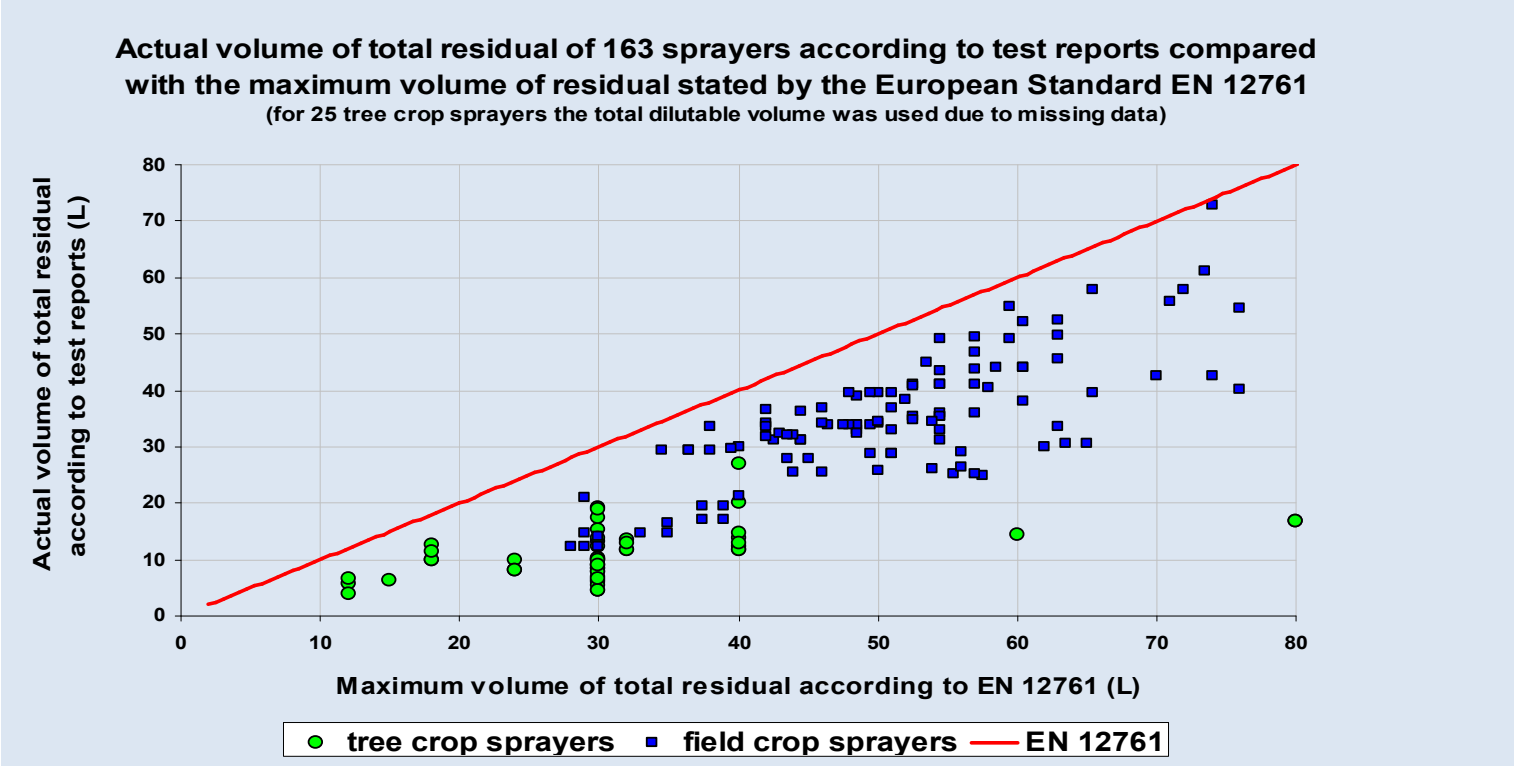
- Residual volume in BTC – Sprayers lower due to less pipes (hydraulic network – no boom)
- but concentrations sprayed are higher and more applications in specialty crops (cleaning frequency ?)

Thorough inside cleaning is necessary

Cleaning – Inside
Residual volume

Analysis of ENTAM – reports on conformity of sprayers with the EN standard 12761

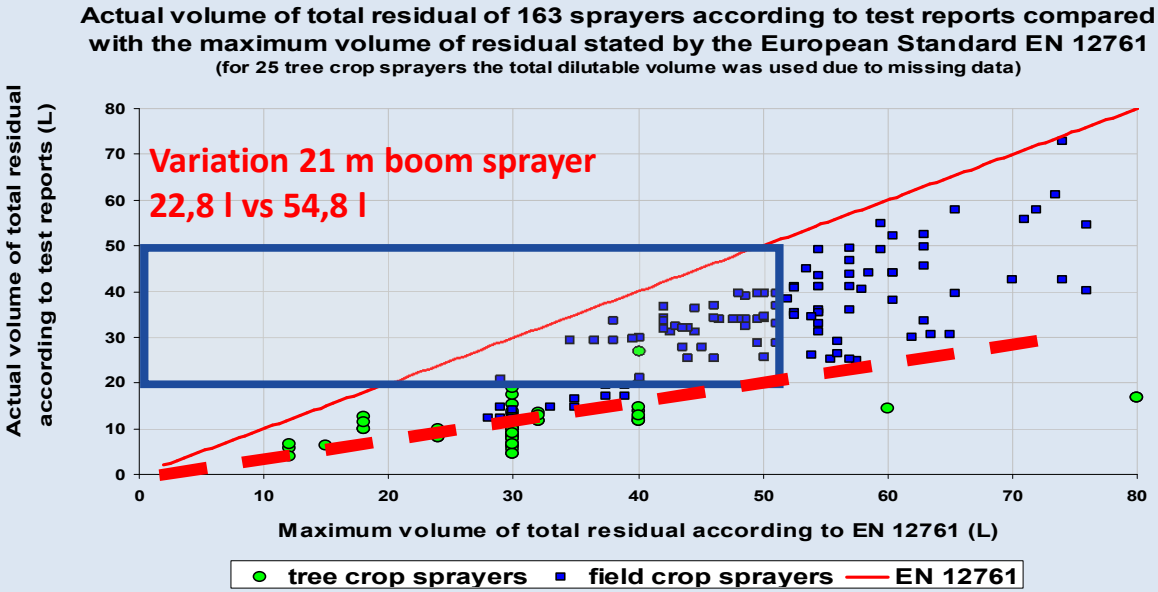
AAB conf.2008 : C. Debaer et al.



All of the new sprayers tested complied with the EN standard 12761/ISO 16119

Internal Cleaning

.... sprayers should be designed for lowest possible residual volumes - effective mitigation measure to reduce point sources



Standard should be more ambitious

Residual volumes also have a little known economic aspect

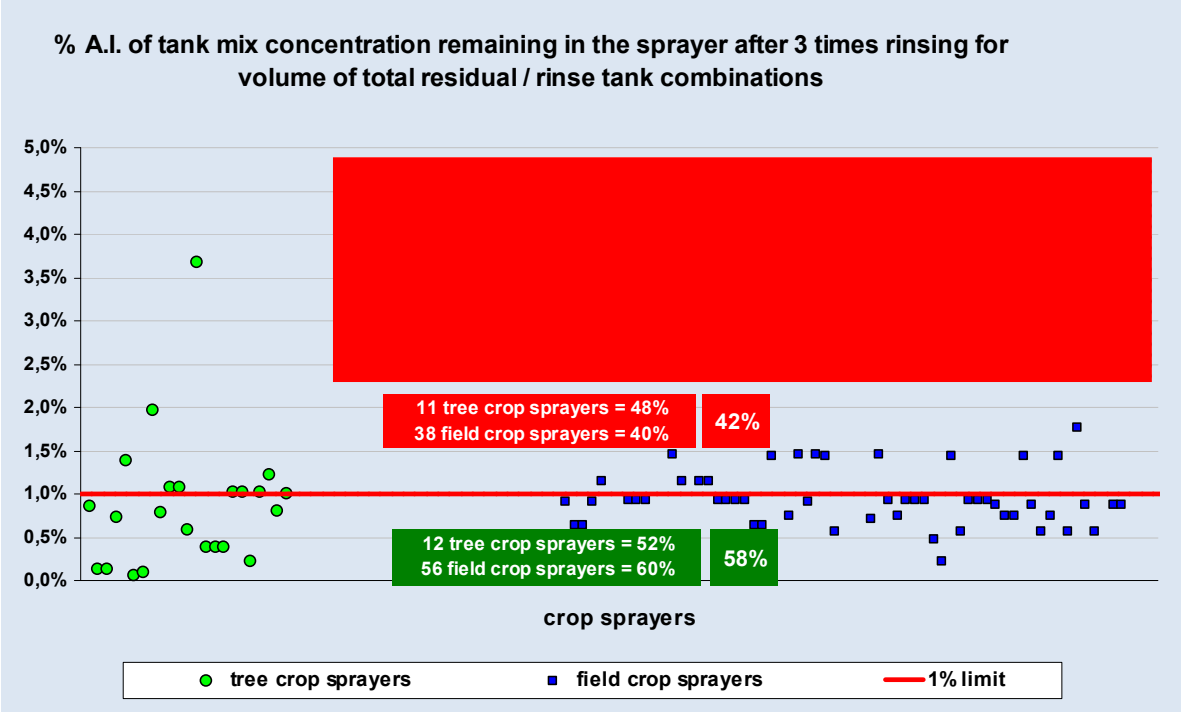
Lower residual volumes mean

better use of PPP, better internal cleaning, clean water capacity for outside cleaning

Farmers are not well aware of residual volumes

Cleaning process

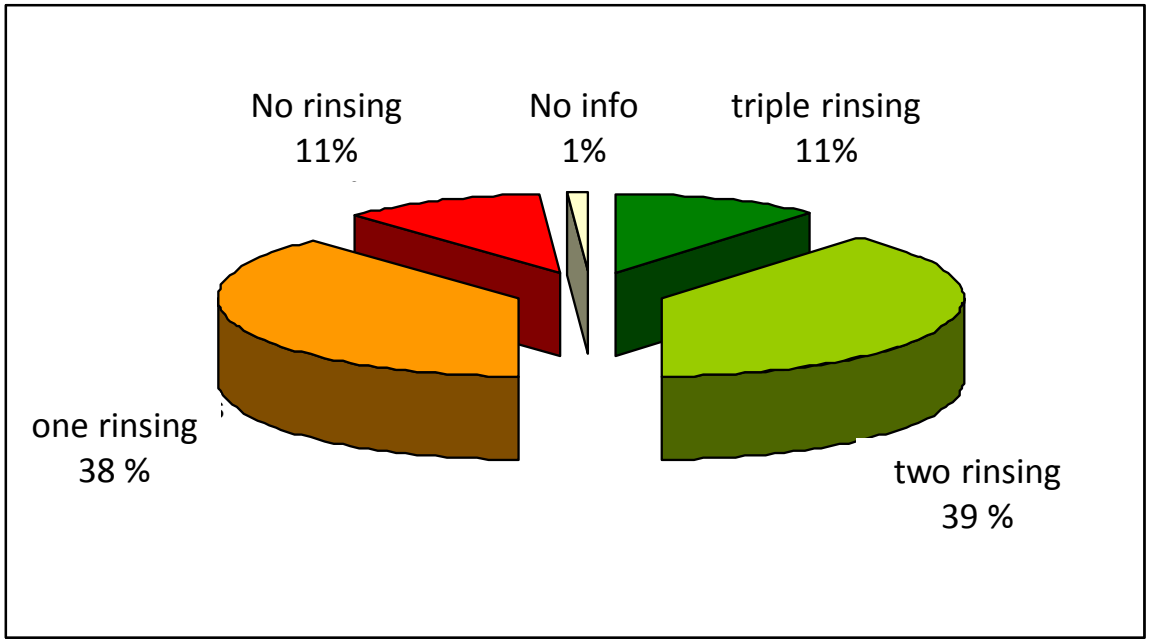
Rinse water capacity not always sufficient / not compliant with Standard to reach a dilution spray solution by a factor of 100 (ENTAM sprayer tests)



Risk of water contamination can be effectively reduced if diluted remnant will remain in the field (natural biobed)

C. Debaer et al. AAB conf.2008 Cambridge, UK changed

Rinsing practice (Fieldsprayers F)

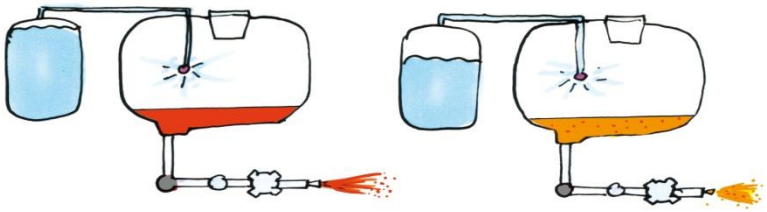


triple rinsing takes time and is inconvenient (multiple step down from tractor)

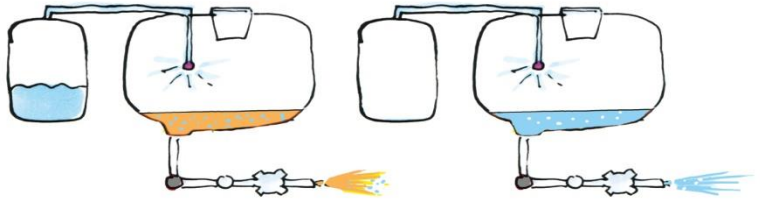
we assume that triple rinsing is not always done

TOPPS farmer survey 2007
Arvalis Inst. du vegetal, Chambre Agiculture Nord Pas Calais
Pilot catchment areas (Farmer n = 100)

Best Management Practice (key recommendations)



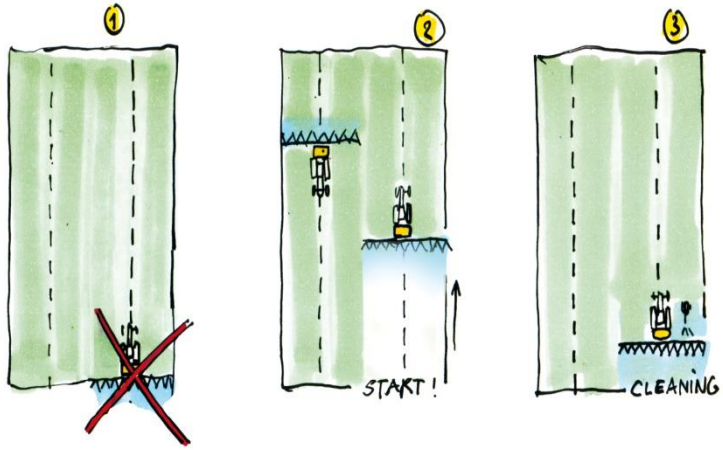
Cleaning inside (after spraying)



Rinse three times

(how many sprayers in use have a rinse water tank?)

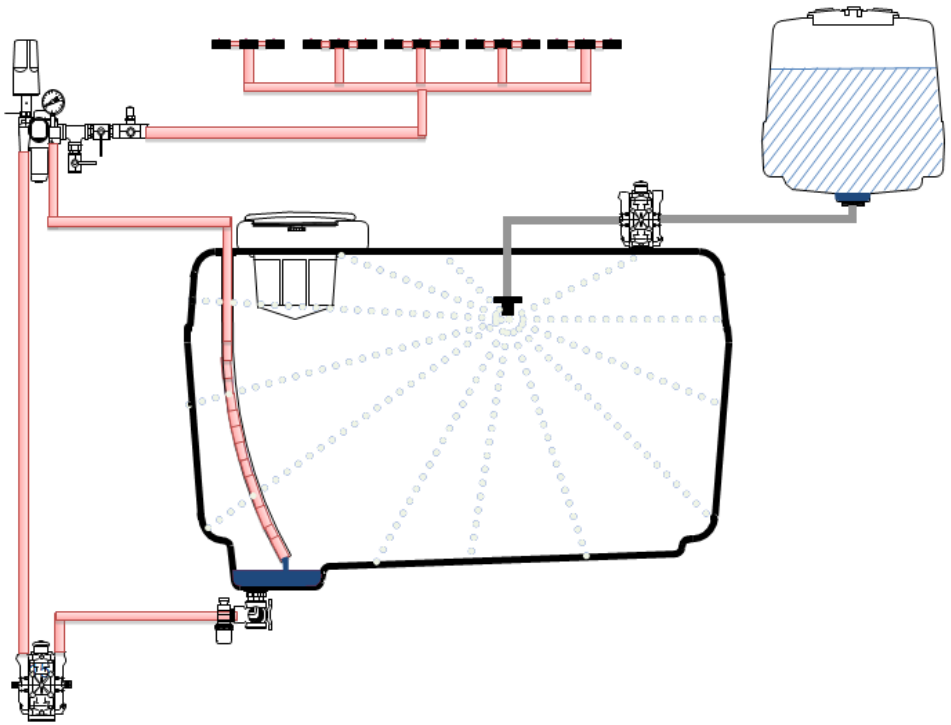
Spray diluted spray solution out in field where you have started spraying



Never bring undiluted spray back to the farm if not reused or treated

RECOMMENDATION: BEFORE RINSING SPRAY UNTIL AIR COMES AT THE NOZZLES – Residual volume can be further reduced (about 3 times) , but full dose is not applied

Continuous cleaning / rinsing



1 | Spray tank Ăemptyñ in the field
Until pressure drops and nozzles close

2 | ĂSpray tank nearly emptyñï until air blows at nozzles

3 | Sprayer pump still operates !!!
Backflow is completely open.

4 | Drive to the field edge where you have started with the spraying

5 | Activate clean water pump
(from tractor)

6 | Start spraying where you have started the spray application in the field / reserved untreated part. Close backflow after few minutes.

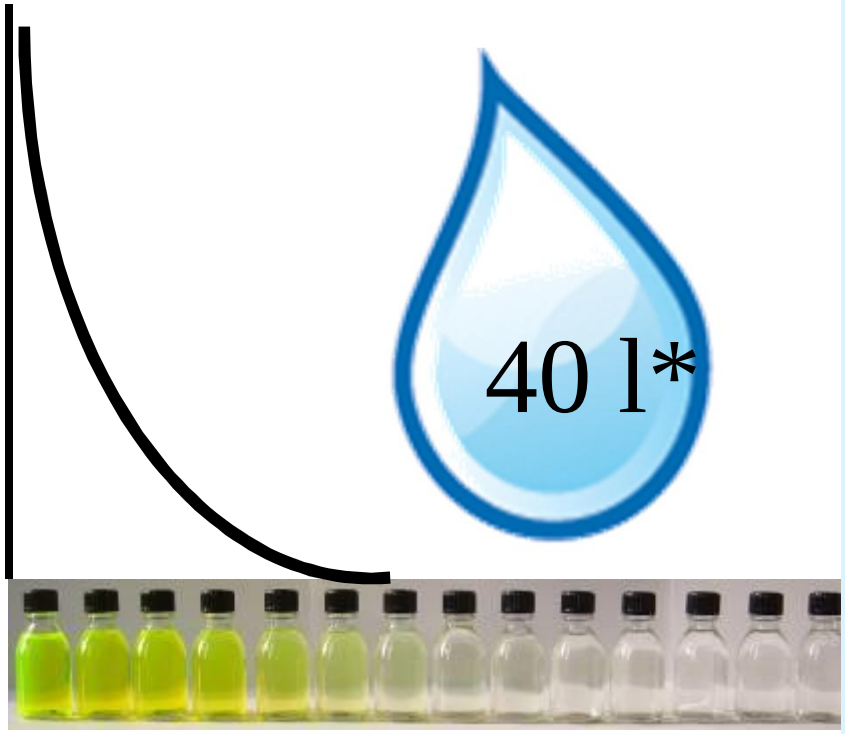
7 | If the clean water tank is empty , pressure drops and nozzles close , rinsing process is completed.

Continuous cleaning / upgrading

TOPPS clean

(1 step cleaning)

logarithmic dilution to < than 1 %



H.Kramer, Kartoffelbau 3/2008 - * Sprayer 600 l, 12 m boom

Continuous cleaning more efficient and convenient

- faster
- can be done easy directly from tractor
- Sufficient rinse water for external cleaning
- But additional pump required

Current concept of multiple rinsing

- More water needed / bigger rinse water tank
- More time needed

Various companies offer upgrading kits . Continuous cleaning now implemented in some new sprayers

Dumping of undiluted residual spray volume is a high risk for creating point source water pollution.

- Residual volumes must always be diluted.
- Dumping residual volumes on hard surfaces without collection devices must be absolutely avoided.
- Cleaning of sprayers need to be executed on biologic active areas, if no special washing place exists.
- It must be avoided to contaminate surface and groundwater with washing waters. (consider safety distances).

Cleaning from outside

- Contamination with PPP on the outside of sprayers can be significant especially with sprayers using air support.
- External contamination also dependent on sprayer design

  Air intake, surface of tank, droplet size, ect.

Outside cleaning device and cleaning in the field

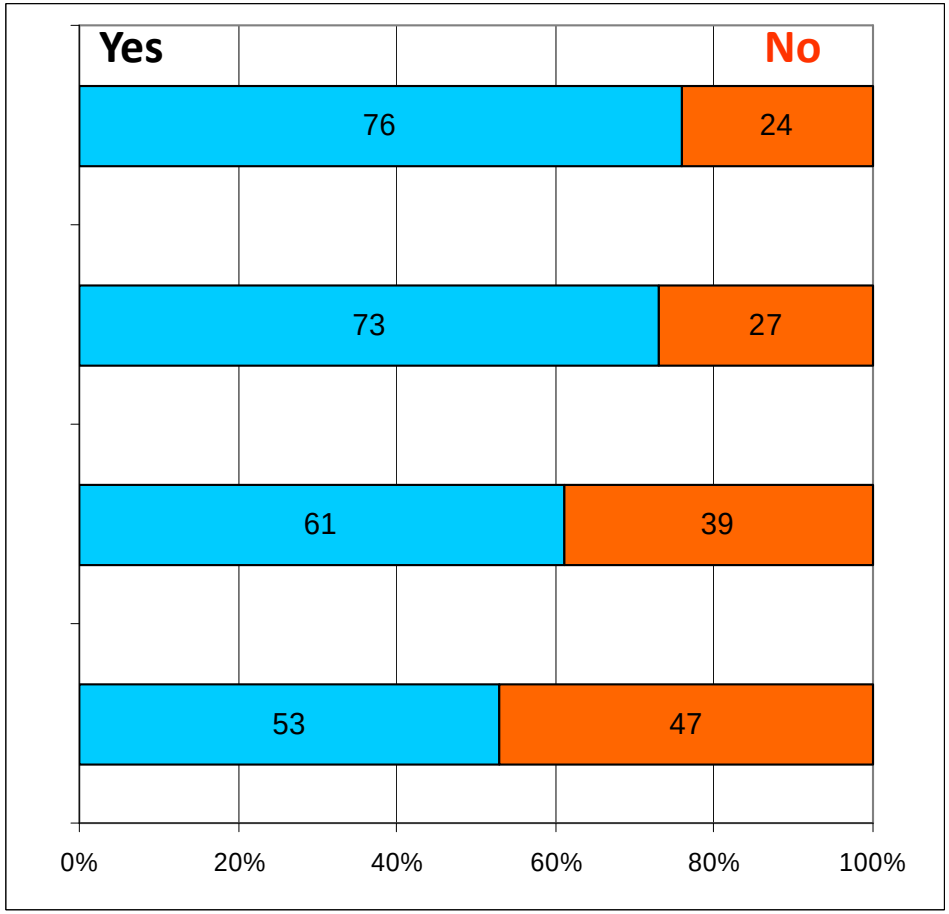
Boom sprayers

- Outside contamination is about 0,01 to 0,1 % of the applied amount measured on boom sprayers. Boom sprayers with air support showed concentrations of 0,47 % (Wehmann 2006).
- Modell calculation:
  Assumption: if 1,5 kg active ingredient/ha is sprayed per year
  Outside contamination: about 0,15 to 1,5 g active incredient / ha (100 ha: 15 g to 150 g active incredient/year); Field sprayers with air support about 7,5 g active incredient/ha

Source: JKI

Situation in practise

What are the reasons, which favours the cleaning of the sprayer on farm ?



Source:Study IVA Germany 2002 Basis 1000 farmers

Easier to manage cleaning

More careful cleaning possible

Cleaning is faster

Equipment to clean in the field is not available

Bad management of empty containers is high risk for point source pollution.

- Cleaning
- Storage
- Disposal

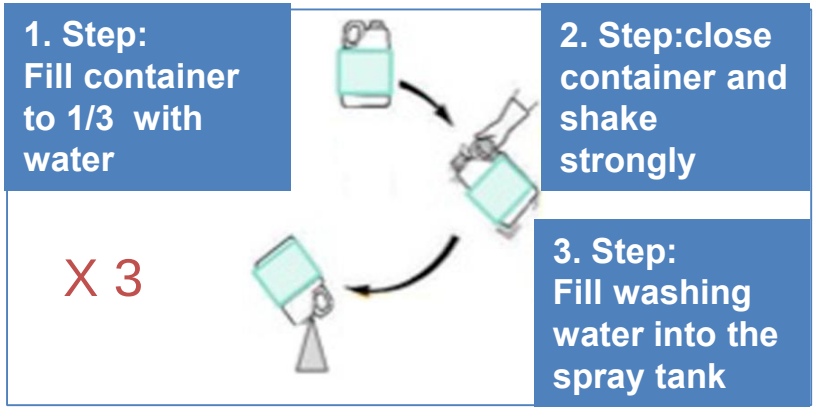
How to clean empty containers? 2 possibilities:

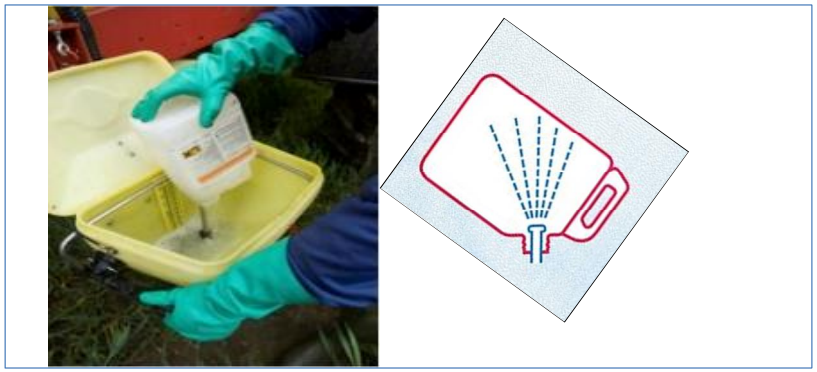
3-times cleaning:

- Fill container to 1/3 with water, close it and shake it strongly.
- Empty washing water into the sprayer tank.

Repeat procedure 3 times!

Use container cleaning nozzle in the induction hopper (if available): high pressure





Do not forget the cap and seals!
Studies showed that not cleaned container caps and seals can be a significant sources for point source pollution.

Clean container caps:

- **Clean caps with clean water in the induction hopper.**
- **Put caps and seals after the cleaning in a clean plastic bag.**

Check requirements with your local empty container recycling system.

Correct storage of empty containers and disposal

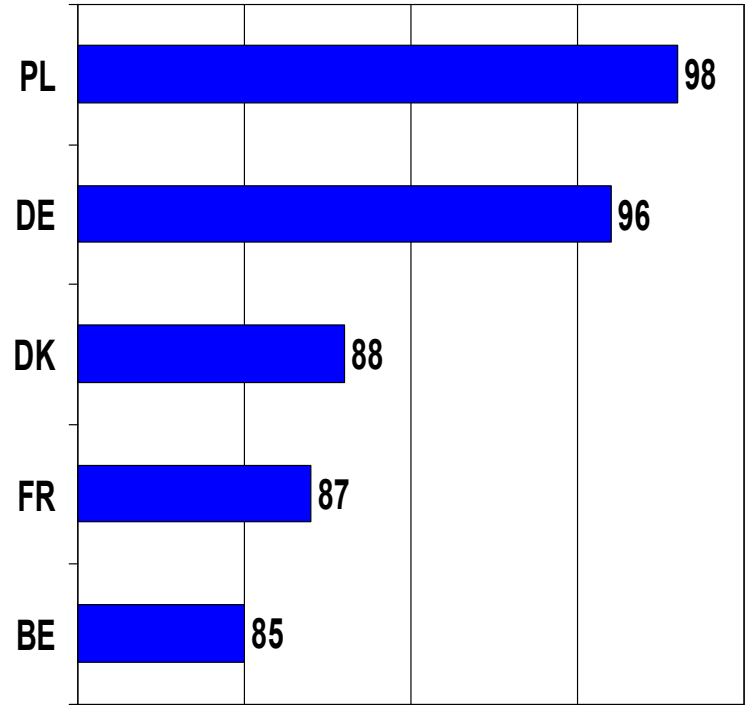
- Empty and cleaned containers to be stored at a dry and protected place.
- Do not burn or bury empty containers.
- Use the local recycling system services

Filling process (Filling/Dosing of PPP concentrate)

Precausionary measures necessary if filling on farm
Saucer Principle !!

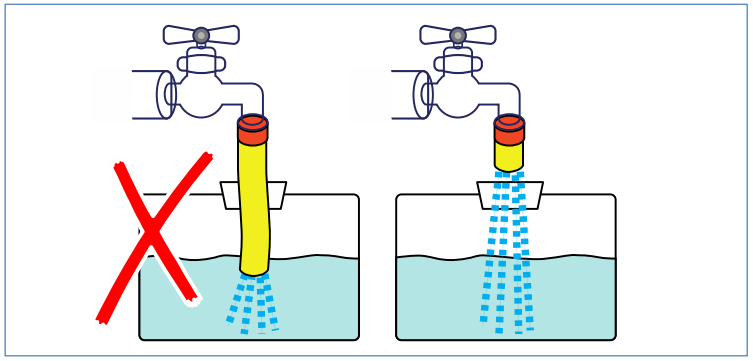
> than 85% of Farmers fill their sprayers on farm

(TOPPS Catchments farmer survey (%))



Precausionary measures to protect water sources

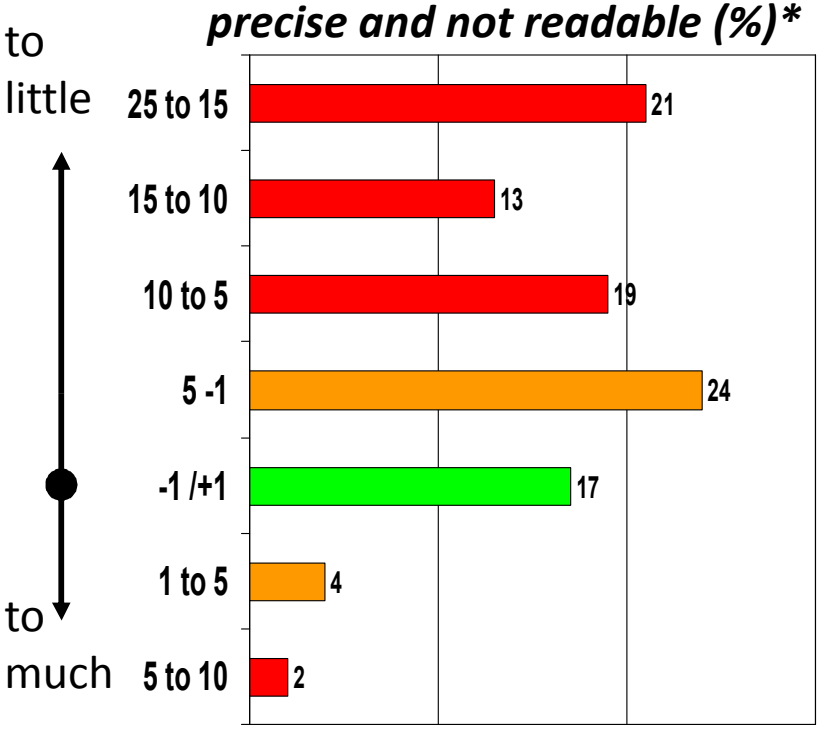
- Never connect a water source directly with the spray solution (Avoid risk of **backflow** by an appropriate valve).
- Never take water directly out of a water course or well.
- Always use an intermediary tank if water is sourced directly from a water body. This garanties that no direct contact exists to the water source.



Filling process (Filling/Dosing of water)

More than 85% of farmers measure the amount of water they fill in the sprayer by using the scale attached to the tank (TOPPS farmer survey)

Tank content gauges poorly precise and not readable (%)*



High precision and low precision can exist on the same sprayer? Holistic system approach needed !!

Specific water measurement devices could bring big improvement !!!

** (DEIAFA survey on orchard sprayers in Piemonte region) pers. communication: Prof P. Balsari Univ. Turin*

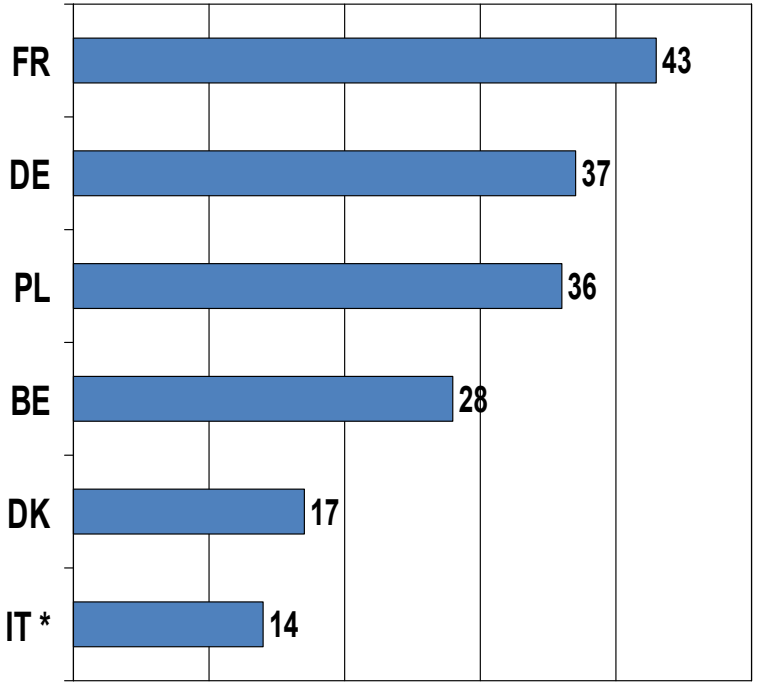
Filling process (Filling/Dosing of water)

Some farmers add extra water to be sure that they have enough spray

Optimized filling techniques, will reduce the need to add any EXTRA WATER / risk to increase residual volume

(Flow meters)

% Farmers adding about 5 to 10% extra water to ensure enough spray liquid for spraying the field (TOPPS farmer survey)



* IT orchard/vine sprayers

…. Uneven fields : difficult calibration therefore spray uneven fields first

Example: Mixing & Loading

Avoid tank overflow

Pay full attention when filling the sprayer. No other activities or distractions!

Technical installations can reduce the risk of tank overflow:

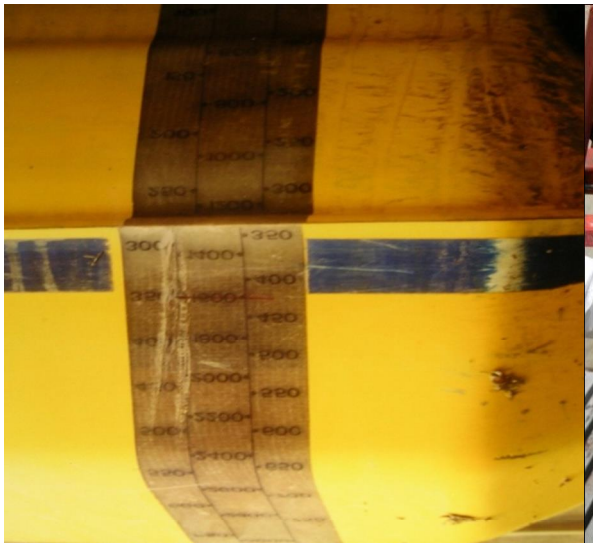
- **„Tank- full“-alarm**
- **Filling from an intermediary tank with defined water volume**
- **Flow meter with automatic water shut off**

BMPs for mixing & loading

BMPs

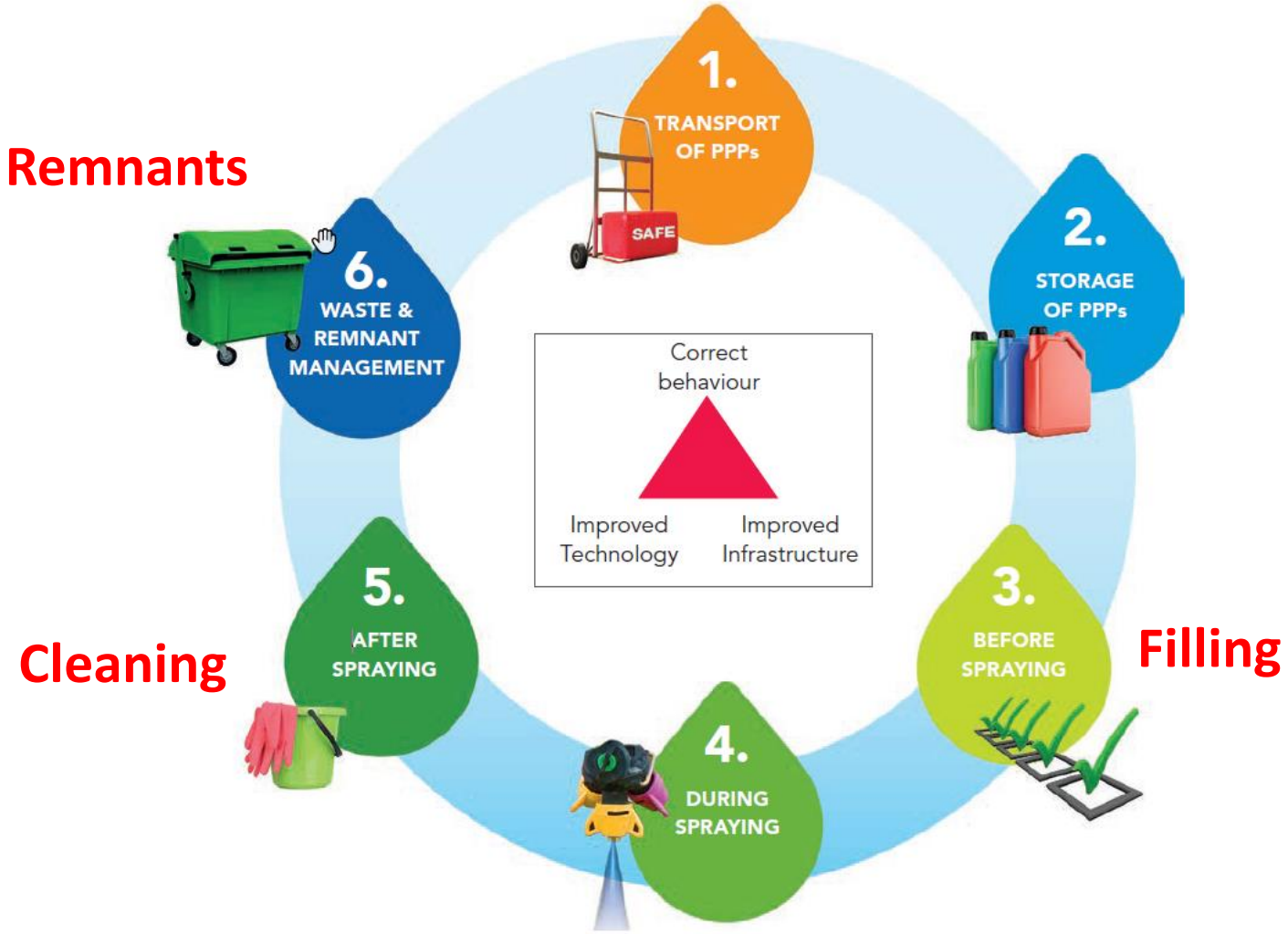
- Use induction hoppers (Close transfers systems)
- Avoid spills / contain them
- Improve water metering

  (Tank scales often not sufficiently precise or difficult to read)
- Calibrate sprayer for correct spray volume / ha



BMPs toolbox : strategic triangle –

Process view includes technique + infrastructure



Transport

a) From retailer to farm

Suppliers of PPP know legal requirements for PPP delivery

- **Get bigger volumes of PPP delivered to the farm from your retailer.**
- **Do not transport PPP volumes above the allowed volumes, if you transport yourselves.**
- **Transport PPP only in good conditions, in original packages and with well readable labels.**
- **Transport PPP in Containers/Boxes able to collect any leakages (Transportbox).**

- ***In case of an accident have a mobil phone and respective telefon numbers available*!**

Transport

b) From farm to the field

Choose the route which has the lowest risk for accidents !

- **Transport PPP on the sprayer / tractor in a stable and fixed transport box**
- **Make sure that the sprayer does not leak.**
- **The tank cover must be closed and tide.**
- **Mobil phone and emergency telefon numbers should be at hand.**

- **As farms grow in size, tendency that farmers need to drive longer distances to the fields**

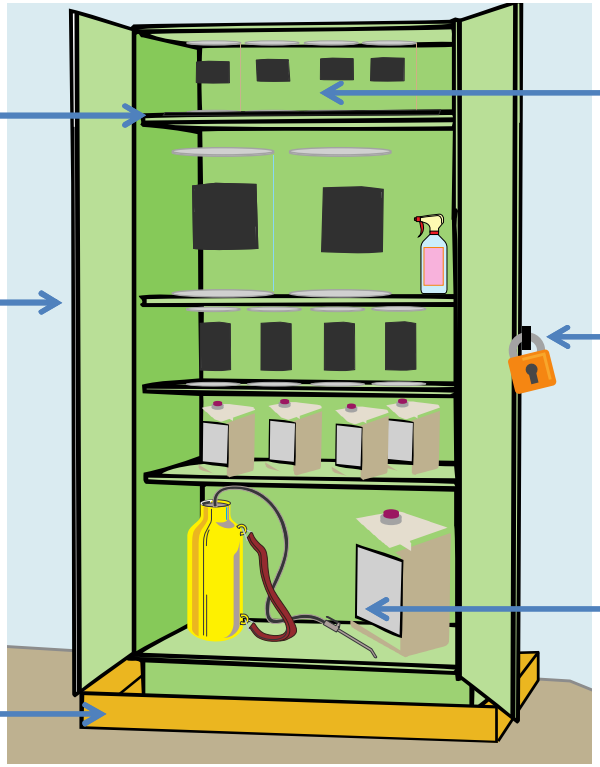
Storage of PPP

Storage room should be ventilated.

Easy to be cleaned shelfs

Fire prove

In case of leakages 10 % of the stored volume should be collectable. In sensitive areas 100% of the stored volume should be collectable. (check local regulations)



Solid materials are always stored on top shelfs.

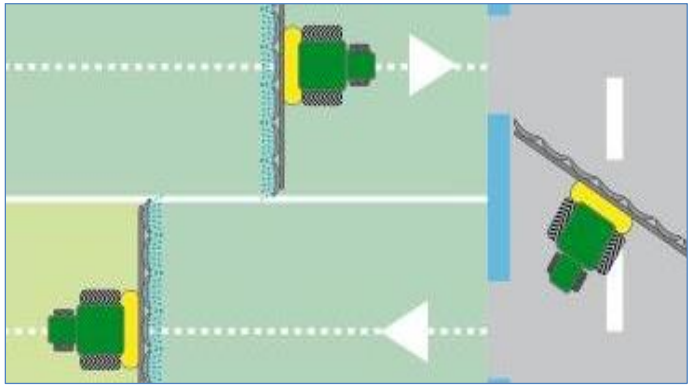
Cupboard should be locked if not used.

Liquid products are stored at the bottom.

Floor should be impermeable , anti-slip and without drains to water.

During application

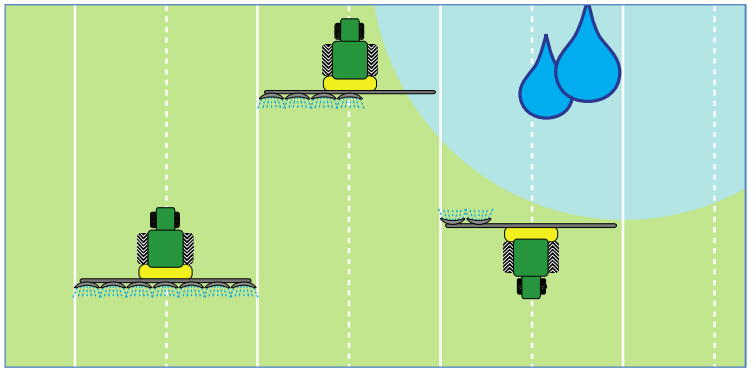
- Never overspray water bodies.
- Do not overspray buffer strips.
- **Do not overspray rural roads or hard surfaces**
  (Studies showed that runoff from hard surface access roads can be an important source for point sources pollution).
- Shut off the sprayer before turning at the end of the field.



During application

Carefull planning and high operator concentration during the application avoids pollution from point sources.

- **Consider sensitive areas for water and mark them ahead of the application**
- **Make sure that wells or water sources are well protected.**
- **Do not damage existing wells with farm implements or tractor.**



Remnant Management

First

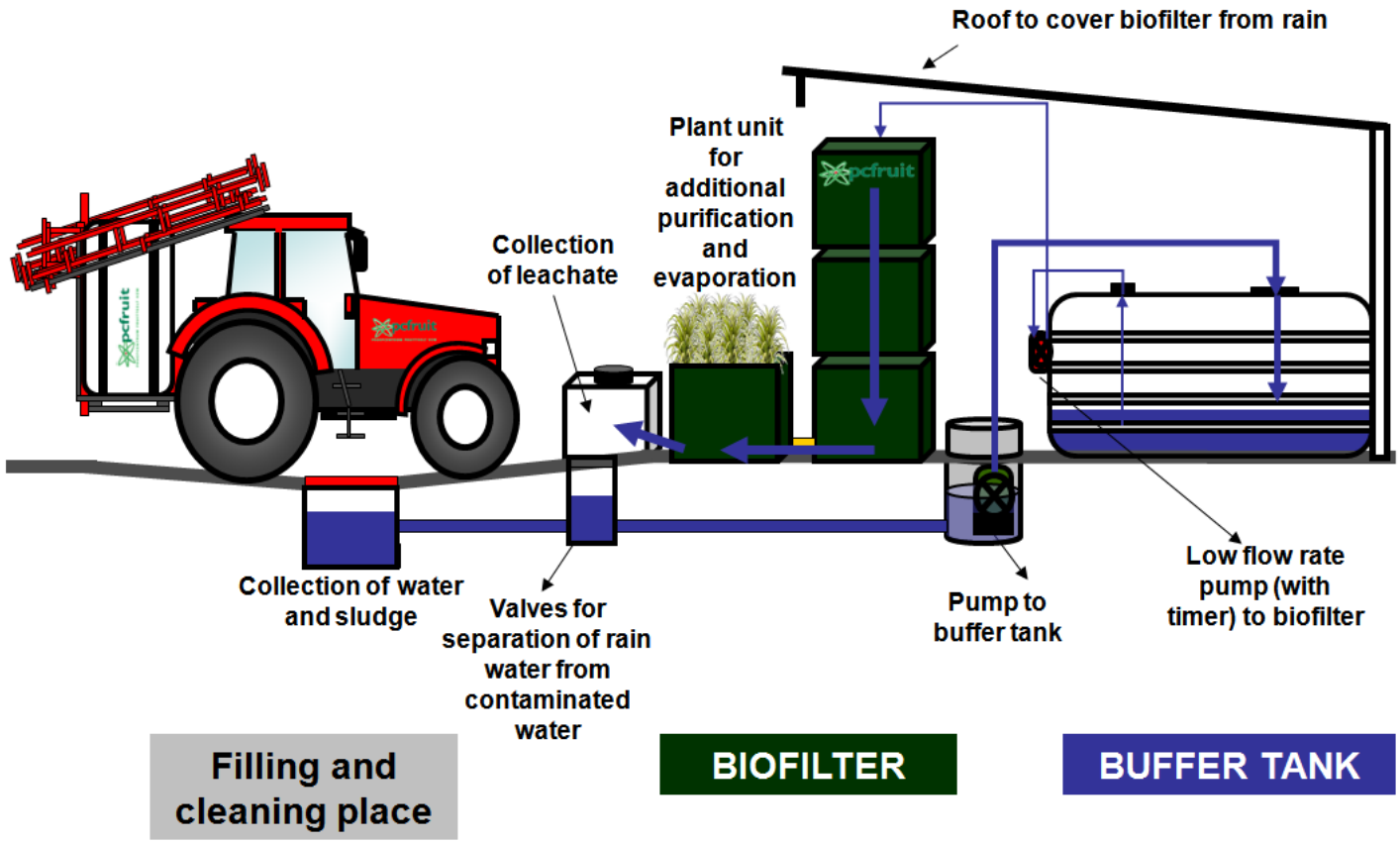
- Bring as little contaminated liquid back to the farm as possible. Thorough cleaning in the field / or biological active area close to the farm is the cheapest option

Cleaning on farm requires investment in

- Washing place (collection of contaminated liquid)
- Treatment of contaminated liquid (biofilter / other)

What to do with residual volumes?

Example:Washing place with biofilter: pcfruit



Technical improvements take time and money

- Average age of sprayers 13 to 15 years (TOPPS surveys 2008)
- Technical status varies strongly among countries and use area (how many carry a freshwater tanks on sprayers?)
- Sprayer manufacturers very diverse: small and big enterprises (600 in EU ?)
- Component suppliers (2000 ?)
- Required standards are not met by all and not enforced

Conclusion
Quick wins and low-hanging fruits

Risk mitigation opportunities need to be realised

Improved Equipment

- Rinse water tank (sufficient capacity)
- Internal and external cleaning device
- Better measurement of water volume
- Filling and container cleaning devices (Induction systems)
- Sprayer design should be optimized for lowest residual volume

Improved Infrastructure

- Filling and cleaning on farm require precautionary measures
- Clear recommendations on remnants management

KEY FACTOR IS THE USER


Thank you


TOPPS
ARVALIS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