



TRAIN OPERATORS TO PREVENT POLLUTION FROM  
POINT SOURCES

**„Perception on point sources and how to create  
more awareness“**

European Project sponsored by

- Life the financial instrument of the EU and
- ECPA the european crop protection association

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## TOPPS - Project

3 year multi stakeholder project covering 15 EU member countries includes 12 partners and subcontractors

Nov 2005 to Oct 2008

## TOPPS - Objectives

- Define Best Management Practices (BMP's) to reduce losses of PPP to water
- Disseminate BMP's to advisers and operators through information, training and demonstration
- Proposal for a sustainable approach across member states

## TOPPS – EU-Context

- Thematic strategy (Training and advice)
- WFD reduce water contamination

## Point Source:

- Spillage of PPP concentrate or dilute spray
- Poor sprayer/nozzle maintenance
- Poor field practice, (eg over-spraying ditches,
- spraying when stationary/turning,
- tractor driving over sprayed area leading to contaminated mud on tractor wheels)

## Diffuse Source:

Spray drift, Surface runoff, Leaching following approved practice

## Content

I will concentrate in my presentation on

Technical aspects in relation to the surveys conducted with stakeholders and farmers in various European countries.

In the TOPPS project we have defined **6 pilot areas**, where we intensively investigate **awareness** and **behaviour** of operators, relevant to reduce point sources (Telefon surveys – **F,B,DK,PL,D,I**) and **audits** on the **technical** and **infrastructural** status (mostly personal audits)

*European Stakeholders perceive point sources as most significant entry route of PPP into water*

Which is the most important source of water contamination by PPP (% respondents)					
	point	diffuse	both	no opinion/resp	n
UK, B, G	46,2	17,7	34,2	1,9	158
Poland, CZ	32,6	27,9	32,6	7,0	43
DK, S	74,0	6,8	12,3	6,9	73
Italy, Spain	43,2	28,8	23,2	4,8	125
France	40,2	20,1	34,2	5,5	199

- *45% of respondents mention point sources the major entry route*
- *Nordic has the most distinct views on the significance of different entry routes . (Point source is dominating)*

Ref.:TOPPS - Stakeholder Survey

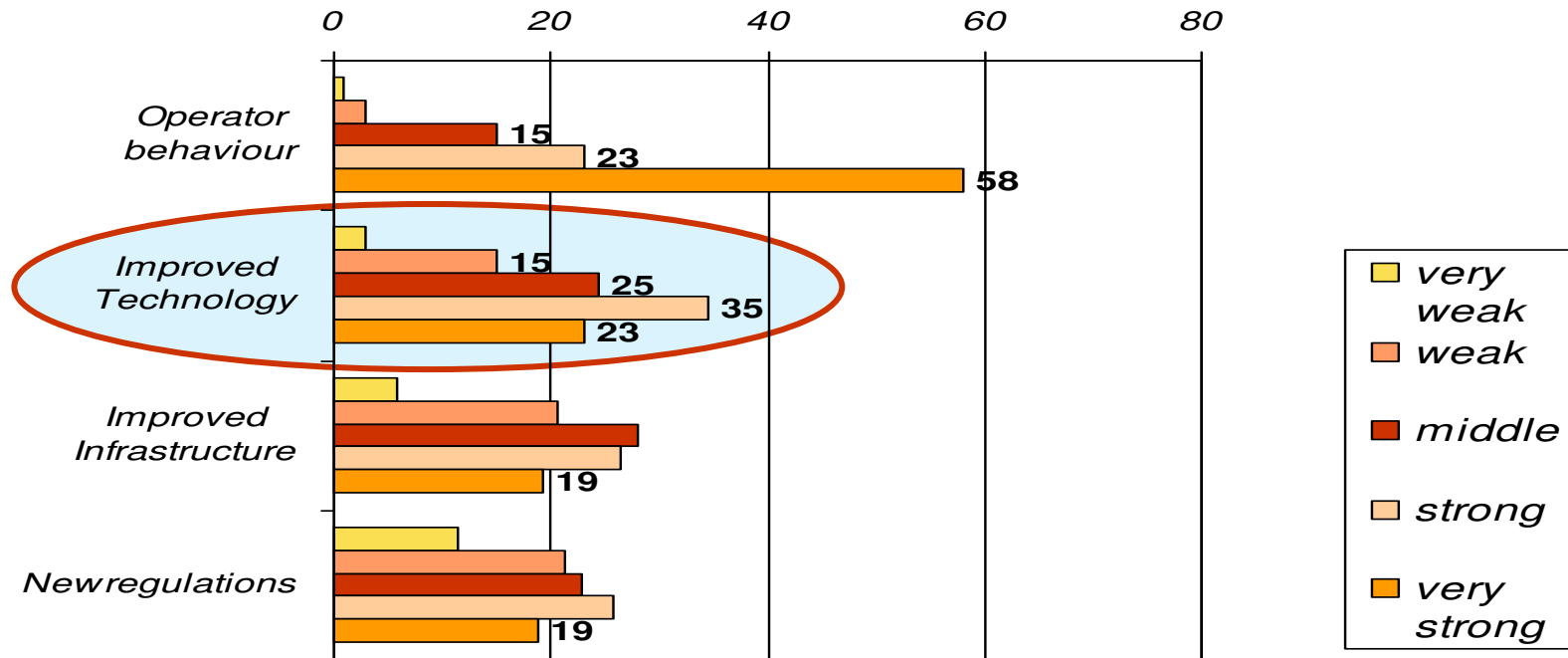
*Perceived potential for quick wins is to focus on point sources*

Which entry route could be reduced easiest? (% respondents)					
	point	diffuse	both	no opinion/resp	n
UK, B, G	85	3	10	3	158
Poland, CZ	81	2	5	12	43
DK, S	88	3	4	5	73
Italy, Spain	70	6	16	8	125
France	86	1	10	3	199

*Broad consensus across Europe*

Ref.: TOPPS - Stakeholder Survey

Where do you expect the most impact on reducing PPP water contamination from point sources? ratings in % of respondents (very strong to very weak)



*Strongest impact for improvements is expected by changing operators behaviour and improve technology*

Ref.: TOPPS - Stakeholder Survey

## Most 4 important technical measures to minimize PPP point source contamination

What do you think is the best technical approach to minimize PPP contamination from						
Ranks of top 4 most important technical measures by regions						
Approaches proposed	UK,B	PL	Nordic	I,Spa	France	Average
Tech solution to avoid spills	1	3	3	1	3	1
Specific component on sprayer	2	1	5	3		4
Rinsing water tank	4	4	1	4	2	3
Reduce residual volume	3			2	1	2
Internal cleaning equipment		2	2		4	5
External cleaning device			4			7
Spray tank full alarm						6
Handwash tank						8

\* Specific component: induction hopper, direct injection ...

... Cleaning aspects will gain importance !

Ref.: TOPPS - Stakeholder Survey



# TOPPS Before spraying: How farmers measure water volume

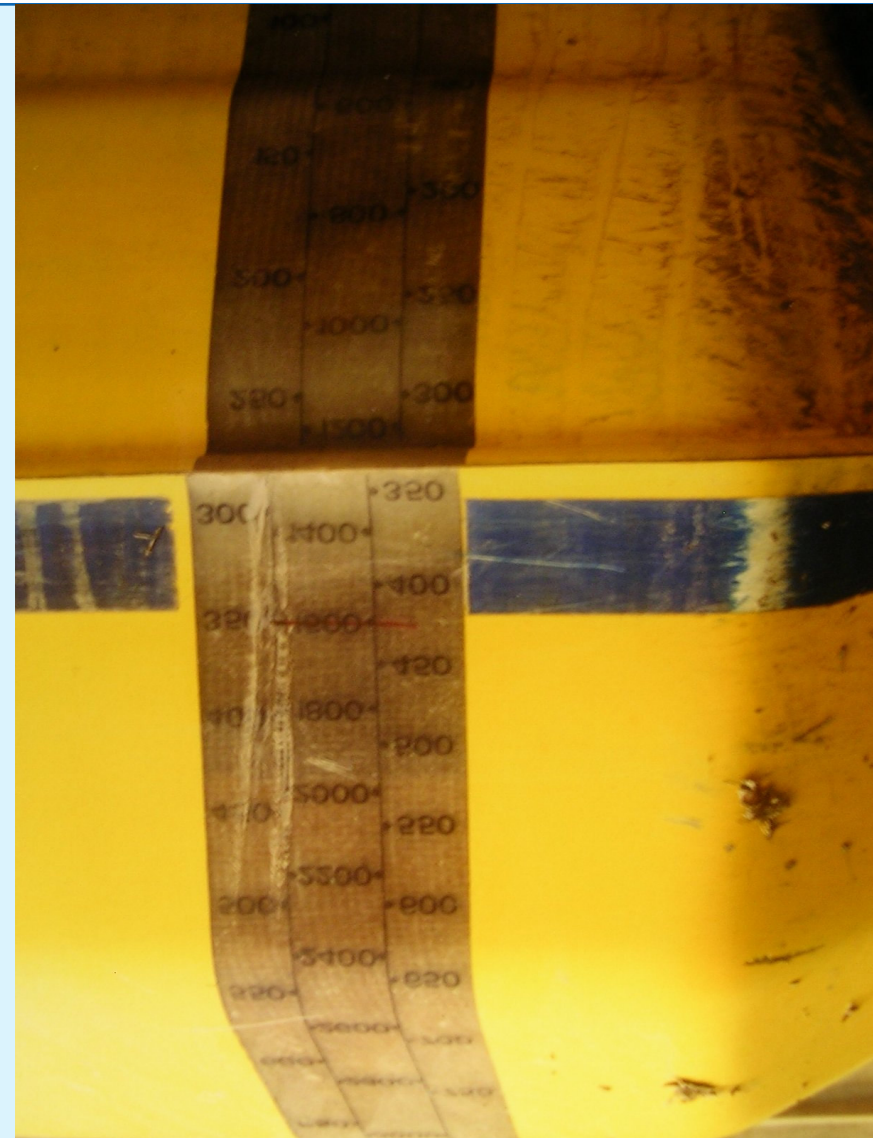
Orchard / Vine sprayers Italy  
(Fieldsprayers Germany)

93 % measure with the scale at  
the spray tank (83%)

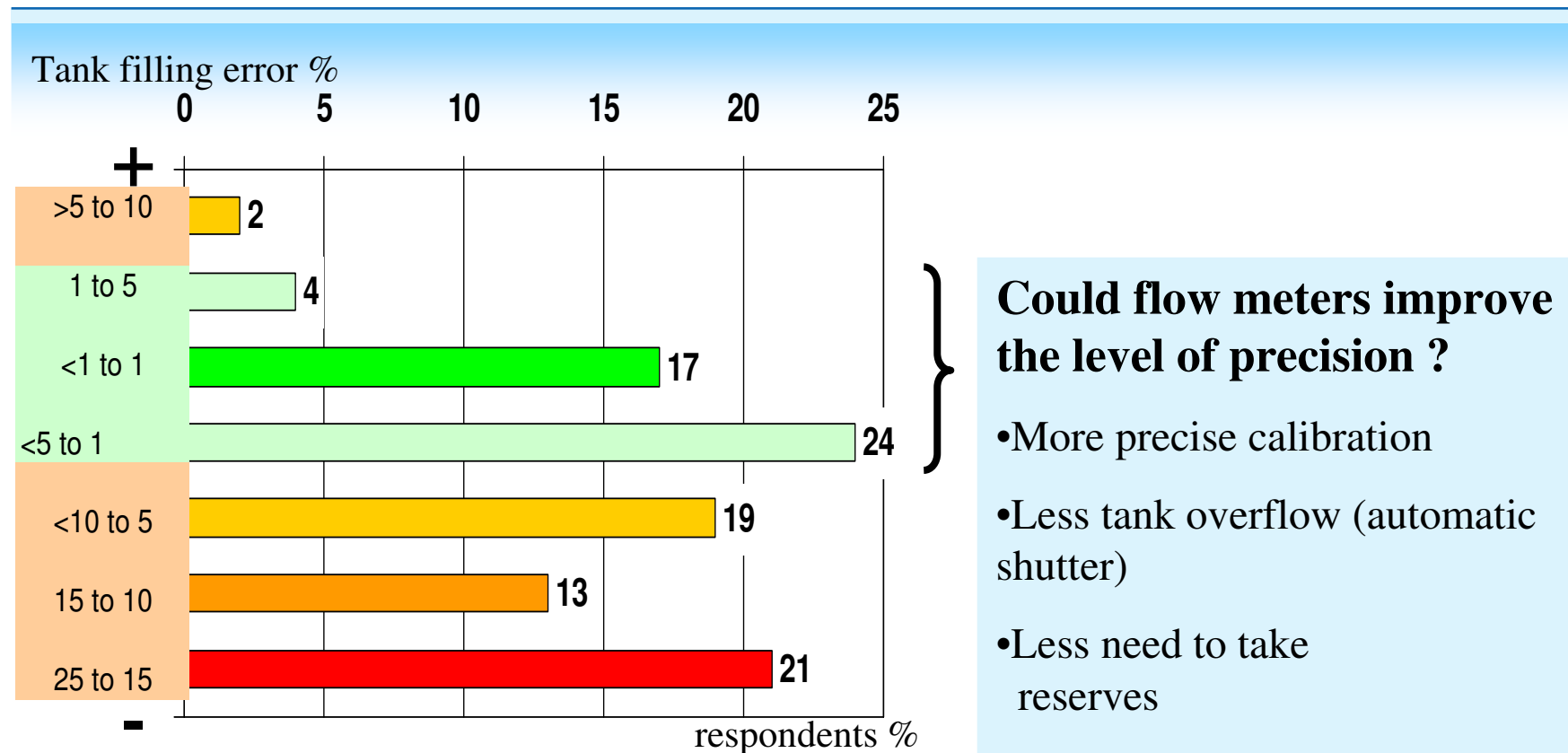
6% measure according to own  
marks at the spray tank (6%)

1% measure with a flow meter  
(10%)

Topps Farmer Survey Italy /Germany 2007  
Orchard/Vine sprayers Italy (n= 141)  
Fieldsprayers Germany (N=157)



## Before spraying: How accurate are the measurements



**Could flow meters improve the level of precision ?**

- More precise calibration
- Less tank overflow (automatic shutter)
- Less need to take reserves

(Investment: 100 to 1000 €)

*Tank content gauges poorly precise and not readable  
 (DEIAFA survey on orchard sprayers in Piemonte region)  
 pers. communication: Prof P. Balsari Univ. Turin*

How are spills managed?  
(% respondents)

What do you do to neutralize possible spills, when measuring, mixing and loading PPP ?			
	Italy orchard/vine	France Field	Germany Field
I have a plastic cover to collect spills	6	8	4
I have absorbing materials at hand	15	29	13
I fill in area where spills/ water is collected	4	22	58
I wash spills off with water	8	31	10
Other / not specified	66	31	15

Spill management is a key area to concentrate consulting and training activities

TOPPS Farmer survey in pilot catchments areas 2007



## How are empty containers managed?

- More than 80% of farmers in Italy and up to 98% of farmers in France use a special collection service for empty packages
- Farmers rinsing their containers, rinse on average 4 times in (I) and 2,3 to 2,5 in Germany and France
- More than 80% in Germany and 96% in France rinse their empty containers
- The need for rinsing empty containers as a measure to reduce point sources need to be a key advice and training goal in Italy



TOPPS Farmer survey in pilot catchments areas 2007

Field sprayer  
What does it mean?

EN12761-2 Standard

0,5% of tank volume + 2l/m boom

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

Air assisted sprayer  
What does it mean?

EN12761-3 Standard

4% of nominal tank volume < 400 l

3% of nominal tank volume > 400 l to 1000 l

2% of nominal volume > 1000 l

Total residual volume in l (EN12761-3)		
Tank volume	%	Total litres
400	4%	16
800	3%	24
1500	2%	30

... Total residual volume and the dilutable volume should be part of the instruction manual for each sprayer ....

## After spraying: Residual volumes

How much spray liquid do you estimate remains in your sprayer after you have finished spraying .- in litres by % of respondents				
Country	Italy	Italy	France	Germany
Production/Sprayer	Orchard/Vine	Field	Field	Field
0 Liters	1	55	12	1
1 to 10 litres	5	32	40	15
11 to 20 litres		2	16	27
21 to 50 litres	1	5	23	41
> 50 litres			3	14
No answer/ response	93	7	7	3
n	141	56	150	157
TOPPS farmer survey in pilot catchments				

- Farmer awareness on residual liquid in the sprayer after the spraying operation is very variable
- Knowledge on amount of remaining spray solution is essential to select the correct rinsing procedures to reduce the risk of point sources

TOPPS Farmer survey in pilot catchments areas 2007

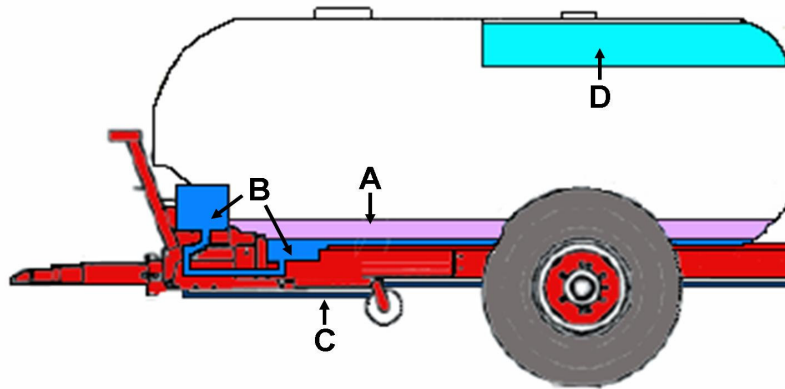


How do you manage the spray liquid, which remains in the sprayer after you have finished spraying ? % respondents			
Country	Italy	Germany	France
Type	Orchard/vine	Field	Field
<b>dilute with freshwater leave in field</b>	<b>1</b>	<b>37</b>	<b>72</b>
leave remaining spray in field	<b>89</b>	1	8
reuse it with next spray	8	4	13
clean on yard and collect / slurry	2	3	4
No answer / other		<b>45</b>	3
<b>N</b>	<b>141</b>	<b>157</b>	<b>150</b>
<b>TOPPS farmer survey pilot catchments 2007</b>			

- ... Management of residual volume seems unclear and associated with unsecurity – Need for training and advise is obvious
- ....legal frames are different, regulation may be not clear enough
- ....support given by the advisers may be not always consistent ?

TOPPS Farmer survey in pilot catchments areas 2007

## Definitions



D: Rinse water tank should be 10% of nominal tank volume or 10 times dilutable volume (EN 12761)

A: Left over spray (more than is needed for a area)

## Total residual volume

Spray mixture which remains in the sprayer, which cannot be delivered with the intended application rate (B+C)

**Indicated: 25% drop of pressure shown at manometer**

B: The dilutable volume is defined as the part of the total residual that remains in the tank or that can flow back to the tank during normal sprayer operation

C: non dilutable volume is part of the total residual that cannot flow back to the tank during normal operation of the sprayer.

Picture: C. Debaer pcfuit



# TOPPS Definitions of „empty sprayer“ differ by focus

Dilutable residual volume can differ between both definitions by more than 50%

## Total residual volume

Spray mixture which remains in the sprayer, which cannot be delivered with the intended application rate

**Indicator: 25% drop of pressure shown at manometer**



1. Definition of empty sprayer (EN12761)  
Focus is on **application**

## Total residual volume

Spray mixture out until there is not any liquid coming out of the nozzles (shut off circulation .- check manufacturer instructions?)

**Indicator: nozzles blow air**

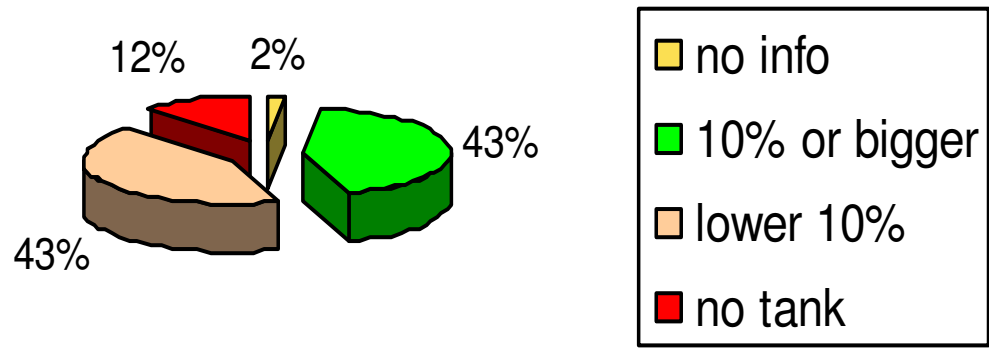


2. Definition of empty sprayer (ISO22368)  
Focus is on **cleaning**

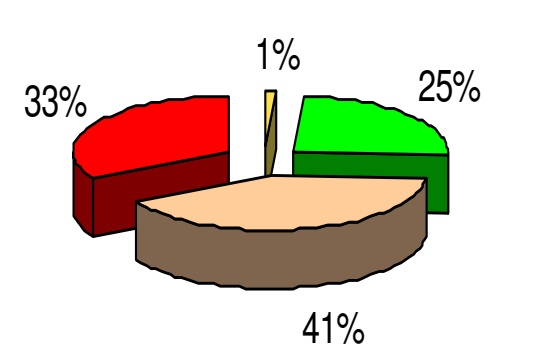
**Target must be to design sprayers and recommend procedures, which will achieve the lowest amount of total residual volume**

## Capacity of rinse water tanks (Fieldsprayers-Aquasite Audit )

**Rinse water tank capacity is critical to achieve sufficient dilution of residual volumes and to have reserves available for outside cleaning in the field**



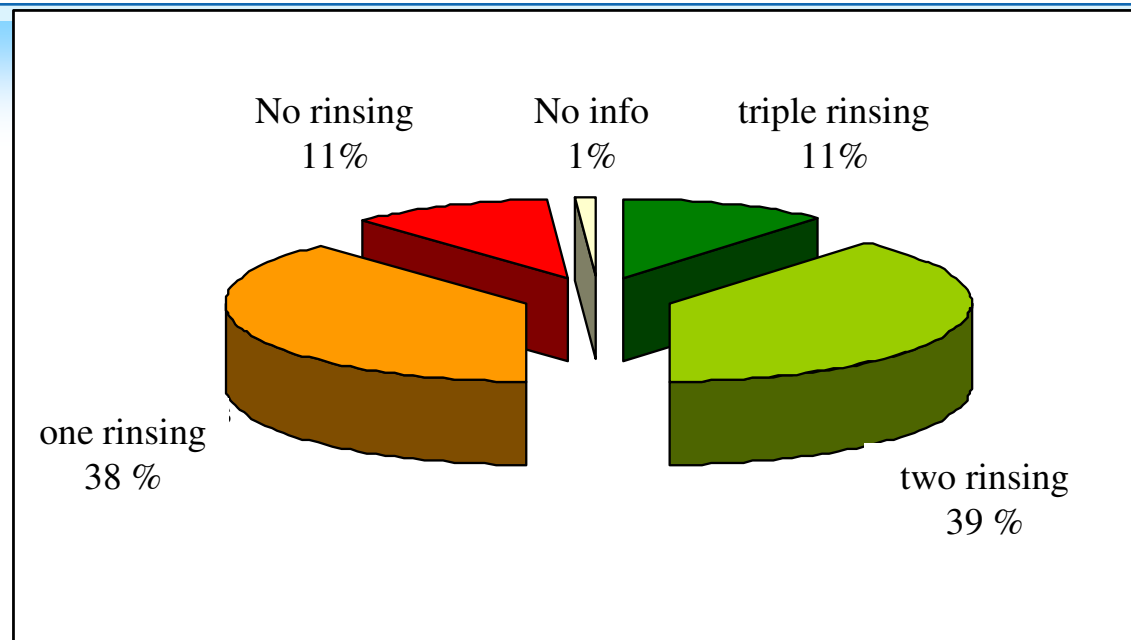
Yser catchment F



Yser catchment B

.... majority of cases rinse tank capacity is below 10% of spray tank

Ref.: Arvalis Inst. du vegetal, Chambre Agriculture Nord Pas Calais, POVLT-Belgium  
 Aquasite Audit in pilot catchment areas (F - n = 100/ B – n=100)

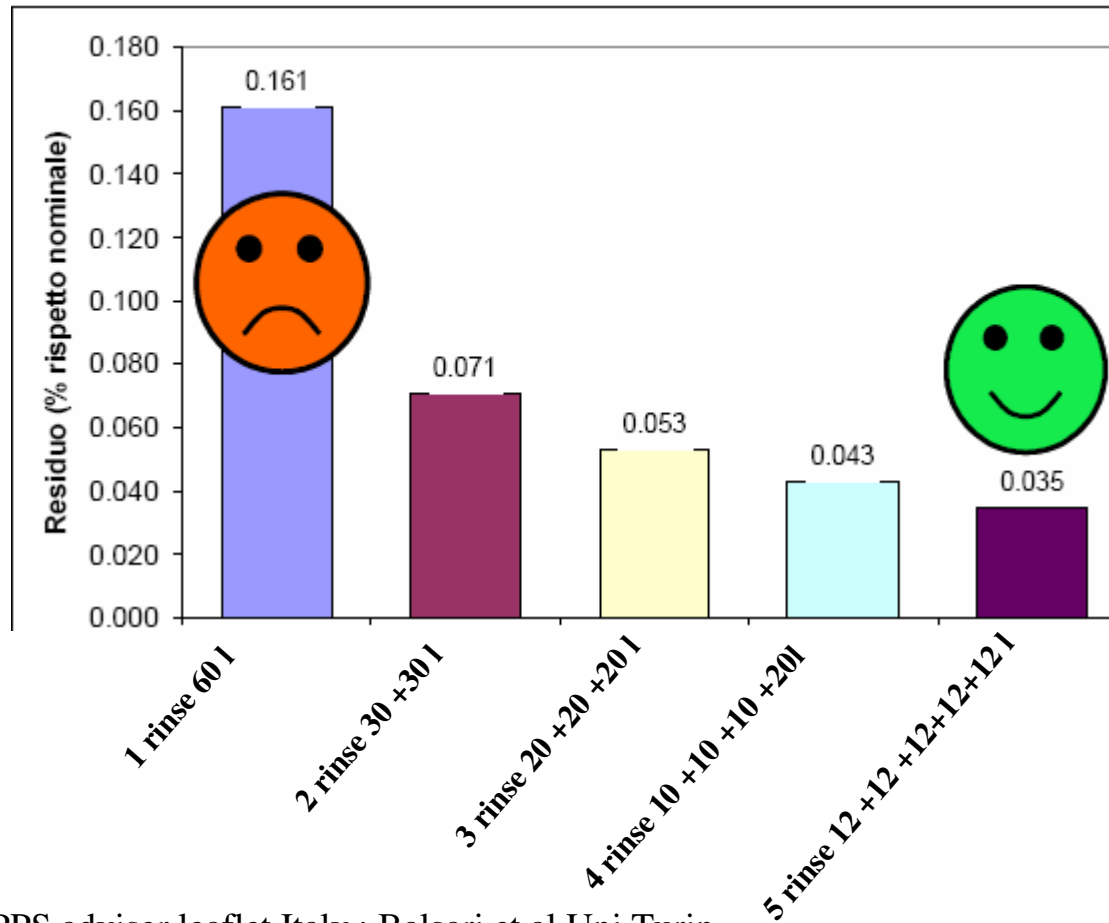


Key elements to manage dilution of residual spray

- |  |                                 |
|--|---------------------------------|
| <b>Low remaining spray solution</b>    | - <b>Technique + Management</b> |
| <b>Sufficient rinse water capacity</b> | - <b>Technique</b>              |
| <b>Multiple rinsing</b>                | - <b>Management</b>             |

Ref.: Arvalis Inst. du vegetal, Chambre Agriculture Nord Pas Calais  
 Aquasite Audit in pilot catchment areas (F - n = 100)

## Multiple rinsing more effective



•Rinsing procedures need to be adapted to sprayers / types and regulations.

(France – dilution factor 100  
Denmark – dilution factor 50  
Others ?)

•Best rinsing procedures should be communicated to operators by advisers and sprayer manufacturers

•Optimization challenge:  
Tank size , necessary dilution and reserve for outside cleaning  
!!!!

**Inside cleaning depends on the cropping pattern on the farm (phytotoxicity) and the regulations for the products applied. BMPs recommend to reuse remaining spray if possible and to clean inside only if required**

	Italy	Germany	France
	Orchard/Vine	Field crops	Field crops
<b>Number of inside cleanings of the sprayer per season</b>	<b>7,6</b>	<b>7,5</b>	<b>10,6</b>
<b>Number of outside cleanings of sprayers per season</b>	<b>7</b>	<b>4,7</b>	<b>2,8</b>

TOPPS Farmer survey in pilot catchments areas 2007

Potential risks for point sources differ depending on sprayer types

Fieldsprayers

Risk: not used spray solution inside the sprayer

Orchard / Vine sprayers (air assisted)

Risk: spray deposits on the outside of the sprayer

Outside deposits on air assisted sprayer can be in the order of 0,5 – 0,7 % of the sprayed amount : Ref.: Vineyard sprayer tests - Prof. Balsari Univ. Turin

- 32 % of sprayers are equipped with outside cleaning devices (but they are not intensively used)
- 41 % clean sprayer outside in the farmyard
- 59 % clean sprayer outside in the field

## Conclusion (1)

- Point sources are a major entry source of PPP into water
- Focus on point sources offer the possibilities of fast wins in reducing PPP contamination
- **Behaviour** and the use of improved technology are having the biggest impact on point source reduction
- Key areas where **technology can contribute** a lot are
  - Avoidance of spills
  - Reduction of residual volumes
  - Rinse watertank (capacity, rinse procedures)
- Aspects of spray left overs and **residual spray volumes** need to be **key topics** in training and advice.
- Sprayer manufacturers should inform farmers on the relevant residual spray volumes in the sprayers they supply



## Conclusion (2)

- Sprayer designs which provide **low residual volumes** should be **promoted**
- Different **definitions** on „ empty sprayers“ need to be **clarified** and clearly communicated to advisers and farmers
- Standards dealing with residual spray volumes and cleaning procedures should be reconsidered in the light of their potential environmental impact.
- Best Management Practices of residual spray management need to be communicated to advisers, operators and regulators.
- Regulations may be not very clear in some countries. This has an impact on the behaviour of farmers by causing insecurity
- Outside cleaning , especially for air assisted sprayers require more understanding of the practices used and will require advice and training of Best Management Practices.

**Thanks for your attention**

