

## Minimizing operator exposure to pesticides via closed transfer systems (CTS)

*Christian Küster (Bayer) / Juan Sasturain (BASF) / Tirso Oteyza (Syngenta)*

*CropLife Europe*



easyconnect



easyFlow M



GoatThroat®

# Introduction to Closed Transfer Systems (CTS)



## What are Closed Transfer Systems (CTS)?

- **CTS allow** crop protection **products to be directly transferred** from their original container **to the spray tank**. These systems are aimed to **reduce operator exposure** from splashing or spilling crop protection products.

## CropLife Europe 2030 Commitments:

- In 2020, CropLife Europe (**CLE**) **published a set of commitments** for the future of agriculture In Europe. Besides others, it was published that *“in order to further reduce operators’ exposure, **make Closed Transfer Systems (CTS) technologies available to 100% of European farmers and operators by 2030”***.

How can we be sure that CTS’ are also used by farmers?







# International Standard ISO 21191:2021

Equipment for crop protection — Closed transfer systems (CTS) — Performance specification



- The only **international standard ISO 21191:2021** available to date.
- Within this ISO standard three parameters characterizing the performance of the equipment and **three parameters with direct relevance to operator exposure**

<p>1. <b>No leakage</b> during transfer and rinsing</p>  A red circle with a diagonal slash over a black icon of two liquid droplets, indicating a prohibition of leakage.	<p>2. Maximum <b>residue on coupler + adapter</b> after disconnection <b>&lt;0.25 ml</b> of undiluted product</p>  Illustration of a black plastic coupler being held by a blue gloved hand, and a white plastic adapter with its cap removed.  A simple black outline of a single liquid droplet. <p>coupler + adapter &lt; 0.25 ml</p>	<p>3. Maximum <b>residue in any container</b> rinsed shall be <b>&lt; 0.01%</b> of the original content of the container</p>  An icon of a white plastic container with a cap, and a black outline of a single liquid droplet. <p>&lt; 0.01 % in container after rinsing (for a 5 L container &lt; 0.5 ml residues)</p>
--	--	---

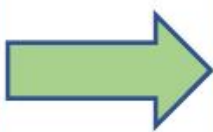
A CTS **passing the first 3 tests** has the **potential** to significantly **reduce the operator exposure**

**Important:** The ISO standard was defined to also cover future CTS developments and machineries.

**In laboratory tests, CTS passed various tests → But what about real-life data?**

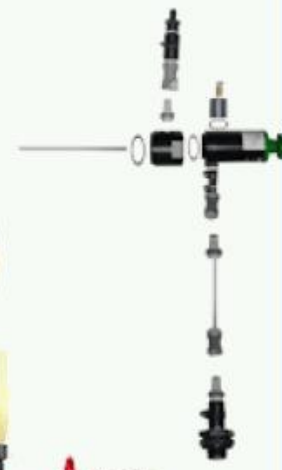
# Open Pour

Historic data from the European standard reference model: AOEM






# Closed Transfer Systems

A new study!



# Three systems were tested in our study

Objective: Demonstrate exposure reduction under real farming conditions in four countries

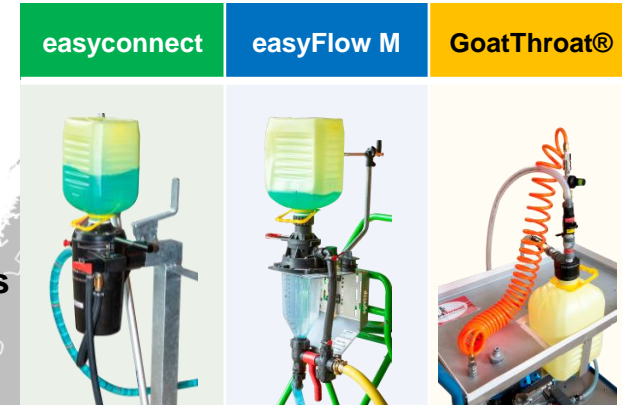
	easyconnect	easyFlow M	GoatThroat®
System Type	<u>Inverted</u> extraction	<u>Inverted</u> extraction	<u>Probe</u> extraction
Connector (CTS-Container)	<u>Pre-fitted cap</u>	<u>Adapter</u>	<u>Adapter</u> with probe
Container needs foil seal?	<u>No</u>	<u>Yes</u>	<u>Yes</u>
Cleaning process	<u>Mechanical</u> rinsing	<u>Mechanical</u> rinsing	<u>Manual</u> rinsing
			

- The systems were chosen to cover the **diversity of different CTS types** available on the market (or as prototypes)
- All system passed **ISO 21191:2021**

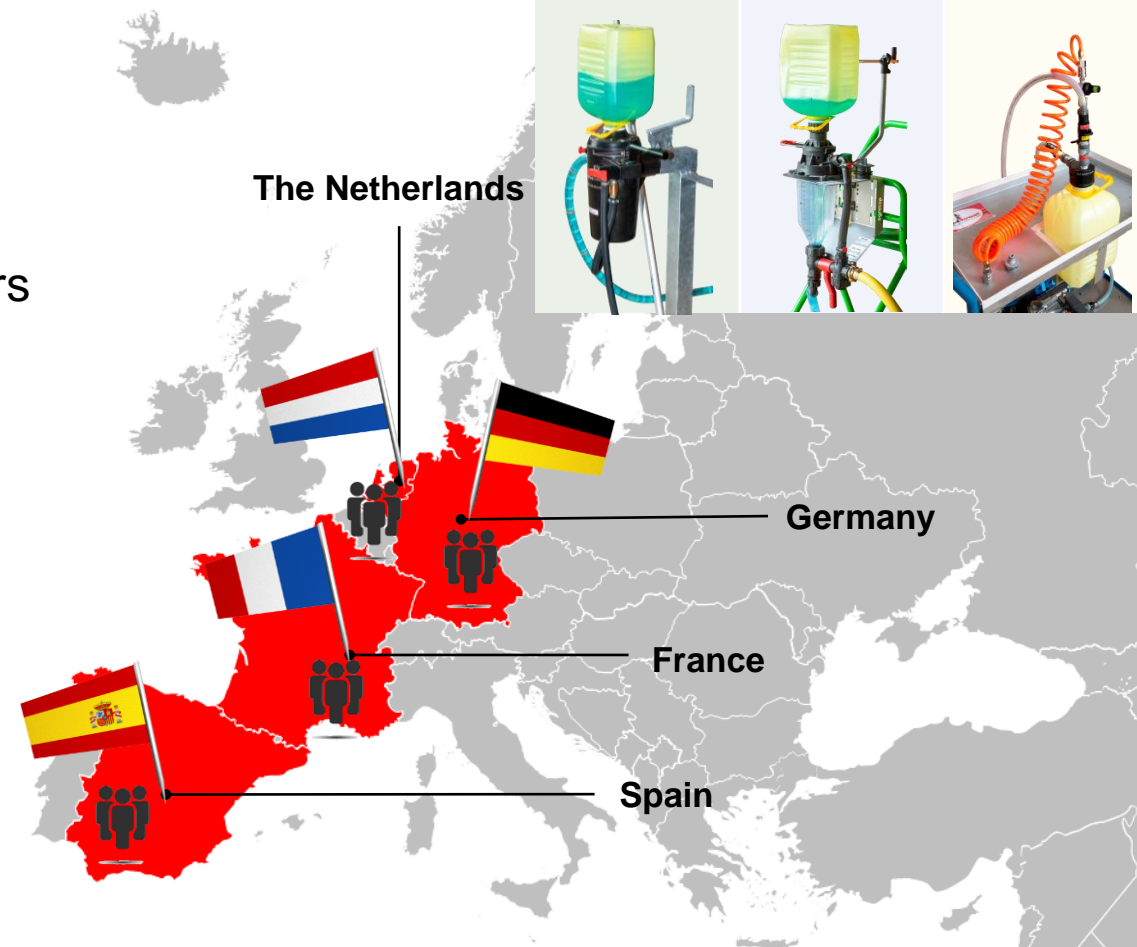
# Study conducted in four countries to cover different European conditions



- To cover a broad range of agronomic conditions and farmer habits within Europe, **the study took place in four countries:**
  - Germany (11.10.2021)
  - Spain (08.11.2021)
  - France (15.11.2021)
  - The Netherlands (22.11.2021)
- 2 products, 3 CTSs, 4 countries, 12 operators, 28 containers per operator per CTS: **1008 filling operations**



The number of bottles each farmer had to fill with one CTS type.



# Study impressions

## 1) Training (1-2h)



## 3) Sampling



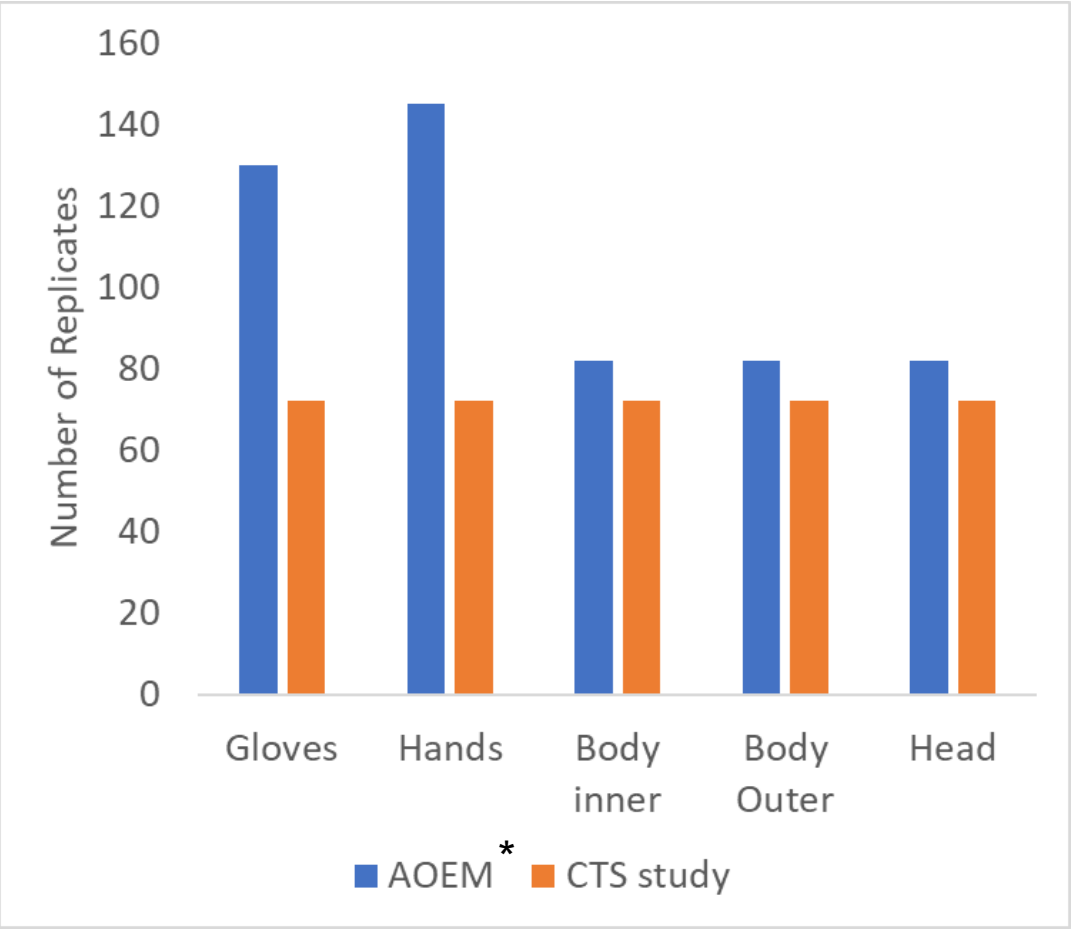
## 2) Filling and Rinsing (2-4h)







## ...but also incidents



# A huge amount of data was generated



- **72 replicates**, each for gloves, hands, head, inner- and outer body were analyzed:

**4 Countries**   
 x **3 Systems**   
 x **3 Operators**   
 x **2 Products**   


---

**72 Replicates**

- This number is **equivalent to 50%-88% of the replicates used to build the AOEM\***.

\* M&L. Tank. Liquids



# Results: Potential Operator exposure

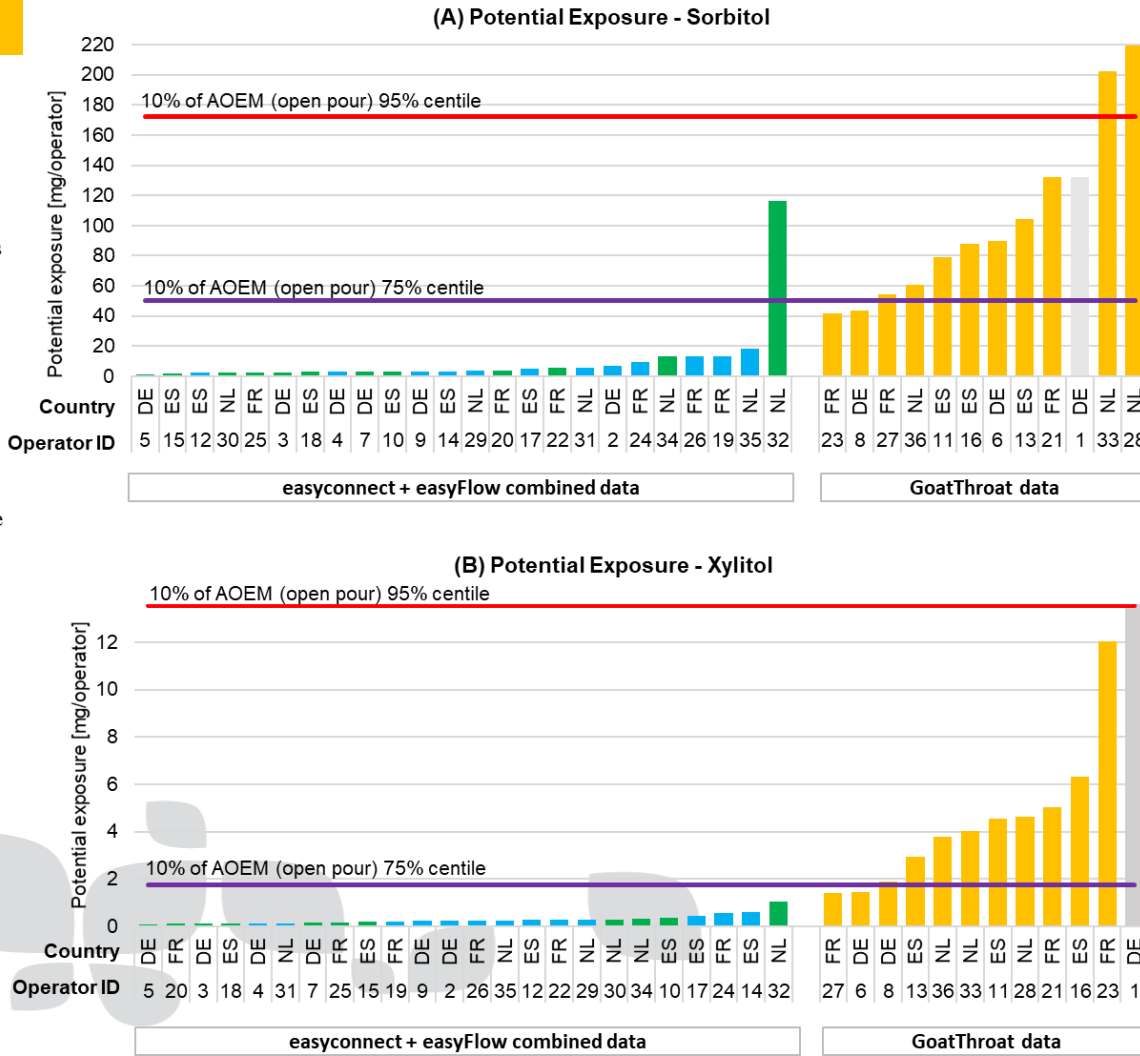
Outcome: All systems performed well or even excellent



Figure 3



**Fig. 3** Individual operator values for the potential exposure to (a) Sorbitol and (b) Xylitol. Green bars denote easyconnect, blue bars denote easyFlow and orange bars denote GoatThroat; striped bars denote the 75<sup>th</sup> (purple stripes) and 95<sup>th</sup> (red stripes) centiles for the measured values for inverted CTS types and the GoatThroat CTS. The red line denotes 10% of the open-pour AOEM 95<sup>th</sup> centile and the purple line denotes 10% of the open-pour AOEM 75<sup>th</sup> centile



**Take home message:** All three systems performed good in terms of OPEX reduction,

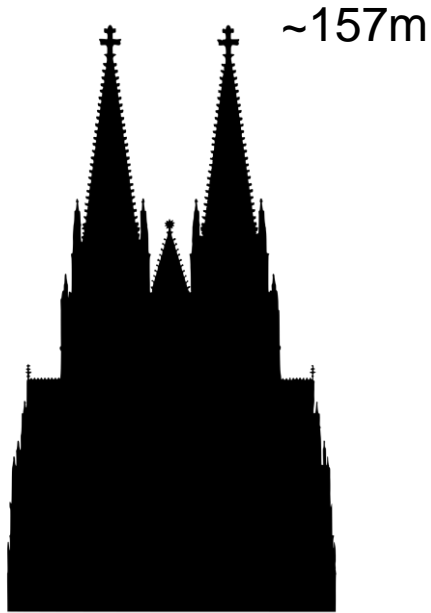
- >90% reduction for EC/EF
- >70% reduction for GT (strong performance even though the system was not specifically designed for larger tanks)

# An Analogy to better understand the performance in terms of Exposure reduction:

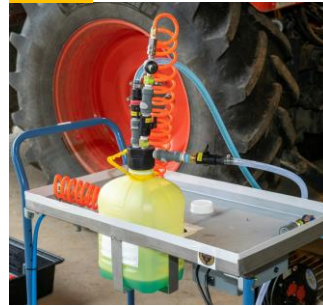
Cologne Cathedral = Operator exposure by open pour loading



Height in m as an analogy for exposure



GT



70-90% Exposure Reduction compared to open pour



GoatThroat®

EC



95-99% Exposure Reduction compared to open pour

EF



~1.80m



easyconnect

easyFlow M



Open Pour

**Take home message:** All three systems performed good in terms of OPEX reduction,

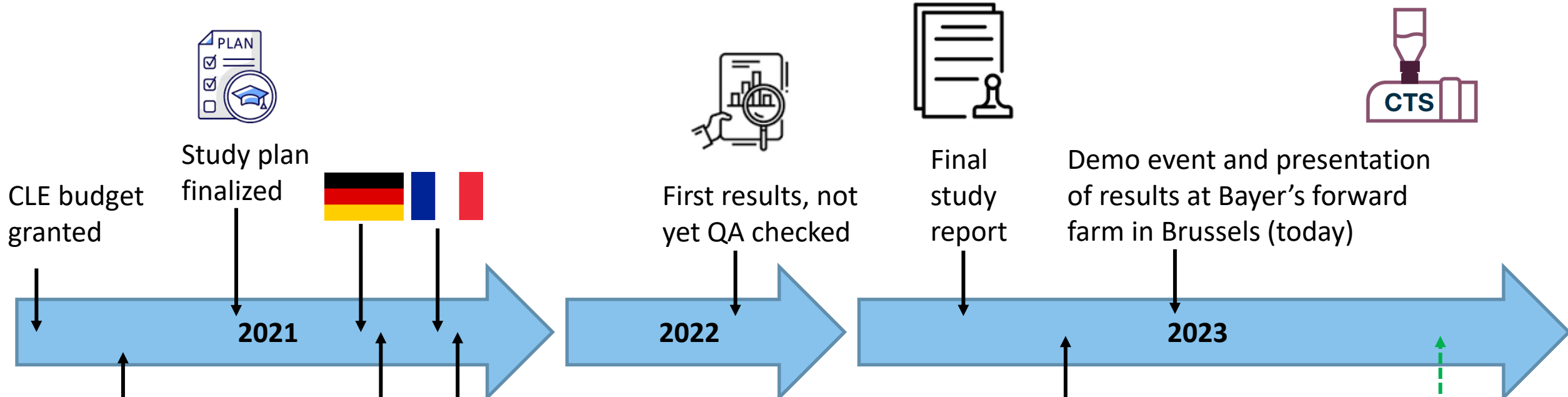
- >90% reduction for EC/EF
- >70% reduction for GT

# Why did we see differences between “probe extraction” and “inverted extraction” systems?



- **ALL three systems show significant reduction in operator exposure** when compared to the AOEM open pour data.
- **GoatThroat®**, the tested probe extraction system, is **designed to fill smaller spray rigs** with fewer loadings per day.
- **Cleaning** of the containers **with GoatThroat®** system is performed **manually (shaking)**. The fatigue factor of the operator when manually rinsing 27 containers is probably very important and probably led to reduced diligence by the farmers to properly clean the equipment generating more contamination than is expected when the directions are properly followed.
- This hypothesis is strengthened by the results from previous testings: **With fewer loadings (5), residues were very low also for GoatThroat.**

# Wrap up - Timeline



CLE budget granted



Study plan finalized



2021

Virtual Kick-off meeting with European regulators



First results, not yet QA checked



2022

Final study report



Submission of study report and evaluation report to EFSA



Demo event and presentation of results at Bayer's forward farm in Brussels (today)

2023

Publication of results in a peer-reviewed journal



**SPECIAL THANKS TO THE MANUFACTURERS  
FOR THEIR CONTINUOUS SUPPORT!**



GoatThroat®



easyFlow M







# Environmental Exposure Studies Information on the Exhibition Stand



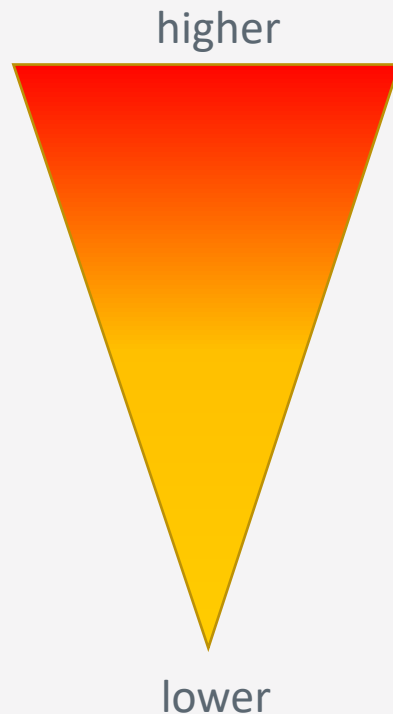
Agritechnica 2023

Tirso Oteyza (Syngenta), Juan Sasturain (BASF)



# REDUCTION IN SURFACE WATER CONTAMINATION

- Point sources represent the most important transfer pathways of PPPs into surface water and can represent from 40% up to 90% of the contamination measured in surface water bodies if preventive measures are not taken.\*



## General Priorities - Point Sources

- **Sprayer cleaning**
- **Mixing and loading**
- **Remnant management**
- **Container management systems**
- Transport to the field
- Farm pesticide storage
- Transport to the farm

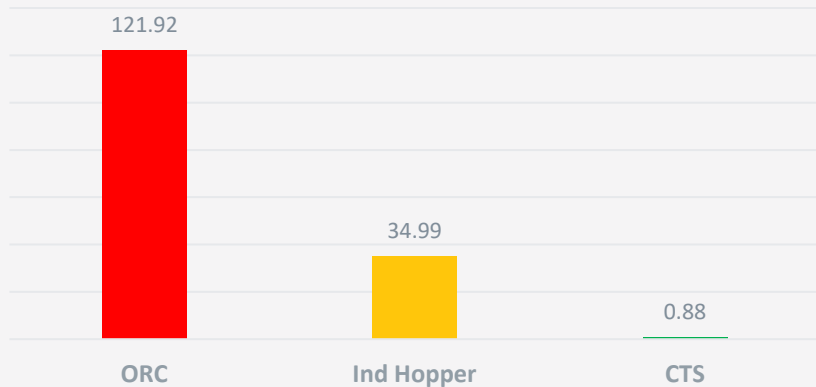
Closed transfer systems are meant to reduce exposure to the operator and the environment, as per ISO requirements



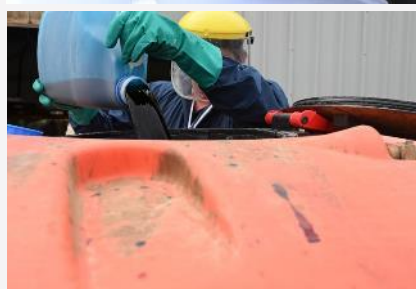
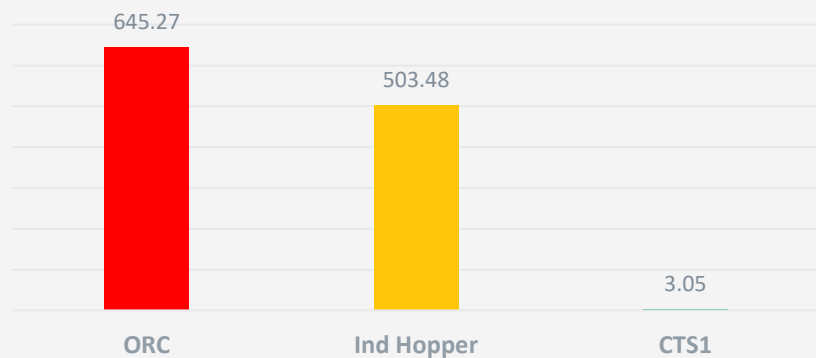
# EXPOSURE STUDIES WITH EASYCONNECT

- Two separate studies, comparing the filling of a sprayer by top loading, induction hopper and CTS show a clear reduction in exposure potential to the ground and the containers

Contamination on Bottles (Mean)



Total (mean) on Floor, Boot Covers, and orchard sprayer tank exterior



easyconnect

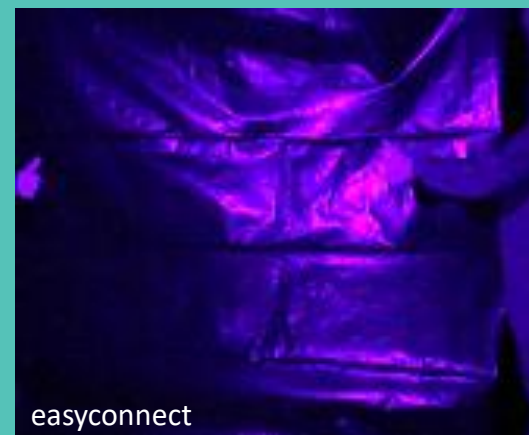


induction hopper



container outer surface

easyconnect



induction hopper



floor contamination

# easyconnect Working Group (ECWG)

- The pilot phase is coming to an end.
- The first high-output easyconnect cap facility has started the commercial cap production in November 2023.
- Larger numbers of CP products with easyconnect caps can be expected to reach the market starting in 2024.

**ECWG  
member  
companies**

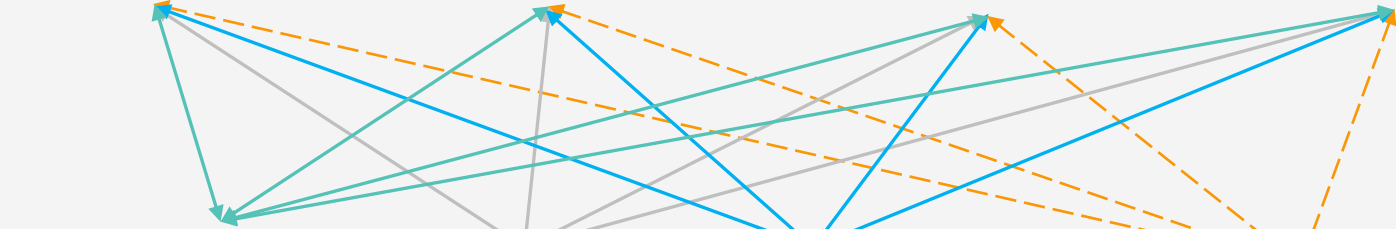
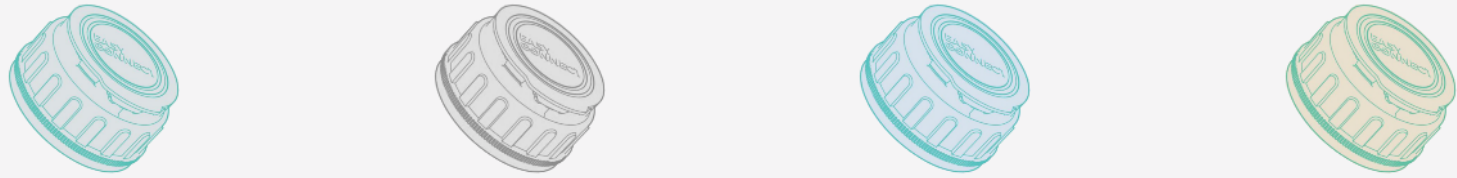
**EASY  
CONNECT**



# Compatibility of Closed Transfer Couplers with the **EASY CONNECT** cap



Various cap manufacturers



Pentair ✓



Tefen ✓



Lechler ✓



Agrotop (✓)

Various equipment manufacturers. Visit us in Hall 9, Booth 09C32

