



Bringing Real-World Rice Cultivation Practices into Environmental Risk Assessment

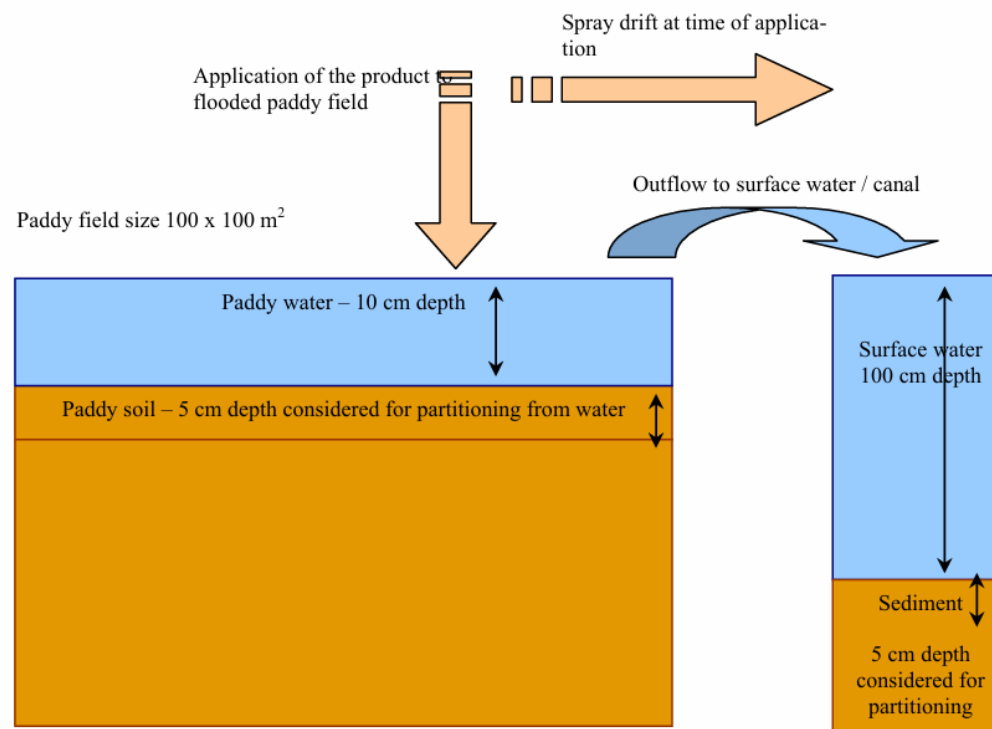
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SEPTEMBER 3, 2026

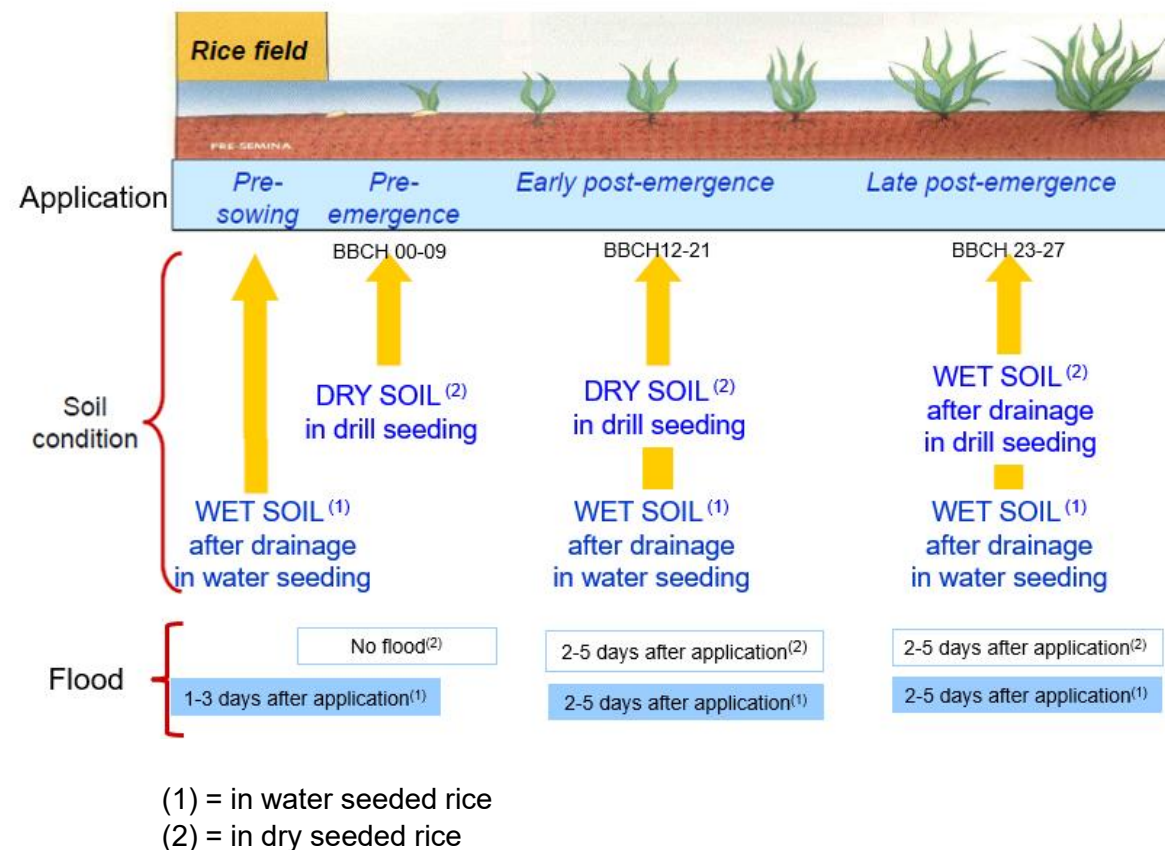
Rice Environmental Risk Assessment in Europe

- Environmental risk assessment for rice pesticides follows MedRICE guidance (SANCO, 2003)
- Step 1 surface-water assessment assumes continuously flooded rice paddies with a static water layer of 10 cm during application
- Higher-tier methods (e.g. RiceWQ modelling) were proposed (at Step 2/3), but detailed workflows and representative scenarios were not defined at the time (≈ 2002).



Conceptual scenario description for Step 1 Surface Water Calculations (MedRice 2003)
Water depths of 10 cm and 1 m were assumed for paddy field (left) and the canal (right), respectively.

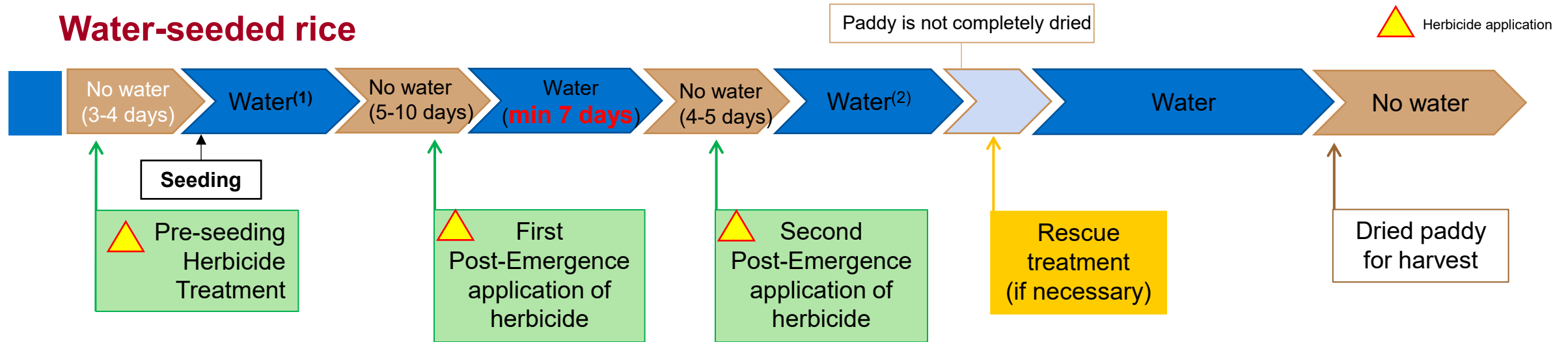
Herbicide application under real European rice-field conditions



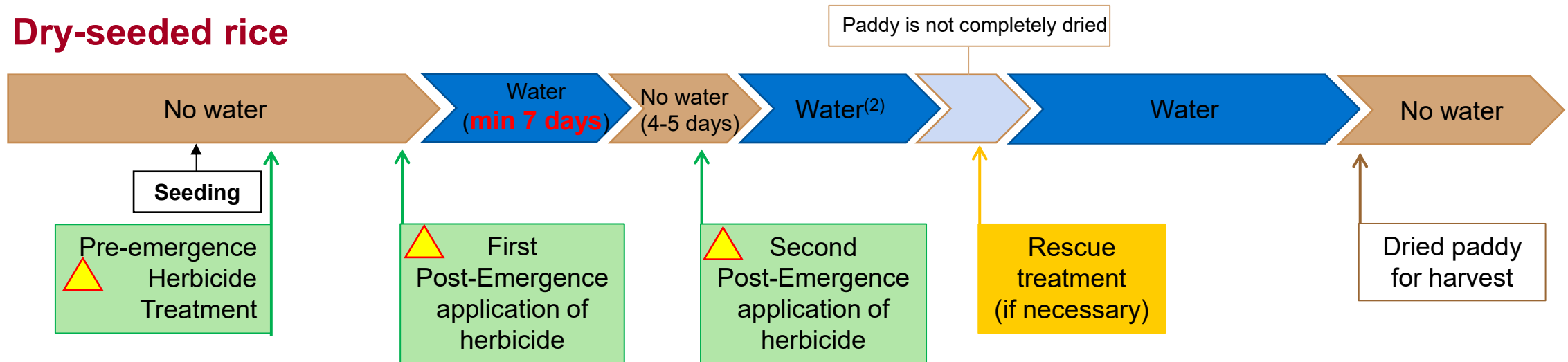
Herbicides are frequently applied to drained or semi-drained paddies before flooding

Control of weeds and water management in rice

Water-seeded rice



Dry-seeded rice



(1) In this period the paddy is dried for about 7 days to allow rooting of rice (2) Around stem elongation stage of rice, the paddy can be dried for about 7 days for yield improvement

Case-study objectives and modelling approach

Objectives

- ❖ Evaluate the relevance of current SANCO and draft MedRice (ICPS) scenarios against actual European rice cultivation practices
- ❖ Assess the impact of water management and application timing on surface water exposure estimates
- ❖ Compare and analyze exposure outcomes from MedRice and coupled RiceWQ/RivWQ modelling using regionally representative scenarios

Modelling approach

- **6 representative GAPs**
 - Include wet- and dry-seeded rice systems
 - Include pre-plant and post-emergence application types
- **Evaluated Compounds**
 - strongly sorbing parent with short DT50s
 - 1 mobile metabolite with short DT50s
- **Exposure Modelling Tools**
 - Classic (SANCO) and new (ICPS) MED-Rice
 - Coupled RiceWQ / RivWQ

MED-Rice tools

A	B	C	D	E	F	G
1	SUBSTANCE:	Testcompound				
2						
3	INPUT: Scenario data I	Scenario 1				Scenario 2
4	Soil texture	clayey				sandy
5	OC soil (%)	1.8				0.9
6						
7	depth _{water} (m) (water level in field)	0.1				0.1
8	Water velocity:					
9	field (L/sec/ha)	3				3
10	outflow (L/sec/ha)	0.5				0.5
11	Leakage (mm/d) (infiltration rate)	1				10
12						
13	t _{close} (d) (time of closure of field)	5				5
14	t _{flood} (d) (time of flooding)	120				120
15						
16	depth _{canal} (m) (deepness of outflow)	1				1
17						
18	INPUT: Scenario data II					
19	area (m ²) (area of rice field)	10000				10000
20	Volume of water in field (L)	1000000				1000000
21						
22	depth _{soil} (m)	0.05				0.05
23	BD soil (kg/dm ³) (soil bulk density)	1.5				1.5
24						
25	Outflow rate (1/d)	0.0432				0.0432
26	Dilution factor	10				10
27						
28	depth _{sediment} (m) (active sediment depth)	0.05				0.05
29	OC (%) of sediment	1.6				1.6
30	BD _{sediment} (kg/dm ³) (sediment bulk density)	1.5				1.5
31						
32	INPUT: Product					
33	Dose (g/ha) (application rate of product)	100				100
34						
35	f _{dep} (fraction of dose deposited to paddy field)	1				1
36	f _{drift} (fraction drift to adjacent water body)	0.0277				0.0277
37						
38	K _{oc} (dm ³ /kg)	10				100
39	K _d (soil) (dm ³ /kg)	0.18				0.9
40	K _d (sediment) (dm ³ /kg)	0.16				1.6
41	F _{sorbed} (soil) (fraction partitioning to soil)	0.119				0.403
42	F _{sorbed} (sediment) (fraction partitioning to sediment)	0.012				0.107
43						
44	DT50 _{total, pw} (d) in flooded soil system	2				2
45	DT50 _{pw} (d) in water phase	2				2
46	DT50 _{soil} (d) in solid phase	2				2
47						
48	DT50 _{total, sw} (d) in sediment/water system	2				2
49	DT50 _{sw} (d) in water phase	2				2
50	DT50 _{sed} (d) in solid phase	2				2

SUBSTANCE NAME:	Default substance
Paddy field condition during applications	Wet
f _{drift} (fraction drift to adjacent water body)	0.0277
K _{OC} (dm ³ /kg)	200
DT _{50 pw} (d) in water phase (flooded soil studies)	100
DT _{50 soil} (d) in solid phase (flooded soil studies)	100
DT _{50 sw} (d) in water phase (water/sediment studies)	1000
DT _{50 sed} (d) in solid phase (water/sediment studies)	1
DT _{50 soil} (d) in aerobic soil	1



Application #	Dose (g/ha)	Days after previous appl	f _{dep} (deposition to paddy field)
Application 1	250	-	0.75
Application 2	250	14	0.75
Application 3			
Application 4			

Event type	Days after last application
Discharge (t _{close})	3

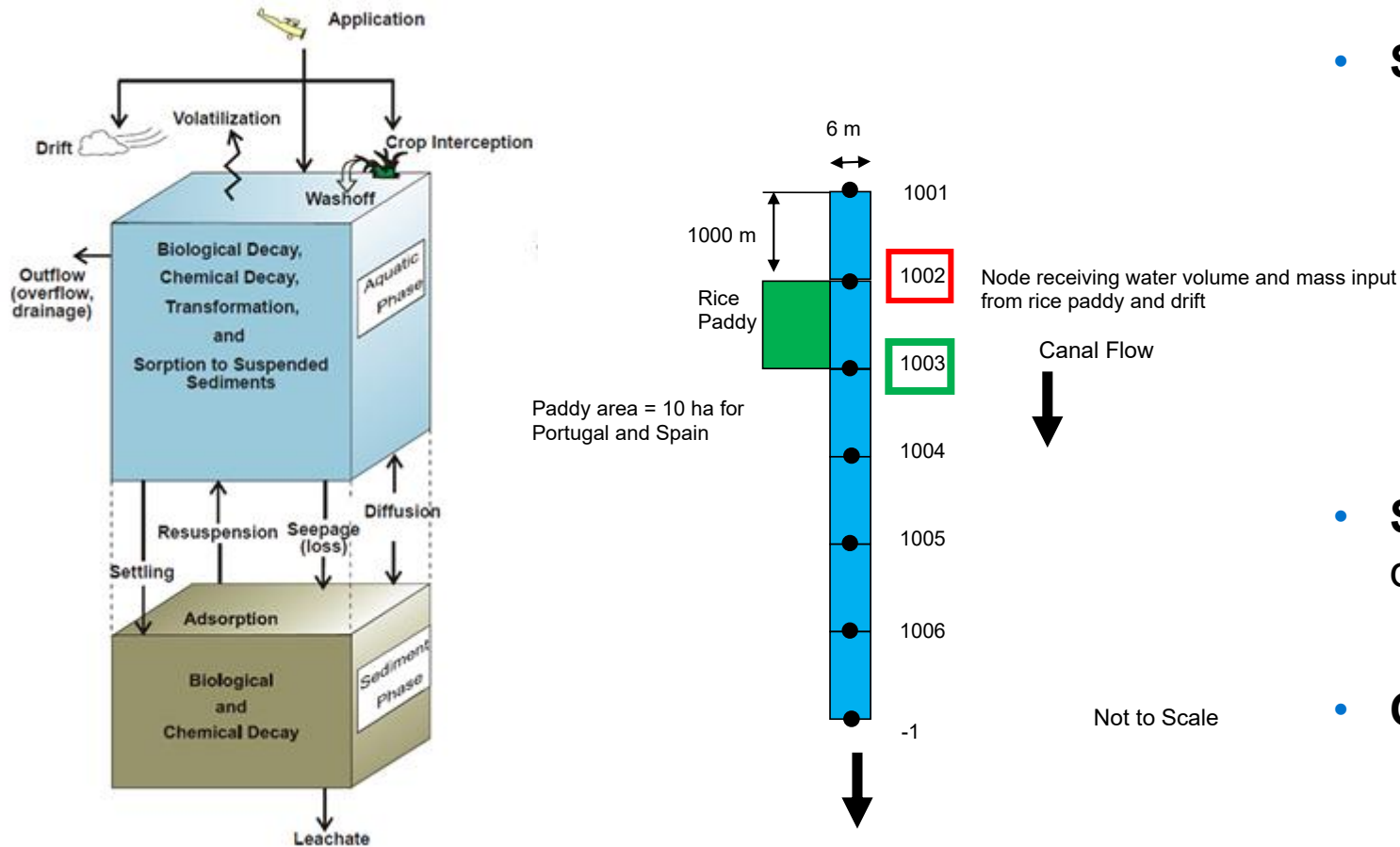
Metabolite calculation?		Yes	
Parent g/ha	MW met	MW p	Max occ%
3443.00	222.00	222.00	100.00
Metabolite g/ha		3443.00	
This value must entered manually in the I6-I9 cells			

Default model-defined input data		
INPUT: Scenario data	Scenario 1	Scenario 2
Soil texture	clayey	sandy
OC soil (%)	0.9	0.9
depth _{water} (m) (water level in field)	0.1	0.1
Water velocity: field (L/sec/ha)	1.8	2.8
Water velocity: outflow (L/sec/ha)	0.5	0.5
Leakage (mm/d) (infiltration rate)	1	10
K _{leak} Leakage rate constant (1/d)	0.01	0.1
t _{flood} (d) (time of flooding)	120	120
depth _{canal} (m) (deepness of outflow)	1	1
area (m ²) (area of rice field)	10000	10000
Volume of water in field (L)	1000000	1000000
depth _{soil} (m)	0.05	0.05
BD soil (kg/dm ³) (soil bulk density)	1.4	1.5
Outflow rate constant (1/d)	0.0432	0.0432
Dilution factor	10	10
depth _{sediment} (m) (active sediment)	0.05	0.05
OC (%) of sediment	1.6	1.6
BD _{sediment} (kg/dm ³) (sediment bulk)	1.5	1.5
K _d (soil) (dm ³ /kg)	1.8	1.8
K _d (sediment) (dm ³ /kg)	3.2	3.2
F _{sorbed} (soil) (fraction partitioning to)	0.558	0.574
F _{sorbed} (sediment) (fraction)	0.194	0.194

New MED-Rice spreadsheet tool proposed by ICPS

MED-Rice SANCO spreadsheet tool

RiceWQ / RivWQ coupling



- **Scenarios for the current case study:**

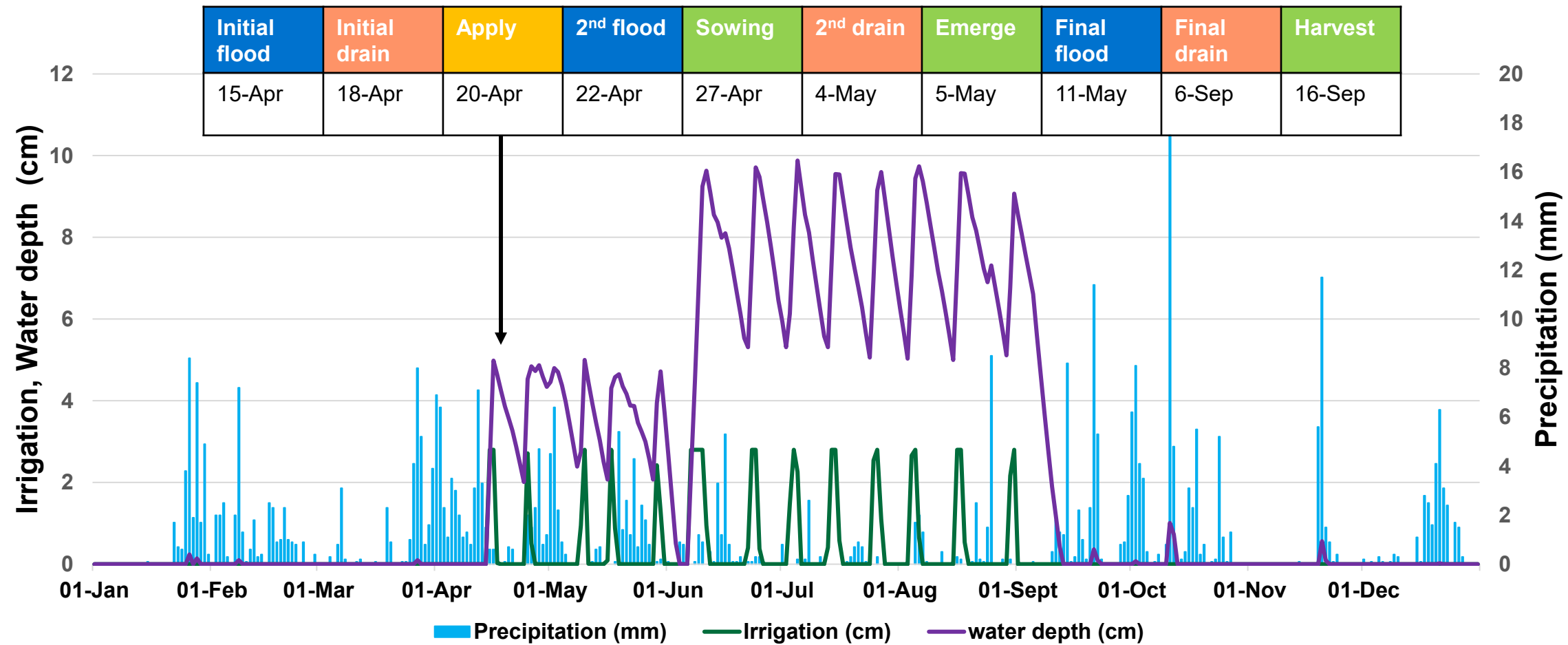
- MED-Rice soils: Sandy soil & Clayey soil, weather data from FOCUS models
- country-specific ICPS scenarios with 4 soil clusters, meteorological data based on MARS-Agri4cast

- **Simulation:** 30 years, realistic irrigation and drainage, parent-metabolite pathway

- **Output:**

- instantaneous maximum PEC_{sw} (used for comparison)
- 90th percentile of 1-day annual maximum PEC_{sw} for future assessment?

Hydrology and water-management considered in RiceWQ simulation

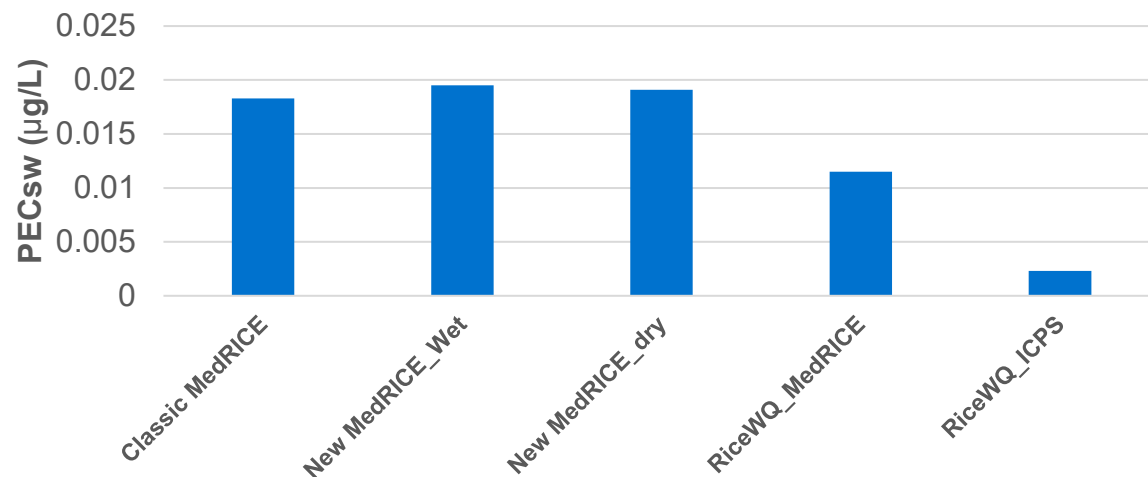


Precipitation and water management for ICPS cluster 1 scenario in Spain, wet seeding pre-plant, RiceWQ simulation

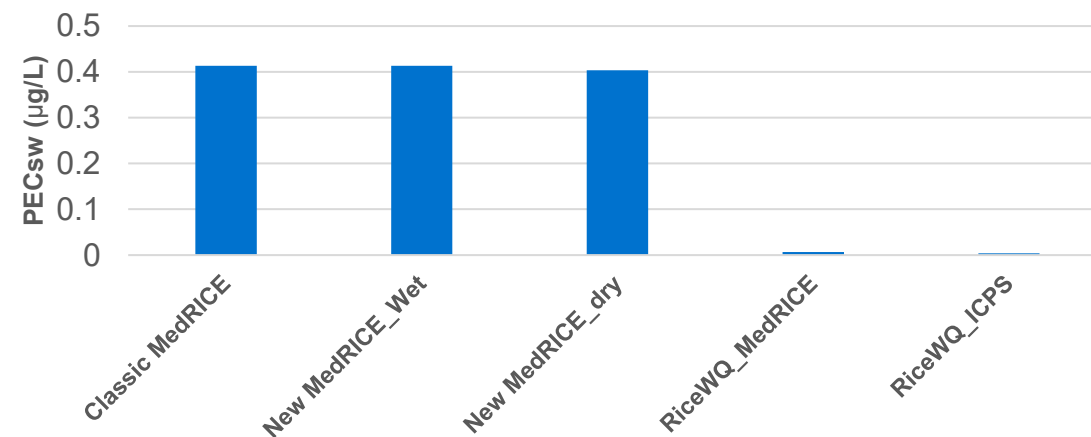
Comparison of overall PECsw values

Single post-emergence application, Wet-seeded rice scenario

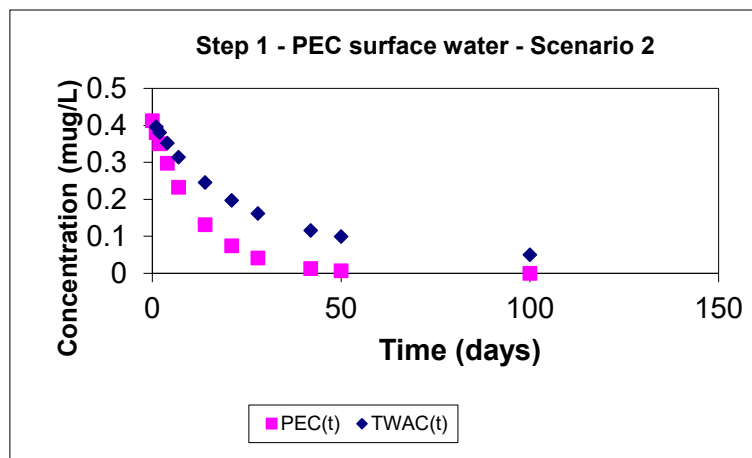
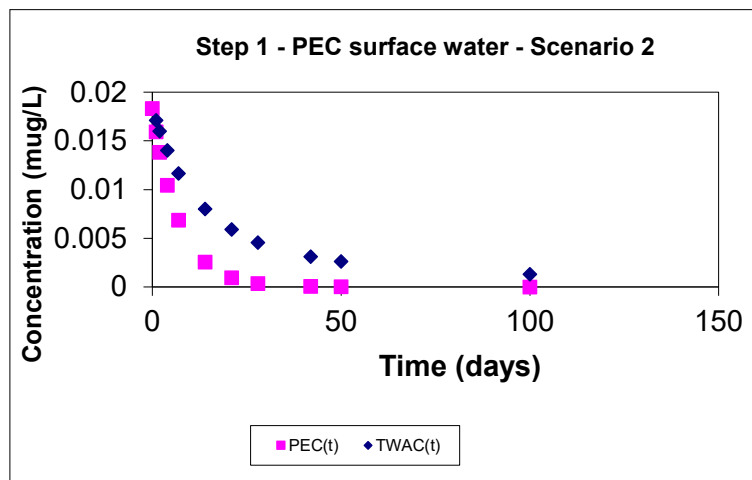
Overall maximum PECsw across all scenarios for parent



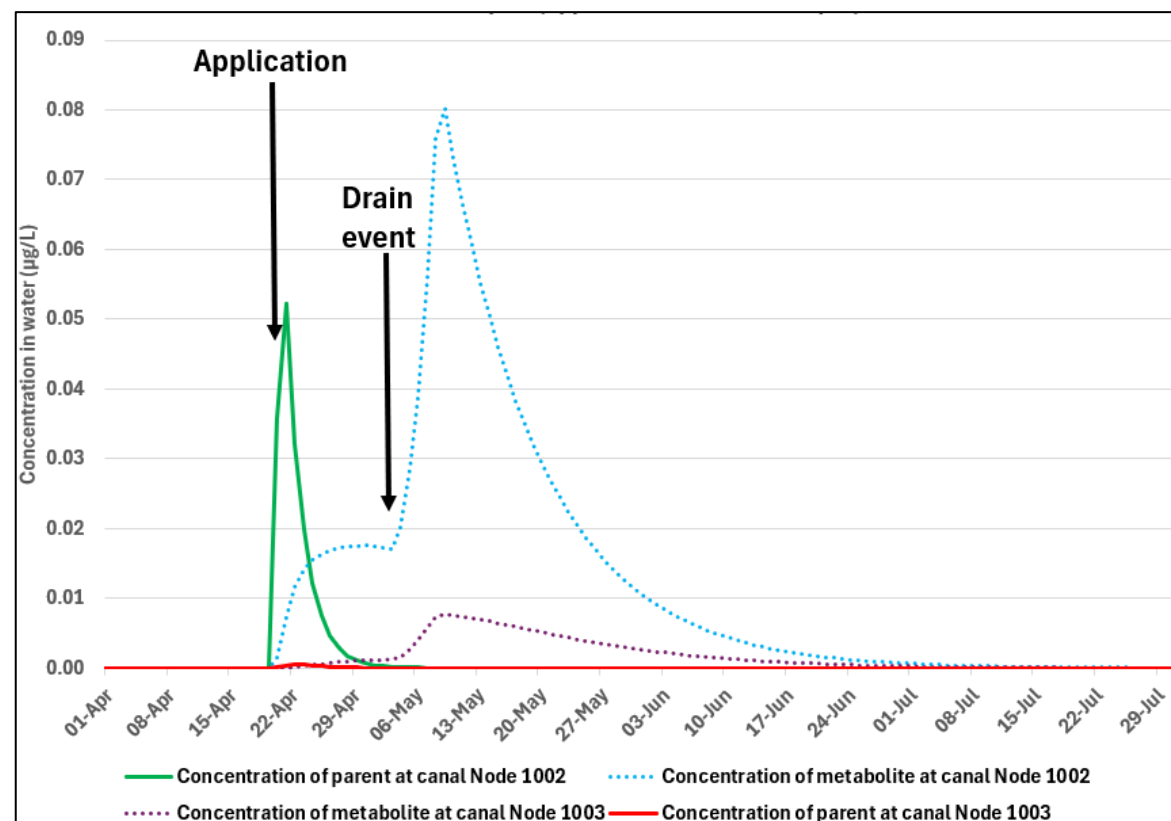
Overall maximum PECsw across all scenarios for metabolite



Time series of parent and metabolite concentrations



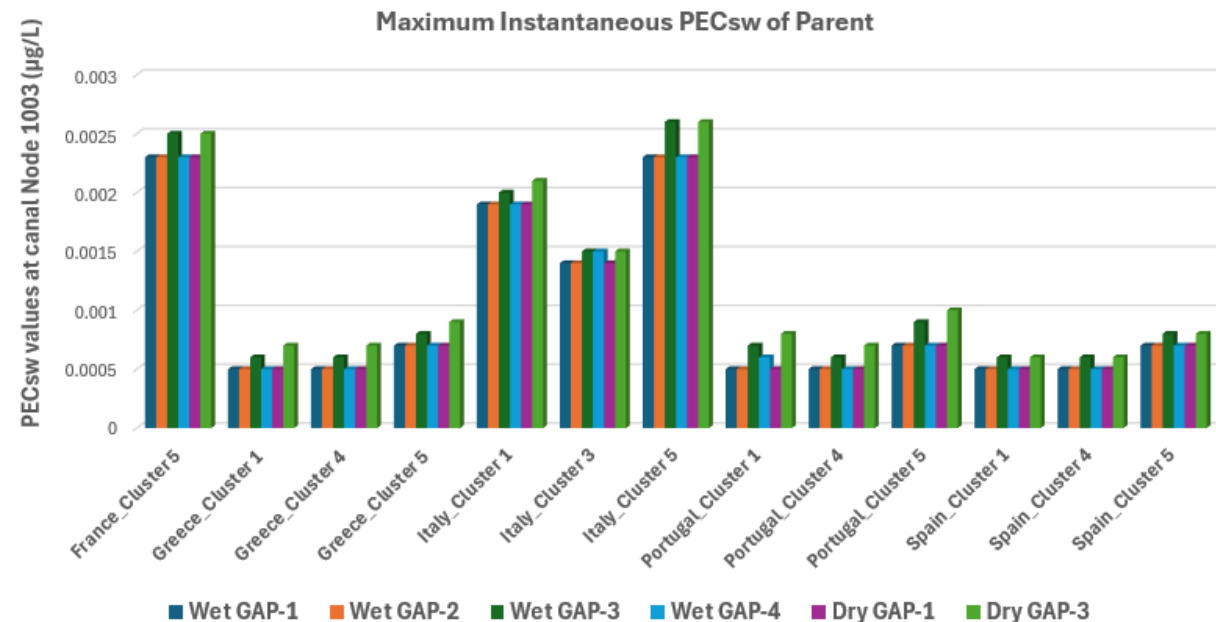
MED-Rice: Time series of parent (up) and metabolite (below) concentration compound in the surface water



RiceWQ / RivWQ: Time series of parent and metabolite concentration compound in the canal for ICPS cluster 1 scenario in Spain (GAP 2, pre-plant application on 20-April, paddy was drained on 4-May)

Comparison of different scenarios and GAPs

RiceWQ / RivWQ

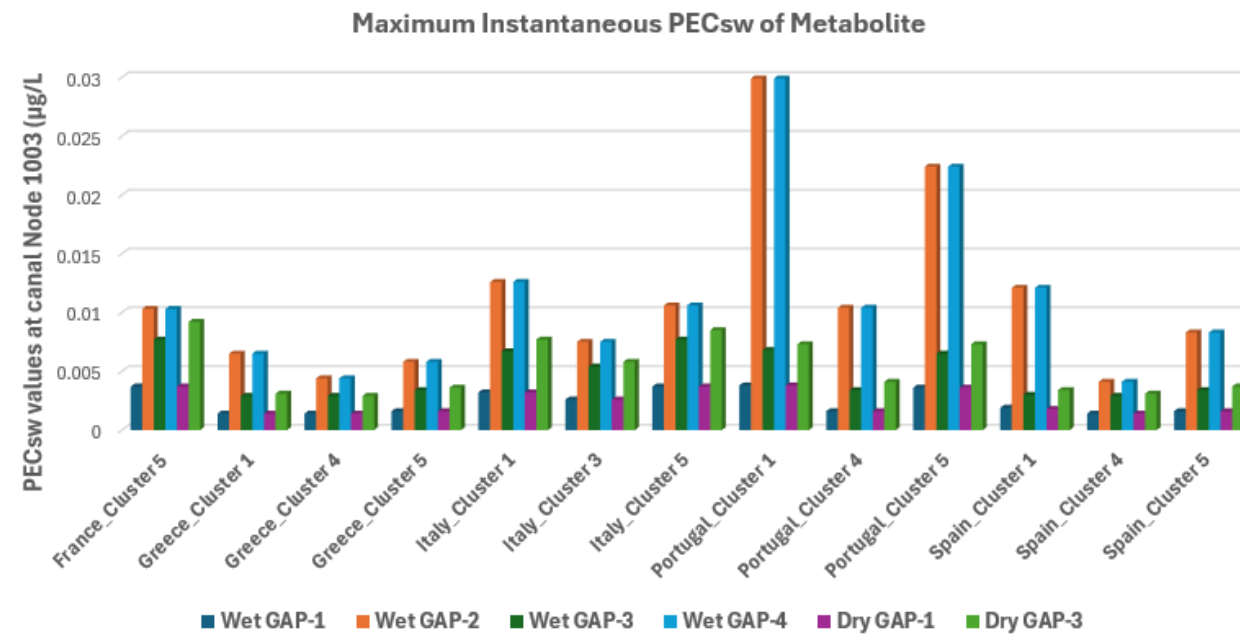


Wet Seeding GAP 1 – Post-Emergence Application

Wet Seeding GAP 2 – Pre-Plant Application

Wet Seeding GAP 3 – Two Post-Emergence Applications

Wet Seeding GAP 4 – One Pre-Plant and One Post-Plant Application



Dry Seeding GAP 1 – Post-Emergence Application

Dry Seeding GAP 3 – Two Post-Emergence Applications

Conclusions

- MED-Rice tool does not reflect the dynamic water management used in European rice systems and does not explicitly address metabolite formation and degradation, which may overestimate aquatic exposure. As a result, it is only suitable for screening-level assessment.
- By comparison, RiceWQ/RivWQ represents realistic flooding and drainage regimes alongside the dynamics of metabolite transformation. Because these elements interact in complex ways, they can substantially influence exposure levels in the drainage canal.
- This work supports moving ERA for rice toward routine use of physically based models (e.g. RiceWQ), supported by standardised, regionally representative scenarios.
- Continued collaboration among regulators, industry, and researchers is key to the successful transition toward more realistic rice exposure assessments, enabling the development of standardized approaches that are scientifically credible, regulatory relevant, and practical to apply.

Thank you!



GAP table for the case study

MEMBER STATE(S)	APPL.#	APPLICATION METHOD	RATE (KG AI/A)	TIMING
Wet Seeding GAP 1 – Post-Emergence Application				
France, Italy, Spain, Greece, Portugal	1	Broadcast spray	0.030	BBCH 12 to 45
Wet Seeding GAP 2 – Pre-Plant Application				
France, Italy, Spain, Greece, Portugal	1	Broadcast spray	0.030	Up to one week before Planting
Wet Seeding GAP 3 – Two Post-Emergence Applications				
France, Italy, Spain, Greece, Portugal	2	Broadcast spray	0.030	BBCH 12 to 45 10-20d Interval Between Apps
Wet Seeding GAP 4 – One Pre-Plant and One Post-Plant Application				
France, Italy, Spain, Greece, Portugal	2	Broadcast spray	0.030	App #1: Up to one week before Planting App #2: BBCH 12 to 45
Dry Seeding GAP 1 – Post-Emergence Application				
France, Italy, Spain, Greece, Portugal	1	Broadcast spray	0.030	BBCH 12 to 45
Dry Seeding GAP 3 – Two Post-Emergence Applications				
France, Italy, Spain, Greece, Portugal	2	Broadcast spray	0.030	BBCH 12 to 45 10-20d Interval Between Apps