



Flooded Rice Pesticide Risk Assessment: the “orphan” cereal in current Guidance Documents

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Introduction

European Pesticide Registration requires a Risk Assessment for non-target organisms according to EU Regulation (Reg. 1107/2009 EC). Through the years, European Authorities developed Guidance Documents (GDs) for risk assessment considering exposure scenarios for the required organisms typical for terrestrial crops. Rice is the only European crop cultivated in fields regularly flooded for long periods, similar to water environments like swamps, ponds and other moist setting. The intrinsic diversity between the two kinds of environment leads to discrepancies in risk characterisation. Up to now, the current GDs have been used to conduct the risk assessment for pesticides application on rice considering rice crop as a terrestrial cereal. The present poster presents the main criticisms identified from the application of the current European GDs together with proposals to perform a focused Ecotoxicological Risk Assessment on rice crop.

Feeding Guilds & Focal Species				BIRDS&MAMMALS			
Feeding Guild	General cereal		Rice		Representative species		
	birds	mammals	birds	mammals	birds	mammals	
Direct exposure							
Frugivorous	Not reported		Not relevant*				
Granivorous	Small granivorous – “bunting”	Not reported	Not relevant**	Small granivorous – “mouse”			
Insectivorous	Small insectivorous – “passerine”	Small insectivorous – “shrew”	Small insectivorous – “passerine”	Small insectivorous – “bat”			
herbivorous	Large herbivorous – “goose”	Small herbivorous – “vole” Large herbivorous – “lagomorph”	Small-medium herbivorous – “rail”	Small-medium herbivorous – “vole”			
Omnivorous	Small omnivorous – “lark”	Small omnivorous – “mouse”	Not relevant***	Not relevant***			
Secondary poisoning (bioaccumulation)							
Piscivorous (fish-eating)	Medium piscivorous - general	Medium piscivorous - general	Medium piscivorous - general	Medium piscivorous - general			
Vermivorous (earthworm-eating)	Small-medium vermivorous – “thrush”	Small vermivorous - “shrew”	Not relevant*				
Benthophagous	Not reported		Small-medium limicolous – “wader”	Not relevant**			

* lack of food source in rice fields
** missing species in paddy
*** considered covered by single-diet species (worst case)

Residue Unit Dose (RUD)

Feeding guild	Food item	Mean RUD value (chronic RA)		90 th percentile RUD value (acute RA)	
		Mean RUD value (chronic RA)	90 th percentile RUD value (acute RA)	Mean RUD value (chronic RA)	90 th percentile RUD value (acute RA)
Direct exposure					
Granivorous	Small seeds	40.2	87	Seeds	40.2 / 87
Herbivorous	Cereal shoots	54.2	102.3	Aquatic macrophytes	100 / 200
	Non-grass herbs	28.7	70.3		
Insectivorous	Ground invertebrates	7.5	12	Foliar dwelling and flying insects	21 / 54.1
Secondary poisoning (bioaccumulation)					
Piscivorous (fish-eating)	Fish	$PEC_{fish} = PEC_{water} \times TWA \times BCF$		Fish	$PEC_{fish} = PEC_{water} \times TWA \times BCF$
Benthophagous	Sediment dwelling	Not reported		Sediment dwelling	$C_A = \frac{BCF \times PEC_{sed}}{f_{oc} \times K_{ow}}$ $LogBCF = 0.9172 \log K_{ow} + 0.8953$

OFF-Field

Rice-cultivated landscape is typically constituted by paddies and the system of channels and ditches in close relationship. Indeed, when rice paddies are flooded, the rice cultivated area can be considered a unique temporary water body.



The edges between single chambers and chambers and ditches are constituted by thin bunds, usually built with pressed soil, highly managed by farmers, and far from a natural environment, with a low biodiversity.



It is proposed to consider belonging to the “in field” (paddy system) scenario the artificial water bodies network carrying water to and from the paddies (ditches and channels), roads bounding paddies and the bunds defining the single chambers, together with paddies where rice is cultivated.

The off-field can be considered composed by uncropped and cropped (different form rice) areas outside the paddy system with vegetation.

AQUATIC ORGANISMS

General cereal	Rice			
Risk Assessment conducted only for edge-of-field surface water. Aim of the evaluation is to preserve the community structure and therefore the environmental functions. The Risk Assessment is performed on organisms representing three levels of trophic chain (primary producers, primary consumers, secondary consumers)	In addition to the off-field risk assessment, an in-field risk assessment is proposed in order to protect the food sources for terrestrial vertebrates.			
	Organism	Time scale	Endpoint	AF
	Fish		Not required*	
	Aquatic invertebrates	Acute	EC ₅₀	100
		Chronic	NOEC/EC ₁₀	10
	Sediment dwelling	Acute	LC ₅₀	100
		Chronic	Not required**	
	Algae	Not required***		
	Aquatic macrophytes	Chronic	E _{c50}	10

*not naturally belonging to in-field aquatic community
**not relevant for the protection goal
***not a food source for terrestrial vertebrates

BEES

Differences only in exposure scenarios, risk assessment scheme according to agreed EFSA GD

General cereal	Rice
	Contact exposure
	Treated crop
Always relevant (all BBCH)	Relevant only during flowering period (BBCH 60-69)
	Weeds in the field
Always relevant (all BBCH)	Not relevant (lack of flowering weeds in paddies)
	Field margins
Referred to the single field	Referred to edges of paddy system
	Adjacent crop (no differences)
	Consumption of pollen
	Treated crop
Relevant if potential exposure is expected	Relevant during flowering period (BBCH 60-69) or for substances absorbed by roots and translocated through the floem
	Weeds in the field
Always relevant (all BBCH)	Not relevant (lack of flowering weeds in paddies)
	Field margins
Referred to the single field	Referred to edges of paddy system
	Adjacent and succeeding crop (no differences)
	Accumulative toxicity (no differences)
	Contaminated water
	Guttation water (no differences)
	Surface water
Edge-of-field PEC _{sw}	In field PEC _{sw}
	Water in puddles
PEC _{puddle} from FOCUS runoff scenarios	Covered by in field PEC _{sw}
	Metabolites in pollen (no differences)

OTHER NON-TARGET ARTHROPODS

General cereal	Rice
In-field risk assessment required for both foliar and soil Non Target Arthropods at higher tiers. Off-field risk assessment to preserve the source for in-field recolonization.	In field risk assessment required only for foliar organisms since no soil community cannot establish due to the semi-aquatic characteristics of irrigated lowland rice fields. Off-field risk assessment performed considering the paddy system off-field characterization.

NON-TARGET PLANTS

General cereal	Rice
Off-field risk assessment according to terrestrial crops characterisation.	Off-field risk assessment performed considering the paddy system off-field characterization.

SOIL

General cereal	Rice
Risk assessment required always for earthworms and for other soil macro-organisms where Tier 1 risk assessment for NTA results in a high risk.	No risk assessment since a soil organisms community cannot establish due to the semi-aquatic characteristics of irrigated lowland rice fields

Conclusions

- The Ecotoxicological Rice Guidance Document will produce :
- More realistic ecotoxicological risk assessment
 - A standardized method to perform risk assessment
 - Benefit for risk manager

References:

- EFSA (2013) Guidance on tiered risk assessment for plant protection products for aquatic organisms in edge-of-field surface waters - EFSA Journal 2013;11(7):3290
- EFSA (2013) Guidance on the risk assessment of plant protection products on bees (Apis mellifera, Bombus spp. and solitary bees) - EFSA Journal 2013;11(7):3295
- EFSA (2009) Risk Assessment for Birds and Mammals - EFSA Journal 2009; 7(12):1438
- Guidance document on Terrestrial Ecotoxicology in the context of Directive 91/414/EEC PDF link to external website (SANCO/10329/2002 rev.2, final)

