

Developing Pesticide Risk Assessment Guidelines for Aquatic Protection in Thailand



MED-Rice



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$$RQ = \frac{\text{Exposure}}{\text{Effect}}$$

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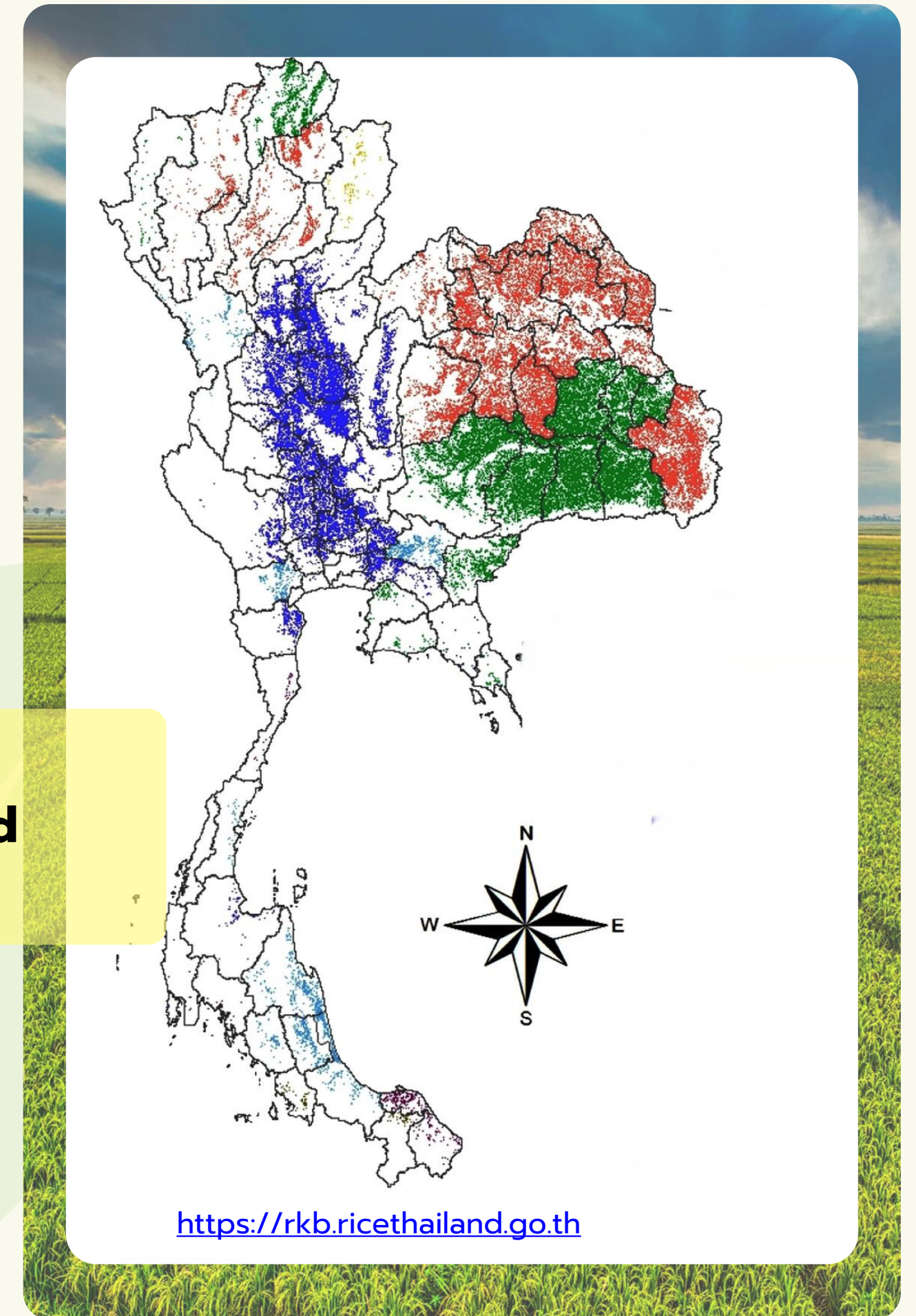
Rice Cultivation Areas in Thailand



The total rice cultivation area in Thailand is **11.87 million hectares**. **(72.19% located in the Central and Northeastern regions)**



“
**Herbicide
Insecticide
Fungicide**
”



Multi-Sectorial Scientific Alliance



Department of Agriculture

Primary institutional host, lead participant in capacity building, and official publisher of the national guidelines.



Croplife Asia & TAITA

Technical partner providing global expert-led theoretical training and international standardization protocols.



Mahidol University

Provided academic validation for guidelines and delivered specialized toxicological advisory.

Aims to standardize aquatic risk assessments for pesticides, driving the ultimate protection and conservation of aquatic life and ecosystems.

Milestones to Institutionalization

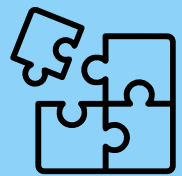
MAR-JUN 2025

MARCH 2025

JUN-NOV 2025

NOV-DEC 2025

JAN 2026 -PRESENT



Training

- Theoretical Training: Intensive sessions with global ecotoxicology experts.
- Practical Validation: Site-specific data collection in Ayutthaya Province.



Exchange

- Information Exchange Session on Agricultural Environmental Exposure Scenarios with the Plant Protection Department, Vietnam



Drafting Phase

- Technical synthesis, parameter localization, and structure definition for guidelines.



Academic Peer Review

- Academic peer review.
- Validation of models against tropical field scenarios.
- Final refinement cycles.



Current Status

- Completion of the comprehensive "Aquatic Risk Assessment Guideline"

Milestones to Institutionalization



Intensive Theoretical Training in Ecotoxicology and Risk Assessment with Global Experts.



Practical validation and data collection at site-specific locations in Ayutthaya Province.



Milestones to Institutionalization

- Information Exchange Session: Agricultural Environmental Exposure Scenarios with PPD, Vietnam.
- Initiation and development of the guideline.
- Finalized Comprehensive Aquatic Risk Assessment Guideline.





GUIDELINE GOAL: PROTECTING TROPICAL AQUATIC ECOSYSTEMS

Establish a standardization tiered architecture for assessing pesticide risk within high-risk tropical agro-ecosystems, specifically focusing on rice paddies and adjacent catchments

- **Protection Targets:** Fish, *Daphnia magna*, and Green Algae
- **Environmental Focus:** Surface water bodies near rice paddy fields, catchments, and irrigation canals

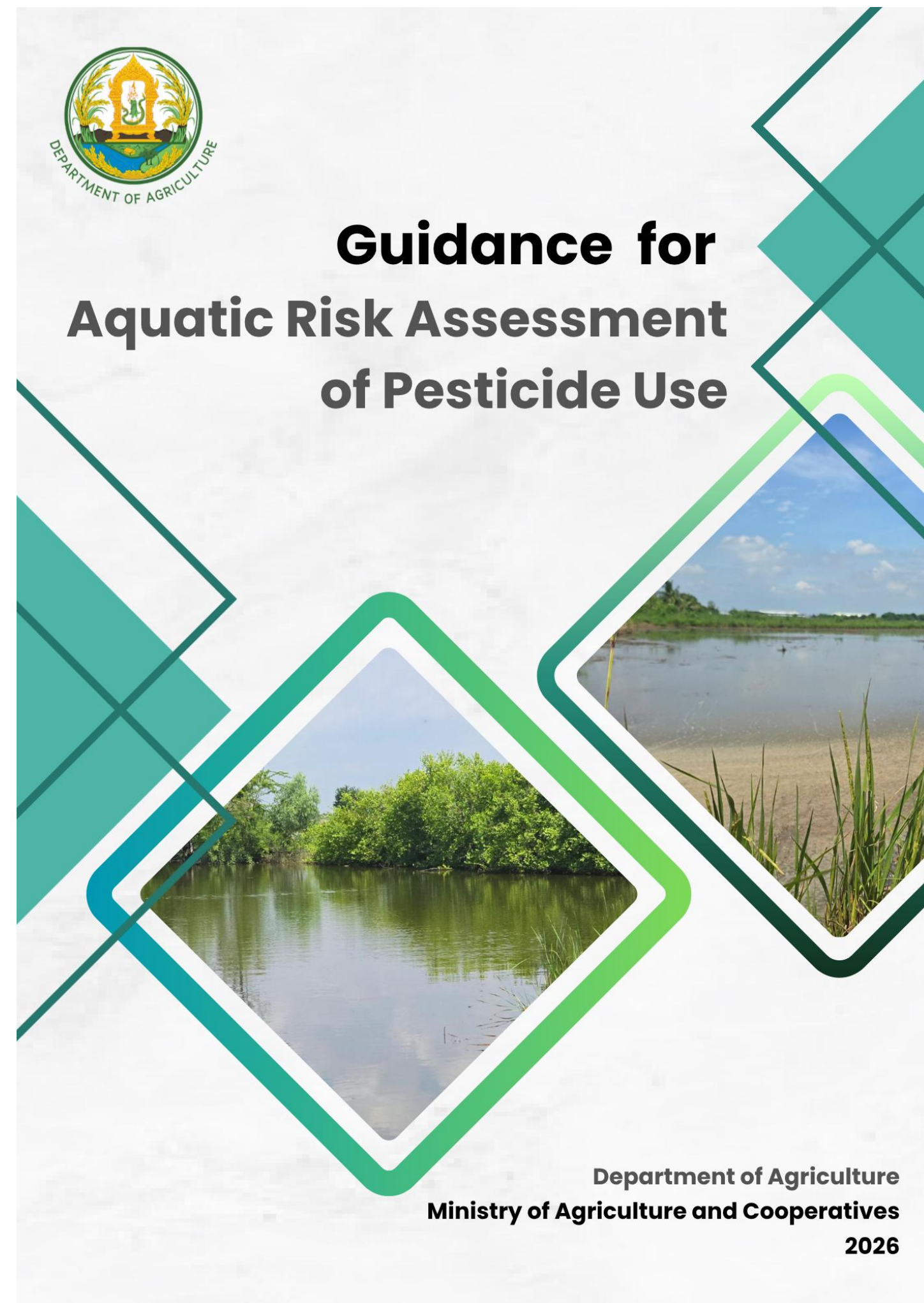
Guidance for Aquatic Risk Assessment of Pesticide Use

“A reference standard for aquatic pesticide risk assessment, designed to protect and conserve tropical ecosystems”

Definitions: defines the terms related to the data used in risk assessment

Methods and Procedures: describes detailed methodologies and provides case study examples to demonstrate the methods used in risk assessment.

Risk Mitigation, Risk Management and Warnings.



Substance A:	
INPUT: Site parameters	
Soil texture	
depthPaddyWater (m) (water level in field)	
depthSurfaceWaterBody (m) (depth of surface water body)	
depthPaddySoil (m) (depth of soil below paddy water)	
depthSediment (m) (depth of sediment below surface water body)	
OC _{PaddySoil} (%) (organic carbon in paddy soil)	
BD _{PaddySoil} (kg/dm ³) (soil bulk density)	
OC (%) (organic carbon in sediment)	
BD _{sediment} (kg/dm ³) (sediment bulk density)	
T _{close} (d) (time of closure of field)	
fact _{dilution} (dilution factor)	
Kd _{PaddySoil} (dm ³ /kg) (sorption coefficient of paddy soil)	
F _{sorbedPaddySoil} (-) (fraction partitioning to paddy soil)	
Kd _{Sediment} (dm ³ /kg) (sorption coefficient of sediment)	
F _{sorbedSediment} (-) (fraction partitioning to sediment)	
INPUT: Use practices	
Dose (g/ha) (application rate of product)	
BBCH stage (f _{interception})	
f _{drift} (fraction drift to adjacent water body)	
f _{dep} (fraction of dose deposited to paddy field)	
INPUT: Substance Properties	
Koc (dm ³ /kg)	
DT50 _{PaddyWater,total} (d) in flooded paddy system	
DT50 _{SurfaceWater,total} (d) in sediment/water system	
INPUT: Toxicity endpoints	
LC50 (mg/L) Acute fish	
Acute fish uncertainty factor	10
EC50 (mg/L) Acute daphnia	
Acute daphnia uncertainty factor	10
ErC50 (mg/L) Algeal growth	
Algeal growth uncertainty factor	1

Aquatic environment exposure modelling: MED-RICE

An international standard exposure model used to assess agricultural pesticide risks in aquatic ecosystems adjacent to paddy fields.

- Site parameters:** Soil texture, Water Depth, OC%, Bulk Density etc.
- Use practices:** Application rate, BBCH Stage, Drift%.
- Substance properties:** KOC, DT50
- Toxicity endpoints:** Acute toxicity test value (LC50, EC50, ErC50), uncertainty factor (UF)

Quantitative Modeling: The Mathematical Framework behind MED-RICE

$$RQ = \frac{PEC_{sw}}{PNEC} = \frac{PEC_{sw}}{(LC50 \text{ or } EC50)} / UF$$

- RQ: Risk quotient
- PEC_{sw}: Predicted Environmental Concentration in Surface Water
- PNEC: Predicted No Effect Concentration
- UF: Uncertainty factor
- LC50: Lethal concentration 50%
- EC50: Effective concentration 50%

$RQ \leq 1.0$

Acceptable Risk

Exposure is safely below the toxicity threshold

$RQ > 1.0$

Unacceptable Risk

Mandatory refined testing or risk mitigation required

Risk Refinement and Mitigation

Refinement

- **Use of Geomean Values:** Using the central tendency of toxicity datasets.
- **Reduced Uncertainty Factors:** Adjusting Assessment Factors (e.g., from 10 to 3) when high-quality field data exists.

Mitigation

- **Reduce the pesticide application rate.**
- **Reduce frequency of use or increase interval between applications.**
- **Reduce drift and runoff via application optimization.**

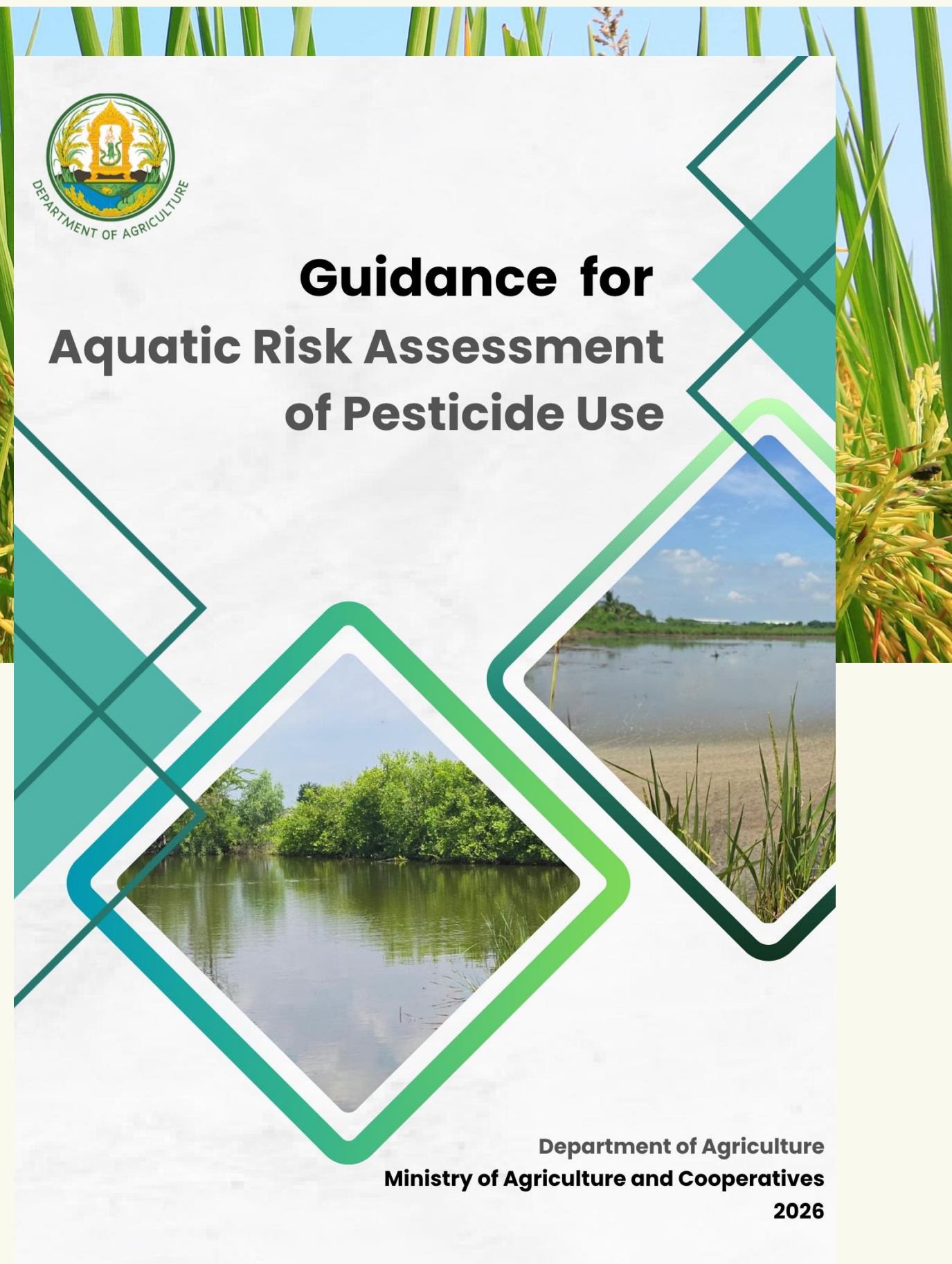
Bridging Science and Sustainability

"Our finalized guidance serves as a **scientific cornerstone**, *empowering stakeholders* to safeguard aquatic ecosystems and ensure agricultural chemical safety."





**THANK YOU FOR
YOUR ATTENTION**



Appendix

Details of plant protection and plant production products in paddy field.

Timing of application	Common name, (ai) and formulation	Purposes	Application rate/rai (0.16 ha) (g or ml)	Application rate/ha (g or ml)
First application (transplanting stage) 8-10 days after sowing	Clomazone + Propanil 12% + 27%W/V EC	Elimination of early post-emergence weeds in the rice, the product control narrow leaf weed and broadleaf weed	350	2187.5
	Bispyribac-Sodium 20% W/W WP	Elimination of early post-emergence weeds in the rice, the product control narrow leaf weed and broadleaf weed and sedge	25	156.25
	Fipronil 5% W/V SC	Prevention and control of rice thrips and rice leaf folder	100	625
	Plant growth regulator (Liquid)	Supplements to accelerate nutrient accumulation and increase grain weight	100	625
	Liquid fertilizer (21-4-4)	Liquid fertilizers to enhance plant vigor and stress tolerance	100	625
	Silicone surfactant (Liquid)	Surfactant agents to enhance foliar application efficiency	2	12.5

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Second application (First tillering stage) 25-30 days after sowing	Chlorfenapyr 10% W/V SC	Prevention and control of rice thrips and rice leaf folder	100	625
	Thiamethoxam 25% W/W WG	Prevention and control of brown plant hopper	50	312.5
	Amino Acid + Seaweed Extract (Liquid)	Nutritional supplements to promote tillering and strengthen vegetative growth	100	625
	Liquid fertilizer (13-13-13)	Liquid fertilizers to enhance plant vigor and stress tolerance	100	625
	Carbendazim 50% W/V SC	Prevention and control of bacterial leaf blight, brown spot and narrow brown spot diseases	100	625

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