

Ranking: surface water

Protection goal: humans and cattle using surface water as drinking water

Goal:

- identify current actives with highest hazard
- identify most relevant crops and cropping systems
- on the basis of cropping system devise a scenario

Condition: do not consider pesticides used for migratory pests

Note: ranking on basis of toxicity only is less relevant for scenario choice, occupational/consumer risk should be dealt with separately.

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Material to work with:

- Lists of imported products (commercial farms and flower farms in separate lists) and locally produced products; only data for 2010 was used
- Information which actives are contained in the products (spreadsheet by Berhan, some additional info added)
- Information on acute (ARfD) and chronic (ADI) risk to humans (spreadsheet by Berhan, lots of additional info added)
- Information on pests and crops (Consultancy report Elaboration of Registered List of Pesticides in Ethiopia According to PSMS Template)
- Paper D. Gorfu and E. Ahmed

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Condition: do not consider pesticides used for migratory pests

- Seems 'logical' if this is considered 'non-agricultural' use
- Actives against army worm, locust, quelea bird excluded only if use for this purpose is actually mentioned by Berhan
- Actives involved are quite toxic and high volume:
 - Carbaryl (ARfD: 0.01 mg/kg, volume 2010: 19 tons)
 - Diazinon (ARfD: 0.025 mg/kg, volume 2010: 47 tons)
 - Fenitrothion (ARfD: 0.013 mg/kg, volume 2010: 22 tons)

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Condition: do not consider pesticides used for migratory pests

Consequence:

- These actives are not included in any of the rankings
- This may underestimate actual hazards/risks
- Devised scenario will not include use for migratory pests

Although these actives are not considered in the process of scenario construction, the risk of possible **agricultural** uses can be evaluated using the relevant scenario

- Carbaryl (ARfD: 0.01 mg/kg, volume 2010: 19 tons)
- Diazinon (ARfD: 0.025 mg/kg, volume 2010: 47 tons)
- Fenitrothion (ARfD: 0.013 mg/kg, volume 2010: 22 tons)

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Outline of procedure:

- Convert volumes of products into volumes of active ingredients
- National scale: divide national volume of active by
 - ARfD → Index for acute risk
 - ADI → Index for chronic risk
- Local scale: divide application rate by
 - ADI → Index for chronic risk at local scale
- Select actives with highest acute/chronic risk
- Identify most relevant crops and cropping systems

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Some corrections necessary:

- Exclude irrelevant types of formulations (pellets, baits), indoor use (granules are not excluded, they are considered relevant)
- Exclude compounds with low mammalian toxicity, these will most likely not cause problems at a local scale, even if national volume is high
- Do not consider actives used against army worm, locust, quelea bird, domestic use etc.
- If ARfD is not available, use mean ratio ARfD/ADI to calculate ARfD from ADI
- For chronic risk, exclude compounds which rapidly degrade in water ($DT_{50} \leq 2$ days) because of irrelevance

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Exclude irrelevant types of formulations (pellets, baits), indoor use

- DDT (indoor use against mosquito)
- Dichlorvos (indoor use, cockroach, mosquito, flies)
- Aluminiumphosphide (pellets, storage pests)
- Brodifacoum (baits)

The scenario(s) to be devised are not suitable for risk assessment for these types of uses

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Exclude low chronic toxicity actives, irrespective of volume

Appears infeasible on the basis of present data, the only compounds with $ADI \geq 0.3$ mg/kg are:

- Glyphosate
- Kresoxim-methyl
- Pyroxsulam
- Fosetyl-aluminum

Possible to use WHO classification (but: considers acute hazard only)

More expert knowledge is needed to justify this step, which is therefore not included in the present analysis

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Overview of actives excluded from the analysis:

Indoor use: DDT, dichlorvos

Formulation type: brodifacum, aluminiumphosphide

Migratory pests: carbaryl, diazinon, fenitrothion

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Result – Volume of Active Ingredient

Active	Volume (2010, tons)	Type ^a , crop	ADI (mg/kg)	ARfD (mg/kg)
2,4-D (AMINE)	1824	H, wheat	0.05	-
GLYPHOSATE	195	H, coffee	0.3	-
MALATHION	193	I, sweet potato	0.03	0.3
MANCOZEB	148	F, tomato	0.05	0.6
ENDOSULFAN	84	I, cotton	0.006	0.02
DIMETHOATE	63	I, barley	0.001	0.01
THIRAM	52	F, seed treatment	0.01	0.6
ATRAZINE	40	H, maize	0.02	0.1
DELTAMETHRIN	30	I, cotton	0.01	0.01
S-METOLACHLOR	20	H, haricot beans	0.1	-

^a (H)erbicide, (I)nsecticide, (F)ungicide

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Result – Acute risk

Active	Volume (2010, tons)	ARfD (mg/kg)	Volume / ARfD (10 ³ units)	Remarks
DIMETHOATE	63	0.01	6247	
ENDOSULFAN	84	0.02	4208	
DELTA METHRIN	30	0.01	3024	
2,4-D (AMINE)	1824	0.62*	2964	High estd. ARfD
MALATHION	193	0.3	642	
λ-CYHALOTHRIN	3	0.0075	403	
ATRAZINE	40	0.1	397	
ABAMECTIN	1.4	0.005	285	
MANCOZEB	148	0.6	247	
OXAMYL	0.23	0.001	232	

* Estimated value

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Result – Acute risk

Most interesting actives:

Dimethoate, endosulfan, deltamethrin, due to high toxicity

(Possibly 2,4-D, due to its high volume)

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Result – Chronic risk

Active	Volume (2010, tons)	ADI (mg/kg)	Volume / ADI (10 ³ units)	Remarks
DIMETHOATE	63	0.001	62471	
2,4-D (AMINE)	1824	0.05	36471	High ADI
ENDOSULFAN	84	0.006	14025	
MALATHION	193	0.03	6422	
DELTA METHRIN	30	0.01	3023	
MANCOZEB	148	0.05	2959	High ADI
ATRAZINE	40	0.02	1983	
DICOFOL	2	0.002	947	
CLODINA FOP	3	0.003	938	
CHLORPYRIFOS	8	0.01	801	

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Result – Chronic risk

Most interesting actives:

Dimethoate, endosulfan, due to high toxicity

(Possibly 2,4-D, due to its high volume)

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Result – Chronic risk

Caution: outcome is influenced by a priori excluding some compounds.

The following compounds would rank in top-10 list for chronic risk

aluminiumphosphide

carbaryl

diazinon

dichlorvos

fenitrothion

malathion

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Result – Local chronic risk

Active	Applic. Rate (N * kg/ha)	ADI (mg/kg)	AR / ADI	Remarks
METAM-SODIUM	153	0.001	153000	Soil desinfestant, greenhouse?
OXAMYL	4	0.001	4000	Nematicide, greenhouse?
DIMETHOATE	0.4	0.001	400	
PROPINEB	1.425	0.007	204	
ENDOSULFAN	0.78	0.006	131	
B-CYFLUTHRIN	0.31	0.003	104	
THIOPHANATE-M.	0.75	0.08	94	
CHLOROTHALONIL	1.24	0.015	82	
PROPYZAMIDE	1.5	0.02	75	
ACEPHATE	1.88	0.03	63	

Application rate and frequency taken from Berhan's list of registered pesticides or from www.fytostat.nl (Dutch registrations)

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Result – Local chronic risk

Most interesting actives:

Metam-sodium, oxamyl, dimethoate, endosulfan, β -cyfluthrin, due to high toxicity

Possibly propineb, combination of high rate and high toxicity

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Result – Combined acute/chronic/local chronic risk

Active	Crops	Volume (2010, tons)	ADI (mg/kg)	Criterion
Dimethoate	Barley, french beans	63	0.001	Acute, chronic, local
Endosulfan	Cotton	84	0.006	Acute, chronic, local
Deltamethrin	Cotton, flowers, cerals, maize, potato, cabbage	30	0.01	Acute (chronic)
2,4-D	Wheat cereals, maize, teff	1824	0.05	Acute, chronic
Metam-Na	? soil desinfestant	0.9	0.001	Local
Oxamyl	? Nematicide	0.23	0.001	Local
b-Cyfluthrin	? similar to deltamethrin	0.02	0.003	Local
Propineb	Flowers	0.51	0.007	Local

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Overall result – Combined acute/chronic/local chronic risk

Insecticides, due to their high toxicity:

Dimethoate, Endosulfan, Deltamethrin, β -Cyfluthrin

Herbicide, due to its high volume: 2,4-D (amine)

Fungicide, due to high application rate and high toxicity: Propineb

Crops: Barley, cotton, wheat, maize, teff, flowers, potato, french beans

Note that some high toxicity actives are not considered, because of their use against migratory pests

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Preliminary results

- Suggestion for choice of **Crops**: barley, cotton
- **Possible additional crops** according to Content report WP B2.1/CR1: horticulture, floriculture (high acreage, high use rate)
- **Cropping systems** should be chosen on the basis of selected crops
- Devise **scenario(s)** on the basis of cropping systems and zones
- Scenario with selected cropping system suitable for estimation of risk for all actives in open air (including those a priori excluded from the analysis)
- Be aware that scenarios for regular crops are not suitable for greenhouses