

Towards a more Reliable Pesticide Risk Indicator to Monitor National Action Plans (NAP): the Limitations of HRI-1 and Alternatives Based on Ecotoxicity

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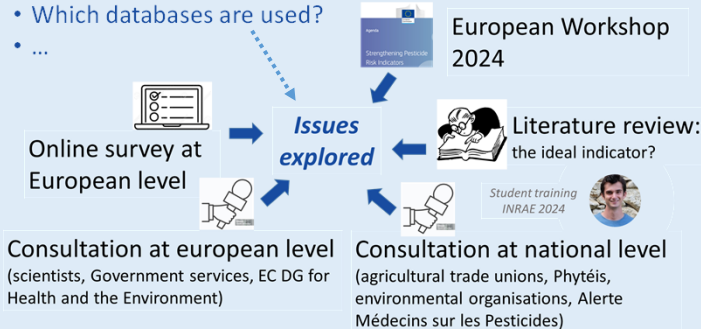
Introduction:

Under pressure from the agricultural crisis in France in early 2024, the French government replaced the monitoring indicator for its NAP with the HRI-1. In light of the criticism levelled at this indicator by scientists and professional organizations, INRAE was tasked with assessing its limitations and proposing ways to improve it. The main conclusions are presented here.

Materiels & methods:

Issues explored:

- Which NAP indicators are used in Europe?
- What are their perceived advantages and limitations?
- What improvements are suggested?
- Which databases are used?
- ...



Results 2. Comparison of HRI-1 with ATAT (i.e. standardised sum of TAT_(year i, taxa j) for various taxa):

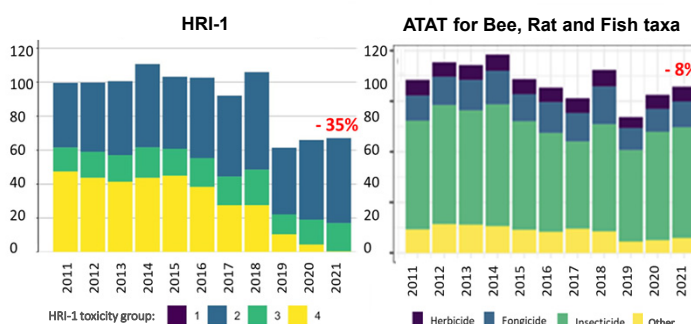
Advantages of ATAT over HRI-1:

- ATAT is Scientifically-based [1],
- It explicitly takes into account the toxicity of each substance,
- The taxons selected can be adapted in line with policy priorities,
- No retroactive calculation or reference period are required,
- It could be used to compare different agricultural practices,

ATAT is also already used in other countries and programmes.

But: Ecotoxicological data mainly concern short-term effects and are not available for all 'taxon x substance' combinations.

$$TAT_{ij} = \sum_{k=1}^{N_{\text{substances}}} \frac{QSA_{ik}}{TOX_{jk}}$$



HRI-1 (left) and ATAT (right) indicators for France over the period 2011–2021 and their respective decreases in 2021 compared with the average for 2011–2013 (% value in red).

Results 1. HRI-1 advantages and limitations:

- HRI-1 is easy to calculate at both national and EU level

$$HRI1_i = \frac{100 \sum_{j=1}^4 QSA_{ij} P_j}{\frac{1}{3} \sum_{k=2011}^{2013} (\sum_{j=1}^4 QSA_{kj} P_j)}$$

But,

- The quantities of substances (QSA_{i,j}) for year i and toxicity Group (G_j)* are summed regardless of their effective doses,
- The weighting coefficient of each group P_j is arbitrary,
- The retrospective reclassification of substances whose group has changed over time leads to an excessive fall in HRI-1, which primarily reflects the transfer of substances to the G4* group, whilst the G2 group remains relatively stable (see the figure below),
- Standardization is based on a same reference period in Europe (2011-2013), despite different levels of progress across Europe at this period.

* G1 : approved low risk, G2 : approved other, G3 : approved but at threat of being replaced, G4 : not approved in accordance with Regulation 1107/2009.

Conclusions:

What should the ideal indicator comply with?

- ✓ Answer the objectives of a NAPs,
- ✓ Be based on objective scientific knowledge,
- ✓ Take into account the toxicity of active substances,
- ✓ Be calculated for each Member State,
- ✓ Be as simple and transparent as possible,
- ✓ Be developed in consultation with stakeholders.

- ATAT appears to be a valuable indicator for monitoring pesticide use and the associated risks.
- To go further, it would be interesting to:
 - improve EU databases in order to make more toxicity data available for a wide range of relevant taxa and a greater number of substances, including co-formulants,
 - consider other risk endpoints as long-term toxicity and endocrine-disrupting effects,
 - compare ATAT with Pesticide Load [2] that also includes human health and environmental fate endpoints,
 - test the ability of these indicators to meet the various objectives of a NAP and the EU, using a standardized methodology.
- Additional indicators to monitor alternative practice progress would help guide public policy towards deep-rooted change.

References:

[1] Bub S., Wolfram J., Petschick L.L., Stehle S., Schulz R. 2023. <https://doi.org/10.1021/acs.est.2c07251>

[2] Kudsk P., Jørgensen L. N. et Ørum J. E. 2018. Pesticide Load - A new Danish pesticide risk indicator with multiple applications. Land Use Policy 70: 384-393. <https://doi.org/10.1016/j.landusepol.2017.11.010>

French expertise final report: <https://agriculture.gouv.fr/les-indicateurs-de-suivi-de-la-strategie-ecophyto-2030>