Correcting the F2F Indicator: A Prerequisite for Effective Pesticide Reduction in the EU

The requirement for the *Farm to Fork (F2F) Indicator*[1] is to monitor the progress in achieving the EU pesticide reduction targets, which consist of a 50 % reduction in **use** and **risk**. The current version of the F2F Indicator is based on the Harmonised Risk Indicator 1 (HRI 1) and uses sales data (in kg of pesticide active substance) as an approximation for *use* and the approval status ("low risk," "normally approved", "more hazardous" and "not approved") as an approximation for *risk*.

Table 1: Concept of the F2F Indicator (Annex 1 of the proposal for a "Sustainable use Regulation")

	Groups			
	1	**2**	**3**	**4**
USE	Sales volume in kilograms of approved "low-risk" chemical-pesticide active substances	Sales volume in kilograms of "approved" chemical-pesticide active substances (not "low risk", not "more hazardous")	Sales volume in kilograms of approved "more hazardous" chemical-pesticide active substances	Sales volume in kilograms of "non-approved" chemical-pesticide active substances
RISK	**risk factors**			
	1	**8**	**16**	**64**

There would be no objection to the simplicity of this approach if it were not for two conceptual errors that make the indicator unsuitable for monitoring EU pesticide reduction targets, which are explained in more detail below.

1. Flawed Representation of use

Since actual *use data* will only be available in the EU from 2028 based on the SAIO[2] regulation, the F2F Indicator legitimately relies on nationally available *sales data* for chemical pesticide active substances (as does HRI 1, which the F2F Indicator is conceptually based on). The error lies in using the sales volumes of pesticide active substances (in kg) directly as a measure for use without

[1] https://food.ec.europa.eu/plants/pesticides/sustainable-use-pesticides/farm-fork-targets-progress_en
[2] https://www.organicseurope.bio/news/agreement-on-agricultural-statistics-saio/

considering their different hectare application rates. Depending on which pesticide is considered, this leads to misjudgments of *use* and *risk* that can amount to a factor of up to 10,000.

For example, hectare application rates for some particularly efficient *synthetic* pesticides[3] are **less than 10 grams**. For others—including both synthetic[4] and most natural[5] active substances—they are in the **one- to two-digit kilogram range**. Therefore, the *use* of 1 kilogram of pesticide active substance can mean very different things in terms of total area treated when comparing the *use* of different pesticides. This is illustrated below using the example of three herbicides, which differ significantly in their application rates: Florasulam, Glyphosate, and Acetic Acid[6].

Table 2: The area where 1 kg of a herbicidal active substance can eliminate weeds varies by up to a factor of 10,000, depending on the choice of herbicide: 1 kg Florasulam, 1 kg Glyphosate, or 1 kg of Acetic Acid.

Active substance	**Florasulam** (Group 2, WF 8)	**Glyphosate** (Group 2, WF 8)	**Acetic acid** (Group 2, WF 8)
Active substance sold	1 kg	1 kg	1 kg
Median hectare application rate[7]	0,006 kg/ha	2,16 kg/ha	60 kg/ha
Area treatable with 1 kg	160 ha	0,46 ha	0,016 ha
Increase in the F2F risk index[8]	8	8	8

The consequence of not considering the hectare application rates is that the F2F Indicator, as proposed by the Commission, calculates exactly the same increase of the F2F index (combination of risk and use) to weed killing on **only 0.016 hectares** with the herbicidal active substance *Acetic Acid* as it does to weed killing on an **area 40 times larger** with the synthetic herbicide *Glyphosate*, or on

[3] e.g. Deltamethrin, Fludioxonil, Florasulam
[4] e.g. Propamocarb, Mancozeb, Glyphosate
[5] e.g. Sulphur, Iron Sulphate, Baking Soda
[6] Although acetic acid is a natural active substance, herbicidal use is only permitted in conventional farming
[7] see below in point *3. The Corrected F2F Indicator*
[8] The calculated increase results from the quantity sold/used (1 kg) multiplied by the risk factor (WF 8).

an **area 10,000 times larger** with the synthetic herbicide *Florasulam*, which is undoubtedly an absurd result.

This example illustrates that ***kilograms* is the wrong unit of measurement** for the use of pesticides with different hectare application rates. A normalisation step that takes into account the different hectare application rates – as also provided for by established pesticide indicators such as the Danish *Treatment Frequency Index* (TFI) or the French "NODU" (*Number of Unit Doses*) – is therefore necessary. It serves to convert the nonsensical measurement "*kilograms of active substances sold*" into a meaningful measure for reflecting pesticide *use*: the "*treatable area*" with the respective amounts of active substances sold.

2. Flawed Representation of risk

As shown above in Figure 1, the F2F Indicator divides chemical pesticide active substances according to their status of authorization into four different groups and equips them with different weighting factors (WF): WF 1 for "low-risk," WF 8 for "normally authorised," WF 16 for "more hazardous," and WF 64 for "non-authorized" pesticide active substances.

The classification into risk groups 1 to 3 corresponds to the hazard or risk classification from the EU approval process. The corresponding weighting factors (WF 1, WF 8, WF 16) reward substitution of More Hazardous Pesticides (Candidates for Substitutions) and create incentives for switching to Low-Risk Pesticides. However, the situation is different with the active substances in group 4.

The (massive and retroactive) increase in the risk weighting in group 4 by applying WF 64 due to the loss of approval is arbitrary. This increase is not based on risk or hazard classifications, as the possible reasons for losing approval are manifold. Failure to meet the approval criteria due to unacceptable risks to health or the environment is only one of them. Often active substances lose their approval because they are no longer economically interesting, because more effective or cheaper alternatives have become available, or because pests have become resistant to the pesticide. This can apply to substitution candidates as well as to low-risk pesticides. Thus, the retroactive increase in the risk factor due to the loss of approval is the **second conceptual error** of the F2F Indicator, as proposed by the Commission. A flawed design with consequences; because it leads to a retroactive increase in the baseline from which the success of pesticide reduction is calculated with every active substance that loses its approval. This makes it possible to achieve the 50% reduction target mathematically without changing the intensity of pesticide use in the fields, leading to feigned pesticide reduction.

3. Correcting the F2F Indicator

The correction of the conceptual errors described above is comparatively simple. The **misrepresentation of use** can be corrected with the help of an additional *normalisation step,* and by completely excluding active substances that are applied only indoors - like storage gases, or substances used in traps, or for post-harvest treatment. The normalisation step consists of dividing the sales volumes of the active substances by their respective *average hectare application rates*. The latter represent an additional data requirement. However, these data can be easily calculated as the *median* from the maximum hectare application rates of the "*representative uses*"[9] determined in the EU approval process. A detailed description of the calculation method can be found in this factsheet created by experts from the German Federal Environment Agency (UBA): https://www.umweltbundesamt.de/sites/default/files/medien/11740/publikationen/factsheet_zum_hri1.pdf. It also lists the *median hectare application rates* for 255 chemical pesticide active substances. **The necessary data for correcting the F2F Indicator are therefore already available here and now**.

Correcting **the misrepresentation of risk** is even simpler: it is sufficient to refrain from increasing the weighting factor (WF) due to a loss of authorization. This means that active substances, even after losing their authorization, will be weighted with the risk factor corresponding to their last authorization status. Only if substances have been banned due to unacceptable risks to the environment or health is a (retroactive) increase in the risk factor justified. Here we propose WF 16

4. Advantages and Limitations

Like any pesticide indicator, the corrected F2F Indicator has its strengths and limitations. The calculation of the pesticide treated area based on sales figures and median hectare application rates is subject to some imprecision. This arises because the median hectare application rate is a standardised value, while the actual hectare application rates for pesticides can vary within and between member states, depending on the pesticide and crop. However, the range of crop-specific hectare application rates for a given active substance is negligible[10] compared to the range of average application rates for different active substances (which can span up to four orders of magnitude; see Table 2).

A second limitation of the corrected F2F Indicator arises from its inherent simplicity: Because the input data is limited to pesticide sales figures, median hectare application rates, and approval status, the indicator does not differentiate between different active substances within the same risk group and weighs each application equally by applying the corresponding risk factor. Specific sub-risks associated with pesticide use, such as impacts on human health, biodiversity, or the condition of environmental compartments are therefore not addressed. While we believe that monitoring these

[9] The use of hectare application rates from representative uses as the data basis has the advantage of simplicity and the use of harmonised data. An alternative approach would be to use national pesticide authorization data, similar to the French NODU or the Danish TFI.

[10] https://www.umweltbundesamt.de/sites/default/files/medien/11740/publikationen/factsheet_zum_hri1.pdf

aspects is important in principle, it is not essential for a method aimed at measuring progress towards the EU's reduction targets.[11]

In fact, the simplicity of the corrected F2F Indicator also results in its greatest strengths, namely transparency, reliability, and robustness. Thus, the indicator shows a reduction in the F2F Index (a combination of use and risk) only when—and exactly when—the use and/or risk has been reduced. In other words, when the area treated with chemical pesticides in the EU (or in a Member State) has decreased and/or the pesticides used have been switched from higher-risk to lower-risk alternatives. This fundamentally distinguishes the corrected F2F Indicator from the version currently proposed by the Commission, which is inherently flawed and yields false conclusions, thereby misinforming decision-makers and the public, as demonstrated in the table below.

Table 3: Performance of the corrected F2F Indicator compared with the indicator proposed by the Commission

	F2F Indicator as proposed by the Commission	Corrected F2F Indicator
Accurate representation of the trend in the area treated with pesticides?	NO [12]	YES
Systematic pretence of pesticide reduction?	YES [13]	NO
Representation of different risks of active substances within the same risk group?	NO	NO
Representation of sub-risks to human health, biodiversity or the environment?	NO	NO
Meaningful representation of the trend of use and risk of pesticides?	NO	YES
Incentive to abandon More Hazardous pesticides and switch to Low-Risk pesticides?	Quite the Opposite [14]	YES
Promoting particularly efficient (and toxic) pesticides, with low hectare application rates?	YES [15]	NO
Systematic discrimination of natural pesticide active substances?	YES [16]	NO
Favouring natural pesticide active substances?	Quite the Opposite	NO [17]
Fabrication of an apparent conflicting objective between pesticide reduction and expansion of		NO

[11] We believe that such more demanding pesticide indicators should be included in Annex VI to replace the highly problematic HRI 1 as a Eurostat monitoring tool as soon as possible.

[12] See above Table 2

[13] The mechanism for fabricating pesticide reduction is described in this video through a real-world example.

[14] Substitution of 'more hazardous' Difenoconazole with 'low-risk' Potassium Bicarbonate results in an eightfold increase in combined use and risk, according to the indicator proposed by the Commission (see here; example 2)

[15] For example, treatment of 1 ha of vineyard with the synthetic fungicide Penconazole results in a calculated risk that is 200 times higher than treating the same area with Sulphur (see here; example 1)

[16] See Burtscher-Schaden et al. (2022)

[17] Normalisation using median hectare application rates results in equal weighting of pesticide applications regardless of the nature of the pesticide, provided that the active substances fall into the same risk group.

organic farming?	YES [18]	

5. Conclusion

The corrected F2F Indicator is a viable alternative to the Commission's proposed indicator. **The urgent need for a replacement is evident, as the Commission's version is fundamentally flawed in nearly every aspect. It creates incentives that run counter to the objectives of the F2F-Strategy — notably reducing pesticide use and risk and expanding organic farming.**

[18] In Austria, where over 25 % of farming became organic in the last decade, the HRI 1 indicator falsely suggests rising pesticide use; even though 90 % of organic land uses no pesticides. The reason behind is high hectare application rates of natural pesticides (see here; example 3).