

Is it time to update the EU Drinking Water Directive based on scientific data on pesticides?

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INTRODUCTION In the European Union (EU) Directive 80/778/CEE set a concentration limit for pesticide active substances (PAS) of 0.1 µg/liter, or 0.5 µg/liter for multiple substances. There is no background or official document that explains the rationale for such limit which applies to all PAS irrespective of its specific (eco)toxicological characteristics and potency. The limit has remained unchanged in all revisions of the Drinking Water Directive, including the last proposal. This despite the fact that toxicological and ecotoxicological information of PAS has greatly increased that would allow for a proper individualized risk based definition of concentration limits. We present here a comparison between this limit and the limits that would be derived from the studies performed for regulatory purposes for the PAS authorized in EU.

METHODS We derived health-based water limits (here called Toxicological Confidence Limits, TCL) for PAS and compared them with the legal limit. First we identified the acceptable daily intake (ADI) for the PAS, allocated 10% of the ADI to intake from drinking water, and assumed the standard water intake of 2 liters/day for a 60 kg adult (see equation in **Figure 1**). ADIs were taken from the European Food Safety Authority (EFSA) for those PAS that are authorized in EU; for the other PAS, the ADIs set by the EPA, FAO/WHO JMPR or the Australian Government were used.

Figure 1: equation to derive TCL

$$\text{TCL}_{(\mu\text{g/L})} = \frac{\text{ADI}_{(\text{mg/kg/day})} \times 60_{(\text{kg})} \times 0,1 \times 1.000}{2_{(\text{Litres water/day})}}$$

Regarding ecotoxicological effects, we have collected the Regulatory Acceptable Concentrations (RAC) established by EFSA for the active substances approved in the last 10 years. This time limit was chosen in order to have values derived by the current methodology. For some of these active substances, a comparison was made between the RAC values and the maximum concentrations measured in surface waters in Italy (ISPRA report 2020 and ARPA Lombardia 2019).

RESULTS **Figure 2** reports the calculated TCL for PAS authorized in EU (N=312) compared to the 0.1 µg/liter limit. Except for bromadiolone, the ratio was >1 and up to > 10 000. We also addressed the possibility of combined exposures to more than one PAS. Based on monitoring data in Italy we compared the mixture limit of 0.5 µg/liter with the health based limit derived assuming, as a worst case, additive effects for the 6 to 13 molecules most frequently found. The limits would be 11, 2.8 and 2.5 times higher than the 0.5 µg/liter legal limit for the combination of 6, 8 and 11 PAS, respectively. **Figure 3** reports the ratio between the RAC and the maximum concentration found in Italy in surface water for all PAS (**fig. 3a**), insecticides/acaricides (**fig. 3b**), herbicides (**fig. 3c**) and fungicides/bactericides (**fig. 3d**).

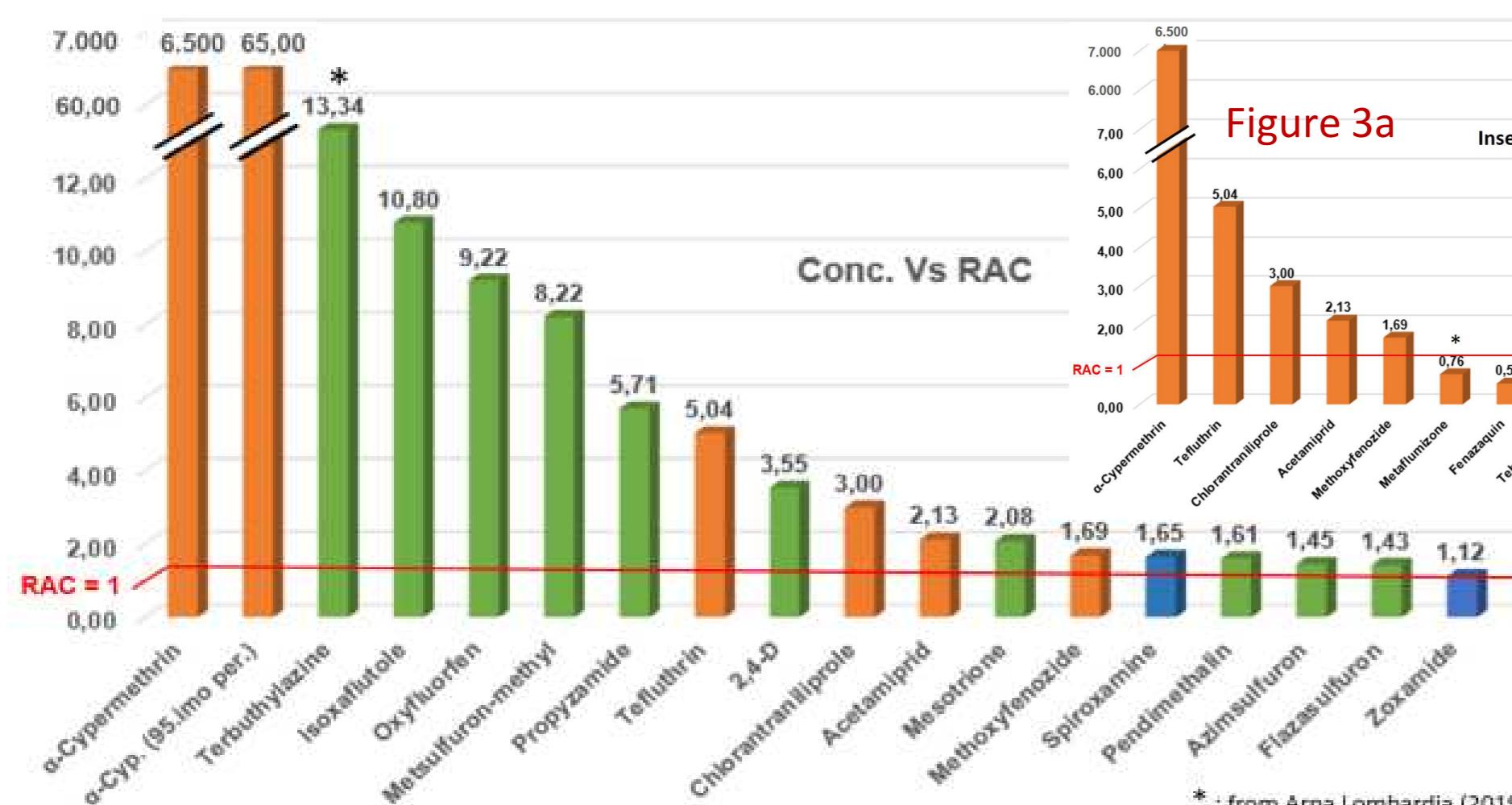


Figure 3: comparison between RAC and max concentration in surface water

All values are referred to the highest concentration found in surface water (worst case). For all active ingredients only these maximum concentrations appeared above RAC except for cypermethrin (all isomers), found 22 times out of 402 samples with almost half of them above RAC.

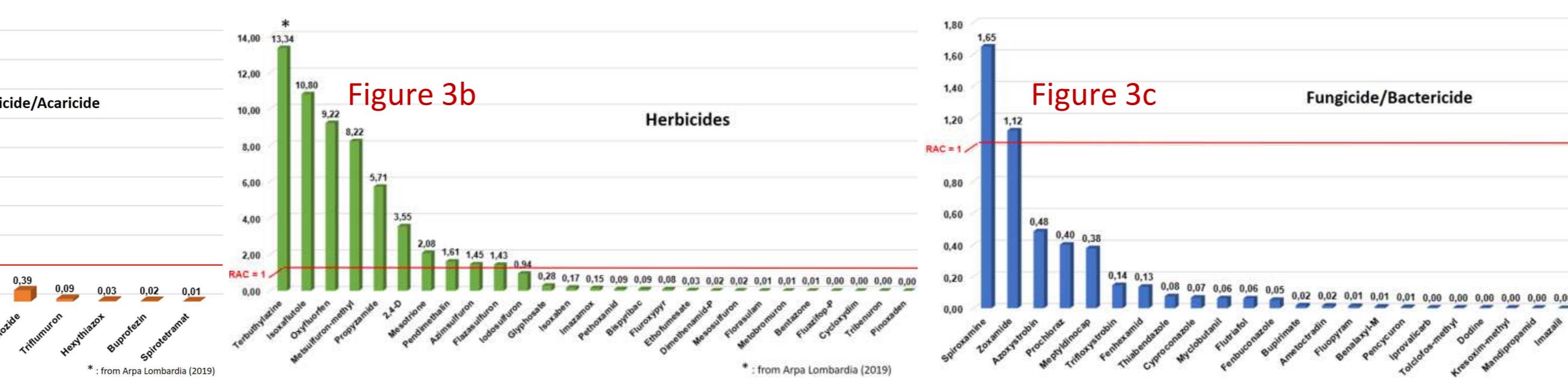


Figure 3: comparison between PAC and may concentration

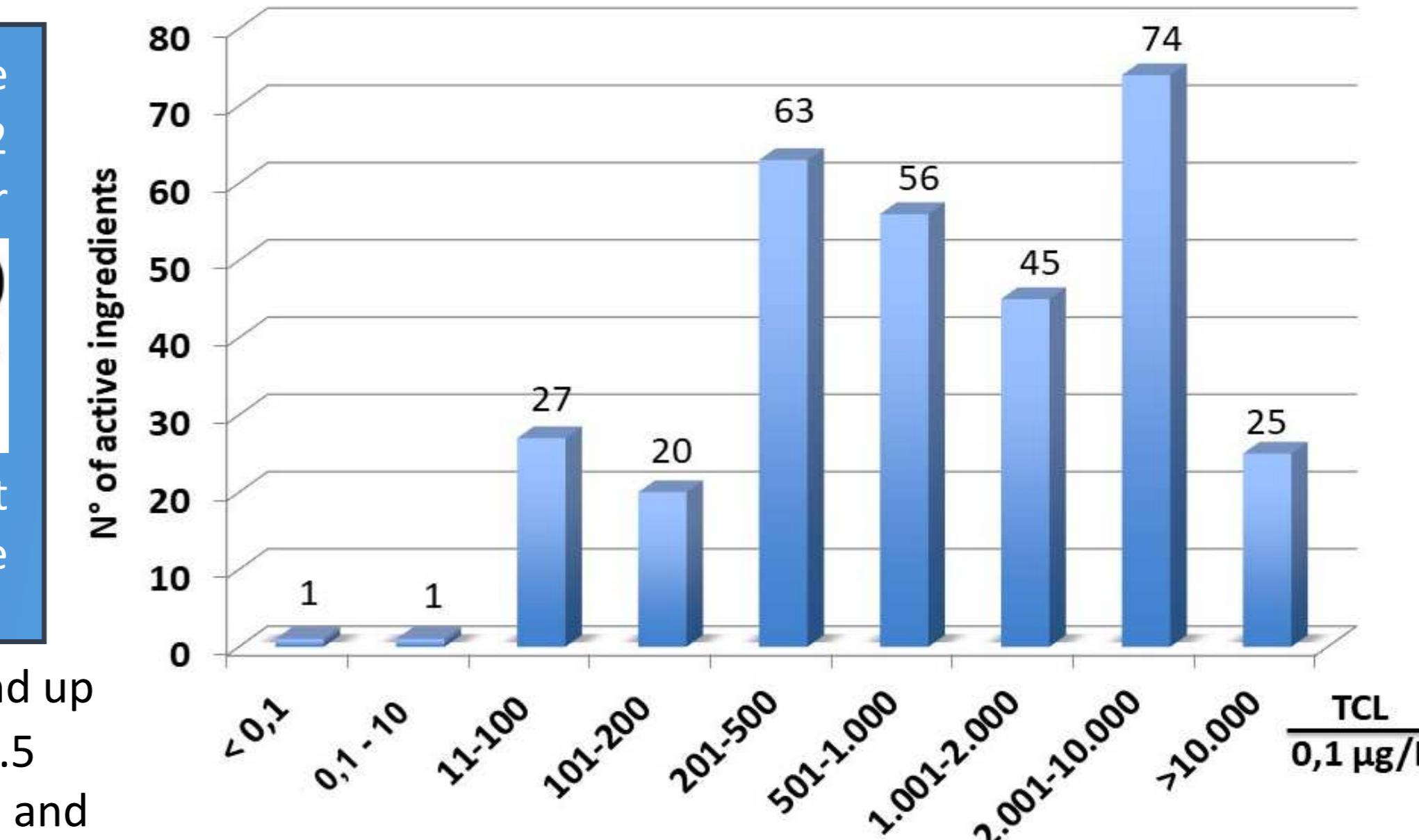


Figure 2: ratio TCL/legal limit for PAS authorised in EU

CONCLUSIONS PAS stand out when compared to all other chemicals in the EU legislation because their limits in drinking water are not health based but are set to the same level for all irrespective of their toxicological characteristics. This level is very low, much lower than that for other chemicals such as arsenic (carcinogen, with a limit of 50 µg/liter), lead (50), chromium (50), cadmium (5) or mercury (1). As a consequence, water supplies may be shut down for exceedances of the limit for PAS that would be without any health consequences for the consumer, or PAS may not be authorized or their use strongly reduced because of modeled, or more rarely measured, exceedance of the limit. In both cases, costly actions with no, at best, benefit to human health. Hence, the existing limits for PAS in drinking water need to be revised and set based on health based data. Regarding environmental considerations, the concentrations in surface waters of most of the active substances considered did not exceed the RAC values, even considering the maximum value found. Where exceedances have been found (Fig. 3a), the ratios between the measured concentrations and the RAC values remain within a factor of 10 for most of the active substances, with only few critical cases among insecticides and herbicides, such as for α -cypermethrin and terbutylazine.