



OWC 2020 Paper Submission - Science Forum

OWC2020-SCI-602

THE CONSTANT AND NECESSARY REDUCTION OF RESIDUES FROM ORGANIC PLANT PROTECTION IN EU

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Abstract: The real-time management of residues of plant protection products (PPP) is a general issue for food producers and/or exporters. Organic biopesticides are described and listed in Annex II of Regulation (EC) No 889/2008 but the organic regulation is subsidiary to the general PPP regulations. Authorized pesticides under European Regulation (EC) No 1107/2009 (Reg. 1107/2009) are granted a maximum residue limit (MRL) defined by the European Chemicals Agency (ECHA). These maximum residue limits are managed by the European Commission and listed in EC Regulation No 396/2005. However, some Organic plant protection products (phytopharmaceutical products allowed in Organic Production) generate residues (i.e. spinosad, Azadiractin A) and therefore survey of these residues. A "Global residue index" was generated in our institute, taking in consideration 3 classes (LMR respectively in Annex IV; Annex V; Annex II and/or III) with corresponding attributed value (0; 1; 2) characterised by an average value (residue classes sum divided by sum of active substances). The evolution of this "Global residue index" (GRI) value was followed through years.

Introduction: Pushed by a civil society seek for crop quality, the importance of residues in plant protection and the possible presence of residues in food becomes more and more stringent through the years, in the follow-up of the crop quality. Yet, the analytical determination of residues content increases the cost of the quality control. Pesticides uses are therefore a controversial subject. Organic biopesticides, described in Annex II of Regulation (EC) No 889/2008 [1], particularly controversial when most of the active substances in EU are from natural (mineral, plant, animal and microbial) origin. However, "natural substance" is not synonym of "absence of concern" or even "low concern". Only two chemicals are allowed in used and only in traps [2]. Other organic active substances are microorganisms, all of them are allowed in Organic Production and most of them are granted with no MRL [3, 4]. In order to follow the impact of residues from plant protection substances in organic production a "Global residue index" was then generated in our institute.

Material and methods:

EU Pesticide Database.

The raw data were recovered from the website EUR-Lex [5] for the Implementing Regulation (EU) No 540/2011 [6]. The EU pesticide database [7] is an updated online database of all active substances depending on the EU pesticides Regulation (EC) No 1107/2009 [8] whether approved or not, and listed in Implementing Regulation (EC) No 540/2011 [6]. A consolidated version of Implementing Regulation (EC) No 540/2011 is also useful for checking all changes in the approval/renewal/withdrawal process. These Databases provide the current status of concerned PPP active substances (approval and date of approval, low risk, natural substance or microorganism).

European regulations.

Other relevant Directives were followed in the Official Journal of the European Union. Previous Databases [4] built for biocontrol agent (BCA) evolution analyses, as microorganisms, natural substances and semiochemicals are managed by PPP Regulation (EC) No 1107/2009, were also exploited. Raw data were taken from the website EUR-Lex [5] for Implementing Regulation (EU) No 540/2011 [6], and the regulations for each substance or block of substances were used to index all the approvals, renewals, withdrawals, and extensions of the approval periods (prolongations) or changes of category. They were also used to determine which and when other parts of the IR540 were added since 2011. A consolidated version of Regulation (EC) No 396/2005 with all modifications and updates may be found via EUR-Lex [5].

Methodology: database search

The EU pesticide database may be searched in diverse ways, such as by substance type [7] for basic and low-risk substances. MRLs for all active substances in corresponding crops are detailed but no search can be performed with MRL values or location in the corresponding Annexes of Regulation (EC) No 396/2005 [4]; therefore a manual search is required. Thus, up until now, no automatic search could be undertaken on the EU pesticides database with the “advance search” process. However, full MRLs values in XML format may be downloaded from the website

MRLs attribution

MRLs for newly approved substances are set for pesticide residues present in products or groups of products covered by Annex V with a default value of 0.01 mg. kg⁻¹, unless they have been considered, elaborated upon on approval and affected in one of the six other Annexes (II to VII). These MRLs are applied as well in the subordinated organic production (OP) EC regulation No 889/2008 [1]. Substances listed in Annex IV are favoured in the selection of substances to be used by producers in organic production as it is for substances with very low potential impacts: low-risk substances [Art. 22 of Reg. 1107/2009] [8] which therefore preferred no MRL; basic substances [Art. 23 of Reg. 1107/2009]; and most microorganisms. The number of substances affected by this lack of an MRL (without residues survey requirement) has been steadily increasing since the publication of the SANCO/11188/2013 Guideline. Many biocontrol agents are listed in Annex IV, including microbial insecticides (e.g. *Cydia pomonella* granulosis virus), semiochemicals used in traps (e.g. putrescine) and some natural substances (e.g. sulphur) as well as all the currently listed basic substances.

A method was then needed to follow the evolution of the MRLs and therefore the potential residues in organic production, in a constant moving panel of approved substances in organic production. Since 2012, numerous substances were approved, later included in organic production plant protection or removed from Annex. II. Thus, the following process should be independent from these changes together with MRL class changes. In fact, MRLs and therefore, MRL classes are also following some variation and must be constantly surveyed. Then, we managed to attribute a value to the different MRL classes.

Results:

Class 0 is defined for MRL in Annex IV with corresponding attributed value: 0. Class 1 is defined for MRL in Annex V with value: 1. Class 2 is defined for LMR in Annex II and/or III) with corresponding attributed value to 2 as described in Table 1.

Table 1.

MRL		
Annex of Reg. 396/2005	Class	Value assigned
IV	0	0
V	1	1
II	2	2
III	2	2

The sum of the computations corresponding to the sum of the three terms nb of substance in the class n times the value of the class n.

$$\Sigma = \text{nb (class 0)} \times \text{value class (0)} + \text{nb (class 1)} \times \text{value class (1)} + \text{nb (class 2)} \times \text{value class (2)}$$

$\Sigma = 0 + \text{nb (class 1)} \times 1 + \text{nb (class 2)} \times 2$. Thus $\Sigma = \text{nb (class 1)} + 2 \times \text{nb (class 2)}$ corresponding to the numerator of the GRI.

The denominator is calculated listing the total number of active substances in organic production: $\Sigma \text{Nb (a.s.)} = \text{nb (class 0)} + \text{nb (class 1)} + \text{nb (class 2)}$.

The "Global residue index" (GRI) value characterised by an average is equal to the numerator Σ divided by denominator $\Sigma \text{Nb (a.s.)}$.

$$\text{GRI} = \frac{\Sigma}{\text{Nb (a.s.)}}$$

The "Global residue index" was generated in our institute, taking in consideration 3 classes defined by the MRL "class".

Currently, 103 active substances or category of active substances (i.e. copper compounds and Straight Chain Lepidopteran Pheromones) corresponding to 53 natural substances from plant (26), animal (5), mineral (16) and microbial (3) origin; 45 microorganisms, 5 semiochemicals and 3 transformed substances. These substances are mainly without MRL (90) or with default MRL (11) and only few are with MRL (6) listed in class 2.

Discussion:

Evolution of the Global residue index

The goal regarding residues from plant protection substances in organic production is to reduce their occurrence and their impact. Therefore, the Global residue index is expected to decrease over the time. However, allowance of a new substance in organic production (Annex II) may increase the GRI, depending of the MRL granted on each substance [4] independently from the organic sector. An arrival of a substance granted with no MRL (in Annexe IV [4]) mechanically decreases the GRI, when an entry of substance from class (1) or (2) increases the GRI. In the same way, any removal (either at the general phytopharmaceutical regulation or from organic Annex II) of a substance class (1) or (2) will decrease the GRI.

Modification process

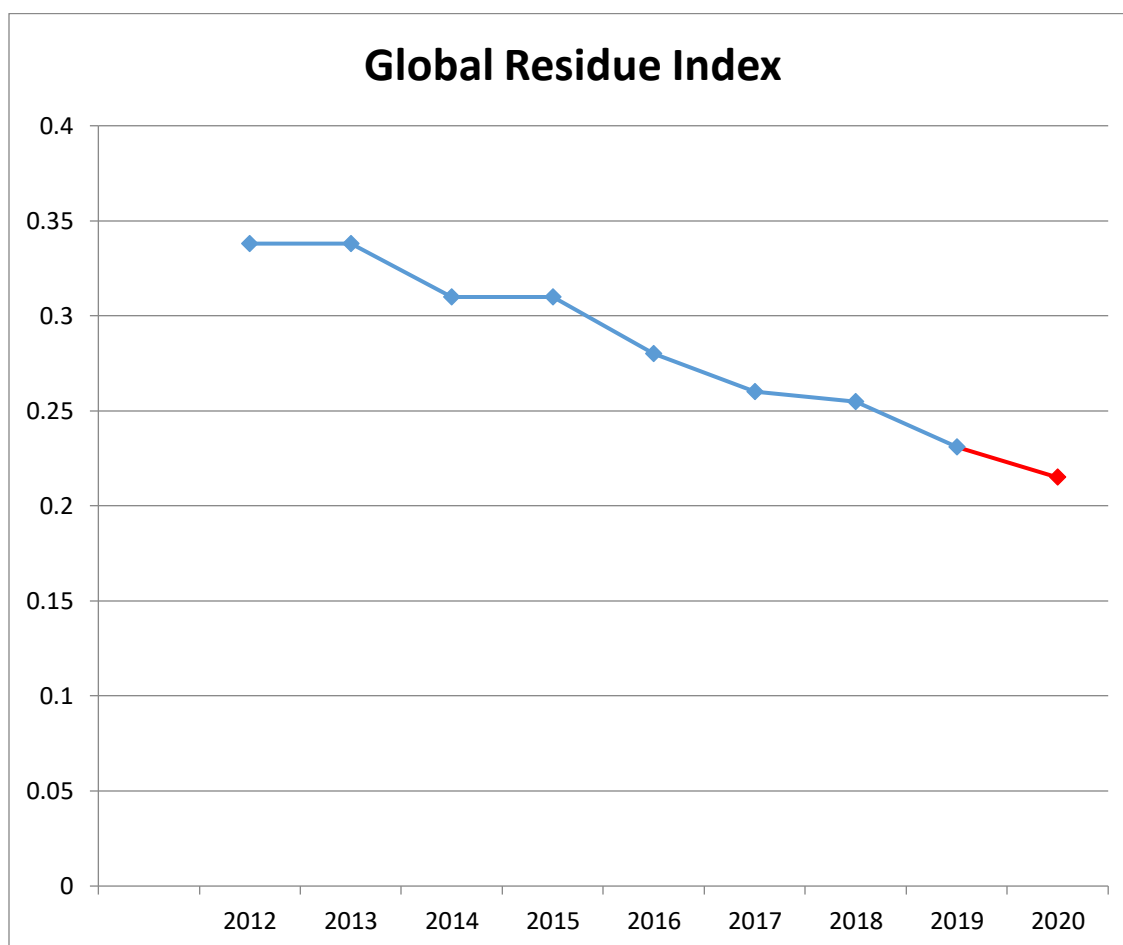
The moves are easy followed by the analysis of the successive modification of Annex II, following implementation of EU corresponding Implementing Regulations. Implementing Regulations (EU) No 354/2014, 2016/673, 2018/1584 and 2019/2164 [10, 11, 12, 13] subsequently modified Annex II content. It has to be noted that the last EGTOP report on Annex II (PPP IV published in March 2019) acknowledge inclusion of few active substances but all with 0 MRL (Annex IV of Regulation 396 [4]) [13], this decreased considerably the GRI. As matter of fact, the type of substances newly included in Annex II is essential, since all basic substances are granted with no MRL [3, 14] and some inclusion are automatic when substance is from plant or animal origin AND with food status. In the same way, most low risk substances are also granted with no MRL [15, 16].

Other biocontrol agents comprising microorganisms (from non GMO origin) and semiochemicals are also directly included into Annex II and may have an impact on the GRI with no decision from organic sector. However, most of them are granted with no MRL, especially low-risk microorganism substances [17, 18].

Another noticeable point to be noted is that some substances are approved with a default value of 0.01 mg. kg⁻¹ (Annex V) therefore in class (1) and are later granted with no MRL (Annex IV) in class (0) following the Residue Section decision of the Standing Committee on Plants, Animals, Food and Feed.

The GRI value was followed through years. Initial value of the GRI was 0.338 in 2012. Slowly the GRI decreased to the actual value of 0.231 in 2019 in figure 1., corresponding to 111 substances: 2 chemicals, 59 natural substances (30 from plant, 5 from animal, 17 from mineral, 3 from microbial origin and 4 transformed) 45 Microorganisms and 5 semiochemicals [9]. Currently, the value is still expected to decrease since the possible approval of new basic substances, new low-risk substances from approvals or renewals [19] and new microorganisms, and the MRL of the active substances requested for inclusion and the ongoing modification of MRL (from Annex V class (1) to IV class (0)) for some microorganisms.

Figure 1. Global residue index evolution from 2012



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