Risk indicators for excess pesticide residues in food of plant or animal origin.

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(final version)

1. Introduction

The necessity to use risk indicators that would allow to measure progress in reducing the dangers to human health and the environment stems from the Directive 2009/128/EC of the European Parliament and of the Council. While member states are preferred to use the so called "harmonised risk indicators", unified at the level of the Community, they can additionally use other indicators, depending on the specific conditions present in their state. So far the "harmonised risk indicators" have not been developed. According to the 2013 - 2017 National Action Plan to reduce the risk of pesticide use, Action 7, Task 2, published on the website of Poland's Ministry of Agriculture and Rural Development (www.minrol.gov.pl), the national risk indicators should be developed based on the ongoing control inspections, monitoring studies and statistical research related to the sale and use of pesticides. Due to the fact that one of the key tasks in the pesticide risk field is to ensure food safety (which was set as one of the major objectives of the National Action Plan) it was assumed that priority should be given to establishing indicators related to excessive concentrations of pesticide residues in food (concentrations above the MRLs). According to the Regulation (EC) No. 178/2002 of the European Parliament and of the Council, "food" means "any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans". This definition includes food products of plant and animal origin, which are currently on the market, as well as produce at the place of production (on a farm). Animal feed is excluded from the definition. The Regulation refers to different types of food, which at the national level are controlled and monitored by different agencies, so it may be useful to develop auxiliary indicators (for the specific types of foods) beside the main indicator, and such a set of indicators would provide a comprehensive view of the situation in an area of risk. It is expected that the indicators will be developed based on the results of the control and monitoring studies conducted by the national agencies and units listed in Section 2. Quality of the studies will have a significant impact on whether the indicators are representative.

2. Objectives of the indicators

The primary objective of creating the set of indicators is to use numbers to provide a picture of the year-after-year changes in pesticide risks to safety of foods available on the national market, and a secondary objective is to illustrate progress in the quality of the control and monitoring studies regarding pesticide residues in food. It is assumed that there will be a main indicator which would provide a comprehensive overview of pesticide risks to food safety and four specific indicators referring to the following:

- safety of food of plant origin available on the market - based on the monitoring data gathered by the State Sanitary Inspection Service (PIS).
- safety of primary food of plant origin (produce) - based on the monitoring performed at the place of production by the State Plant Health and Seed Inspection Service (PIORiN).
- safety of food of animal origin - based on the monitoring data gathered by the State Sanitary Inspection Service and State Veterinary Inspection Service.
- safety of baby food - based on the monitoring data gathered by the State Sanitary Inspection Service (PIS).

A fifth specific indicator could be based on data gathered during monitoring of food of plant origin, animal origin and baby food, performed by the State Sanitary Inspection Service and its results submitted to the European Food Safety Authority (EFSA). This indicator would be a different form of the data used in the first four specific indicators.

3. Assumptions regarding the construction of indicators

The basic measure of food safety from pesticides is the number of irregularities discovered during official inspections and controls, in relation to the number of tested samples. The lower the indicator, the better the situation. An "irregularity" here is a pesticide concentration that exceeds the maximum residue limit (MRL), regulated by the laws of the European Union. Due to the fact that the official control of pesticide residues is carried out by a number of independent agencies who use independent laboratories, with respect to calculating the indicator, it is necessary to consider testing capabilities (quality of the tests) of the individual labs. The construction of an indicator should make the result (the value of the indicator) dependent on the quality of tests, expressed as the testing quality coefficient. The worse the testing quality (lower testing quality coefficient) the higher (worse) the indicator. The evaluation of testing quality could use the list of active ingredients included in the EU multi annual control programme designed to ensure compliance with maximum residue levels of pesticides in food of plant and animal origin, regulated by the EU laws, most recently in

Regulation (EU) No. 788/2012 of 31 August 2012. The Regulation includes lists of active substances (separate for food of plant origin and animal origin) which play a significant role in pesticide safety for food production. While it is mandatory for the State Sanitary Inspection Services to follow the Regulation in its monitoring activities for EFSA, it is merely a recommendation for the scope of work done by PIORiN. Monitoring done by PIORiN also includes a number of active substances not listed in the Regulation, however a 2012 evaluation of the testing results shows that over 99% of residue determinations involve the active substances covered by the Regulation. Currently, the labs do not test for all substances specified in the Regulation. In this situation, the quality of testing performed by individual labs could be evaluated with a coefficient expressing the ratio of the number of active substances tested by the lab to the number of substances listed in the Regulation. The disadvantage is that the share of some active substances in pesticide sales nationwide is very low, while the share of others is very high (e.g. Glyphosphate). This is why the weight given to different substances in the monitoring activities is very different. A more accurate way of illustrating the testing quality of individual labs would be for the testing quality coefficient to include the national sales of active substances under the lab's testing programme in relation to the sales of all active substances listed in the Regulation. For the labs that test for all substances listed in the Regulation, the coefficient would equal 1 (100% quality), and it would be less than 1 for the labs that test only for some of the substances. Data for individual active substances sold nationwide are available and updated every year.

4. Description and form of the indicators

Keeping in mind the above assumptions, we propose that the indicators have the following general form:

$$RI_{MRL} = [\sum N_i / \sum (P_i \times JB_i)] \times 100$$

where:

RI_{MRL} - general risk indicator of excess pesticide residue in food [%].

i - index of the testing laboratory,

N_i - the number of irregularities (findings in excess of the MRL) discovered by the lab,

P_i - the number of samples tested by the lab,

JB_i - testing quality coefficient for the lab, calculated according to the following

formula:

$$JB_i = (LB_i / LR) \times W_{LB} + (SB_i / SR) \times W_{SB}$$

where:

LB_i - the number of active substances included in the lab's testing programme,

LR - the number of active substances listed in the Regulation (191 substances listed in 2013),

SB_i - total national sales volume of active substances under the lab's programme (sales for the year the active substances were tested and the previous year),

SR - total national sales volume of active substances listed in the Regulation (sales for the year the active substances were tested and the previous year).

W_{LB}, W_{SB} weight assigned in relation to the number of tested active substances and their sales volume ($W_{LB} = W_{SB} = 0.5$)

Using the same formula, the following specific indicators can be calculated:

$RI_{MRL.produce}$ - produce indicator

$RI_{MRL.f.\ plant.}$- indicator for food of plant origin,

$RI_{MRL.f.\ anim}$- indicator for food of animal origin,

$RI_{MRL.baby\ f.}$ - indicator for baby food,

$RI_{MRL\ EFSA}$ - indicator of irregularities reported by PIS to EFSA,

except, when calculating the general indicator RI_{NDP} the formula would use the sum of data and results from all labs participating in food monitoring, but when calculating the specific indicators, the data and results from the labs participating in the monitoring of a particular type of food.

The group of indicators can be expected to provide an accurate picture of the changes taking place in the national food market when all substances listed in the EU Regulation regarding the control programme for pesticide content in food are included in the monitoring activities of the national labs (i.e. when the testing quality coefficient "JB" for individual labs reaches 1 (one)). Until that time, the prosed way of correcting the „RI_{MRL}" indicator value should be considered the closest proxy, considering current deficiencies in testing capabilities of the labs. Year-to-year changes in the "JB" coefficient would also be an additional indicator of progress made toward improving the quality of the monitoring studies.