

Jerzy SZYMONA¹

CHEMICAL SUBSTANCES IN NATURAL ENVIRONMENT OF ORGANIC FARMS

CHEMICZNE SUBSTANCJE W ŚRODOWISKU PRZYRODNICZYM EKOLOGICZNYCH GOSPODARSTW ROLNYCH

Abstract: The study contains data of 4 966 organic farms positively controlled by Certification Body Ekogwarancja PTRE, which constituted 28.4 % of all farms controlled in 2009. There were used 19 biological plant protection products in analyzed farms in 2008.

Among used plant protection products 15 of them were registered in Poland and published on Institute of Plant Protection List and 4 of them were registered in European Union but banned in Poland.

Under monitoring there were collected 74 samples of plant material, 54 samples of fruits and vegetables and 2 samples of soil in order to check out chemical pesticide residues not allowed in organic farming. Totally there were collected samples from 130 farms, which constituted 2.62 % of all controlled farms not allowed substances were revealed in 20 samples, which constituted 15.38 % of all collected samples.

Keywords: organic farming, farm, plant protection, pesticides

The organic farming is a system of agricultural production based on an use of natural processes within given farm. According to this, organic fertilizers generated in a farm are used for plant growing and exclusively own fodders are applied in animal breeding.

The high-quality food, that must not be produced using substances harmful – even in theory – for human's health, is the most important goal. It is the system that excludes synthetic agents as artificial fertilizers, chemical pesticides, growth regulators, etc. However, no permission for synthetic substances is not sufficiently equivalent condition to organic farming. If the environment contamination is high, even the most "organic" farm is not able to produce the high-quality food, because high levels of harmful substances contained can be expected. Therefore, organic farms should be localized only in pure area. Current EU regulations on organic farming set the details for organic production, processing, controlling, marking, and importing methods, while no qualitative parameters for organic food products, nor the status of agricultural environment where

¹ Department of Agricultural Ecology, University of Life Sciences in Lublin, ul. Akademicka 13, 20–950 Lublin, Poland, phone: +48 81 445 68 95, email: jerzy.szymona@up.lublin.pl

they have been produced, are not included [1]. However, commonly used means of conventional farming penetrate out of their application sites, thus their remains can be found in many ecosystems, even where they had never been applied. In consequence, those substances are identified in organic food as well [2]. It accounts for the fact that organic food is not free from remains of illegal agents. Many literature references define organic food as a food produced with no synthetic means use, but it is not defined as completely free from synthetic agents [3].

Despite of the fact that EU Council Regulation (EC) No. 834/2007 does not obligate to analytical determination of a final product quality, while only forces to comply with organic production technology, analyses of organic food for chemical pesticides remains or heavy metals contents, are more commonly performed. Institutional producers' norms setting the limits of prohibited synthetic means in organic food, become binding.

A great variety of chemicals and elements harmful for human, animal, and plant's health exists in a natural environment. Cadmium, lead, nickel, copper, and zinc are considered as items indicating the soil environment contamination level. Sulfur is also included, because it has an exclusively strong impact on Polish soils acidity. At plants – besides the same elements (except from sulfur) – nitrates are additional harmful substances monitored [4].

The pesticide remains in a soil are sometimes a subject to very complex transformations resulting in more toxic substances formation than the initial ones. Some of them are very durable in soils and contaminate the environment to significant degree. Inorganic pesticides and chlorine carbohydrates withdrew from a production are in this group.

Material and methods

The research consists of data collected from 4 966 organic farms that were inspected by certifying body *Ekogwarancja PTRE*, which constituted 28.4 % of all farms controlled in 2009 [5]. The survey on the type and quantity of permissible plant protection means applied in organic farms was conducted in 2008. Number of 130 farms was selected, then plant and soil samples were collected to test for chemical pesticide remains illegal in organic farming, in 2009 and the first half of 2010. Achieved results are presented in a form of detected means types, number of samples with illegal substances identified, as well as type of plant material the prohibited agents were found: crops, vegetables, fruit trees, and berries.

Results and discussion

The certifying body *Ekogwarancja PTRE* inspected 4 908 organic farms, including 4 813 that were positively judged in 2008 [6]. That group comprised of 3 207 organic farms. The remaining experienced the first or the second year of conversion. Biological plant protection means were used in 585 farms, which made up 12.2 % of all controlled farms. Total number of 4966 farms were inspected in 2009. Within the frames of

monitoring, 74 plant material, 54 fruits and vegetables, and 2 soil samples were collected to test for pesticide remains, which are prohibited in organic farming. In total, samples from 130 farms were collected, *ie* 2.6 % of all inspected farms. The pesticide remains were identified in 20 samples, which made up 15,4 % of all samples tested.

The organic farming is the only system of agricultural production that is regulated in details by legal acts [7]. The EU Council Regulation (EC) No. 834/2007 is a principle set of regulations concerning the organic farming [2]. In Art. 12 pt. 1, let. g, it is said that *“the prevention of damage caused by pests, diseases and weeds shall rely primarily on the protection by natural enemies, the choice of species and varieties, crop rotation, cultivation techniques and thermal processes”*. The statement informs that prophylaxis leading to create such an ecosystem within a farm that would be harmful for agrophages, is an obligation. This task is not easy, and even impossible to some hazardous organisms. When the prophylaxis does not bring expected effects, letter h of the same Article can be quoted: *“in the case of an established threat to a crop, plant protection products may only be used if they have been authorized for use in organic production under Article 16”*. This act describes only the exceptional situations when biological pesticide can be applied, and furthermore, it can be used only for confirmed threat to a crop, which excludes the prevention activities [8].

Therefore, the use of biological pesticides is not common among organic farmers. The certifying body *Ekogwarancja PTRE* positively inspected 4 813 farms in 2008 and only 585 of them applied biological plant protection products, which made up 12.2 % of all positively inspected farms. Nevertheless, these numbers do not suggest that remaining almost 90 % of controlled farms had not encountered the plant protection problems. Unfortunately, most of farmers who make a decision to perform an organic farm, count on subsidies for that purpose. Such farms are typically extensive.

In small farms, the agricultural goods are utilized for their owner's and families' needs. Cereals are grown in such farms. Sometimes they own small areas of potatoes with continuous problem of beetle that is manually removed. The organic farms group is also composed of such, the owners of which live in distant cities. The area of these farms is most frequently covered by permanent meadows cut not more than once a year. No fertilizers nor plant protection means are applied in these large – often several hundred hectares – farms.

Surveyed farms used 19 biological plant protection products in 2008, including 14 registered in a current IOR Poznan list. Miedzian was the most readily applied substance by 252 farms, then Bioczoz – in 136 farms, Siarkol – in 35 farms, as well as Grevit and Novodor – in 30 farms. Among plant protection products used, there were also such, the active substance of which are listed in EU Council Regulation, but are not registered in Poland yet. In this case, applying such agents is not conflicting with EU law; however, it is not allowed in a view of Polish act on plant protection [9].

Another issue is associated with use of means for plants, for which a given product was not registered. It probably results from quite short list of permissible chemicals as well as the thrift of owners who register the agents only for the most common – *ie* most profitable – plant species.

Among preparations applied in farms certified by *Ekogwarancja PTRE*, there is lime sulfur that is forbidden in Poland not only in organic farming. However, Annex II, Table 6 of EU Council Regulation (EC) No. 889/2008 [10] mentions that agent as allowed in organic farming. The problem of using the lime sulfur is discussed from time to time in Polish horticultural journals. *Ekogwarancja PTRE* has been allowed [11] by Ministry of Agriculture and Rural Development to test the lime sulfur under organic farming conditions, hence the agent appears in the list of permissible means applied in farms certified by that body.

In 2009 and the first half of 2010, the certifying body *Ekogwarancja PTRE* made additional inspection in 130 farms by means of collecting the plant and soil material samples. The choice of particular farms resulted from the suspicion of controllers made during the earliest obligatory control on the use of illegal products and laboratory determinations of purchase centers that perform analyses of organic products supplied.

Table 1

Plant protection means used in organic farming

	Number of farms where the mean was used	Name of plant protection mean	Amount of the mean used [kg]
1	252	Miedzian	3276.2
2	136	Bioczos	1904.0
3	35	Siarkol	714.0
4	30	Grevit	75.8
5	30	Nowodor	77.0
6	8	Biosept	5.6
7	30	Biochikol	111.8
8	7	Cuproflow	83.0
9	5	Bovecol	655.0
10	14	Tiotar	378.0
11	6	Antifung	215.0
12	9	Madex	19.2
13	4	Treol	62.0
14	1	Spruzit	1.0
15	4	Promanal	34.0
16	4	Ciecz kalifornijska (<i>Lime sulfur</i>)	2130.0
17	2	Beauveria basiana	120.0
18	5	Spintor	3.7
19	3	Paroil	77.0

Total number of 130 samples were subject to analyses, including 110, at which no illegal means residues were detected, unlike 20 remaining ones, where remains of synthetic pesticides were found. Unfortunately, as comparing with previous year controls, that number increased [5]. Following plant materials composed the 110 pure samples subject to determinations (in brackets – number of particular samples):

- horticultural and berry plants: apple (10), strawberry fruit (18), raspberry leaf (16), black currant leaf (15), strawberry leaf (25), red currant fruit (1);
- ground vegetables: cucumber leaf (6), onion and chives (4), pumpkin (2), carrot leaves and root (2), parsley leaves and root (2), lettuce leaf (1), tomato leaf (1), pepper leaf (1), cabbage leaf (1), zucchini (1), dill (1), broccoli (1);
- herbs: valerian leaf (1), chamomile inflorescence (1).

Twenty samples contained residues of synthetic pesticides not allowed in organic farming (Table 2): most in ground vegetables – 12 samples, including parsley leaves – 5 samples, cucumber (leaf and fruit) – 4 samples, and carrot and dill – 1 sample each. Of berry group, raspberry (leaves) – 2 samples, strawberry (leaves) – 3 sample, and black berry (fruits) – 1 sample, were the most contaminated.

Table 2

Illegal means used in organic farming

Cultivation group	Analyzed material	Number of samples	Active substance	Type of the mean
Horticultural and berry plants:	Raspberry leaf	2	Chloropiryfos Fenheksamid Heksytiazoks Pirymetanil	Fungicide Fungicide Acaricide Fungicide
	Strawberry leaf	3	Chloropiryfos Tetrakonazol	Fungicide Fungicide
	Black currant fruit	1	Fluvalinat Karbendazym	Insecticide Fungicide
Ground vegetables:	Parsley leaf	5	Chloropiryfos Azoksystrobina	Fungicide Fungicide
	Cucumber leaf	3	Chloropiryfos Dimetoat Alfa-cypermetyryna Bifentryna Ditiokarbaminiany Chlorotalonil	Fungicide Insecticide Fungicide Insecticide Fungicide Fungicide
	Parsley root	1	Azoksystrobina	Fungicide
	Cucumber fruit	1	Chloropiryfos	Fungicide
	Carrot root	1	Azoksystrobina	Fungicide
	Dill herb	1	Chloropiryfos	Fungicide
	Soil	2	DDT, DDE	Insecticide

Residues of DDT – withdrawn in Poland at least 50 years ago! – were detected in the soil. Apparently, it is still problematic for Polish agriculture. Surprisingly, majority of not allowed but used means were fungicides, the number of which is the largest on IOR Poznan list of products permissible in organic farming [12]. Therefore, farmers have a wide choice, but maybe they consider chemical means more efficient or do not know a spectrum of allowed fungicides. Only a single product appeared on a list of permissible insecticides – Spintor. This dramatic situation causes that facing the impossibility of pest control, farmers unfortunately reach for illegal products.

Conclusions

1. Achieved results indicate the need to continue and widen the scope of the control on residues of plant protection means in samples collected from agricultural goods produced by organic means.
2. Results also indicate that plant protection in organic farming system is not satisfactory and the number of farms applying plant protection means is insignificant.
3. Residues of illegal pesticides found in plant material may result not only from their use, but also contamination from adjacent conventional cultivations.
4. Considerable interests of farmers in organic system of a farm management forces the science and administration a task to work out a new and more efficient techniques of plant protection.
5. The increase of organic production faces the barrier of efficient protection of plants sensitive to agrophages.

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CHEMICZNE SUBSTANCJE W ŚRODOWISKU PRZYRODNICZYM EKOLOGICZNYCH GOSPODARSTW ROLNYCH

Katedra Ekologii Rolniczej
Uniwersytet Przyrodniczy w Lublinie

Abstrakt: Praca zawiera dane z 4 966 gospodarstw rolnych, pozytywnie skontrolowanych przez jednostkę certyfikującą Ekogwarancja PTRE, co stanowi 28,4 % wszystkich polskich gospodarstw objętych kontrolą w 2009 r. [1]. W badanych gospodarstwach używano w 2008 r. 19 biologicznych środków ochrony roślin.

W ramach monitoringu pobrano w 2009 r. i pierwszej połowie 2010 r. 74 próbki materiału roślinnego, 54 próbki owoców i warzyw, 2 próbki gleby w celu zbadania pozostałości chemicznych pestycydów, niedozwolonych w rolnictwie ekologicznym. Razem pobrano próbki z 130 gospodarstw, stanowiących 2,62 % wszystkich kontrolowanych gospodarstw. Wykryto pozostałości w 20 próbkach, co stanowi 15,38 % wszystkich badanych próbek.

Słowa kluczowe: rolnictwo ekologiczne, gospodarstwa rolne, ochrona roślin, pestycydy