

PROTECTION POSSIBILITIES OF ORGANIC CROPS AGAINST DISEASES IN THE EUROPEAN UNION

Summary

Only products containing substances listed in the Regulations (EC) No 889/2008 and 354/2014 are permitted in the protection of organic crops. Despite the common list of active substances and schemes of qualifying products for use in organic farming, availability of measures to protect organic farming in the Member States varies widely. Obtaining information concerning the list of plant protection products qualified for use in organic farming was possible only for 12 Member States. Among the countries, the biggest number of fungicides to protect organic crops has been approved in Italy, France and Czech Republic. The lowest number has been noted in Sweden and United Kingdom. Italy has the broadest protection capacity for each group of organic farming: agricultural, vegetable, fruit and ornamental. Active substances most frequently registered in the products approved for use in organic farming are copper compounds, sulphur and microorganisms. Differences in the availability of ways to protect organic farming in the European Union Member States hinder equal competition in the common market.

Key words: organic farming, plant protection, availability, fungicides, protection against diseases, the European Union

MOŻLIWOŚCI OCHRONY UPRAW EKOLOGICZNYCH PRZED CHOROBYMI W UNII EUROPEJSKIEJ

Streszczenie

Do ochrony upraw ekologicznych dopuszczone są tylko środki zawierające substancje wymienione w Rozporządzeniach Komisji (WE) nr 889/2008 oraz 354/2014. Mimo wspólnej listy substancji aktywnych systemy kwalifikowania preparatów do stosowania w rolnictwie ekologicznym oraz dostępność środków do ochrony upraw ekologicznych w poszczególnych państwach członkowskich są bardzo zróżnicowane. Uzyskanie informacji dotyczących listy środków ochrony roślin zakwalifikowanych do stosowania w rolnictwie ekologicznym było możliwe tylko dla 12 państw członkowskich. Wśród tych państw najwięcej fungicydów do ochrony upraw ekologicznych dopuszczonych jest we Włoszech, Francji oraz w Czechach. Najmniej w Szwecji oraz Wielkiej Brytanii. Włochy posiadają także najszersze możliwości ochrony dla każdej grupy upraw ekologicznych: rolniczych, warzywniczych, sadowniczych i ozdobnych. Substancje aktywne najczęściej rejestrowane w środkach dopuszczonych do stosowania w rolnictwie ekologicznym to związki miedzi, siarka i mikroorganizmy. Różnice w dostępności możliwości ochrony upraw ekologicznych w poszczególnych państwach członkowskich utrudniają równorzędną konkurencję na wspólnym rynku.

Słowa kluczowe: rolnictwo ekologiczne, środki ochrony roślin, dostępność, fungicydy, ochrona przed chorobami, Unia Europejska

1. Background and purpose of the study

In 2013, the European Union had close to 260 thousand organic farms with a total acreage of over 9.5 million hectares [1, 2]. Many diseases threaten organic crops, as well as other crops [3]. Regulations allow for the use of certain plant protection products to reduce the infestation of these diseases. In organic farming only active substances listed in the Regulations (EC) No 889/2008 and 354/2014 can be used [4, 5]. These provisions are common across the European Union, but despite this the availability of plant protection products in the various Member States differs quite significantly [6-8]. It results from the fact that individual Member States have different climatic conditions, different crops, and a separate system of qualification of plant protection products for use in organic farming.

The aim of the study was to compare the possibility to protect organic crops from diseases in the Member States of the European Union.

2. Material and methods

An overview of lists of plant protection products to protect organic farming in the European Union was carried out in 2015. For the analysis the lists of products approved for organic farming protection in 12 European Union Member States were used (Belgium, Croatia, Czech Republic, France, Germany, Hungary, Italy, Luxembourg, Poland, Slovakia, Sweden, United Kingdom) [9-20]. In the remaining 16 Member States either there were no official lists recorded of protection products designed for organic farming (Denmark, Estonia, Greece, the Netherlands, Ireland, Latvia and Romania), or obtaining information about such lists was very difficult (e.g. Spain and Portugal). Material for the study comes from the official websites dedicated to organic farming within the Member States. We analyzed all the fungicides approved for use in organic farming. Based on the labels of the products, protected crop species were identified. The crops were then divided into four groups: agricultural, vegetable, fruit and ornamental.

3. Results and discussion

Collective data on active substances of fungicides approved for use in organic farming in the 12 analysed Member States are presented in Table 1.

The majority of fungicides approved for use in organic farming are in Italy (356), France (152) and Czech Republic (70). The minority are in Sweden (9) and United Kingdom (10). In other countries the number of preparations is: 37 in Belgium, 34 in Hungary, 25 in Poland, 24 in Croatia and Germany, 15 in Luxembourg and 13 in Slovakia. The active substances contained in these plant protection products are as follows: substances of plant origin (oil of fennel, clove oil, tea tree oil, orange oil and other vegetable oils), laminaire (polysaccharide derived from brown algae cells), copper and its compounds, sulphur and microorganism, which can be divided into two groups: bacteria (*Bacillus amyloliquefaciens*, *Bacillus subtilis*, *Pseudomonas chlororapsis*, *Streptomyces*), and fungi (*Ampelomyces quisqualis*, *Aureobasidium pullulans*, *Aureobasidium pullulans*, *Coniothyrium minitans*, *Gliocladium catenulatum*, *Phlebiopsis gigantea*, *Pythium oligandrum*, *Trichoderma atroviridae*, *Trichoderma asperellum*, *Trichoderma gamsii*, *Trichoderma harzianum*).

Italy (15), Belgium (12) and Germany (9) have the most fungicides containing microorganisms to protect organic crops. Slovakia (2), Czech Republic (3), Luxembourg (3) and Poland (3) have the least. Six products with microor-

ganisms can be used by organic growers in the UK and five in Hungary. On the list of active substances allowed for use in organic farming Laminaire – natural polysaccharide from algae cells is on the list of active substances allowed for use in organic farming. Laminaire is used for the protection of organic crops in Belgium and France. Among the substances of vegetable origin fungicides containing oil of fennel (SK), clove oil (IT), tea tree oil (PL), orange oil (FR) or other vegetable oils in composition with copper or copper and sulphur (HU) are registered in Member States. The majority of the products in fungicide group are preparations containing copper compounds and sulphur. Fungicides based on copper are available in most of analysed Member States, except for Sweden. The majority of copper fungicides are in Italy (184) and France (66) and the minority are in United Kingdom (3). Sulphur is used in almost all analysed Member States except for United Kingdom. Italy and France have the largest number of fungicides based on sulphur: in Italy there are 129 products with sulphur besides 24 products with sulphur and copper and in France 74 products with sulphur as well as 2 products with sulphur and copper. The lowest number of sulphur preparations are in Sweden (1) and Slovakia (2). Commonly used is also potassium bicarbonate. Products with this active substance are qualified for use in organic farming in the following analysed Member States: Belgium, Czech Republic, France, Germany, Italy, Luxembourg, Poland, Slovakia and United Kingdom.

Table 1. List of active substances in fungicides approved for use in organic farming in the European Union
Tabela 1. Wykaz substancji aktywnych w fungicydach zakwalifikowanych do stosowania w Unii Europejskiej

Active substances	Fungicide number											
	Belgium	Croatia	Czech Republic	France	Germany	Hungary	Italy	Luxembourg	Poland	Slovakia	Sweden	United Kingdom
Microorganisms (bacteria, fungi)*	12	-	3	-	9	5	15	3	3	2	8	6
Laminaire	1	-	-	4	-	-	-	-	-	-	-	-
Copper and its compounds (oxychloride, tribasic sulphate, hydroxide, oxide, Bordeaux mixture)	11	14	27	66	7	19	184	6	14	7	-	3
Copper + vegetable oil	-	-	-	-	-	1	-	-	-	-	-	-
Oil of fennel	-	-	-	-	-	-	-	-	-	1	-	-
Clove oil	-	-	-	-	-	-	1	-	-	-	-	-
Tea tree oil	-	-	-	-	-	-	-	-	1	-	-	-
Orange oil	-	-	-	2	-	-	-	-	-	-	-	-
Sulphur	11	10	39	74	6	6	129	5	5	2	1	-
Sulphur + copper	-	-	-	2	-	2	24	-	-	-	-	-
Sulphur + copper + vegetable oil	-	-	-	-	-	1	-	-	-	-	-	-
Potassium bicarbonate	2	-	1	4	2	-	3	1	2	1	-	1
TOTAL	37	24	70	152	24	34	356	15	25	13	9	10

Ampelomyces quisqualis, *Aureobasidium pullulans*, *Aureobasidium pullulans* + kwas cytrynowy, *Bacillus amyloliquefaciens*, *Bacillus subtilis*, *Coniothyrium minitans*, *Gliocladium catenulatum*, *Paecilomyces fumosoroseus*, *Phlebiopsis gigantea*, *Pythium oligandrum*, *Pseudomonas chlororapsis*, *Streptomyces*, *Trichoderma atroviridae*, *Trichoderma asperellum*, *Trichoderma Gambii*, *Trichoderma harzianum*

Source: own work / Źródło: praca własna

Table 2. Number of fungicides to protect individual crop groups in the European Union
 Tabela 2. Liczba fungicydów do ochrony poszczególnych grup upraw w Unii Europejskiej

Crops	Total number of approved fungicides*											
	Belgium	Croatia	Czech Republic	France	Germany	Hungary	Italy	Luxembourg	Poland	Slovakia	Sweden	United Kingdom
Agricultural crops	25	20	66	85	12	27	241	10	14	9	4	6
Vegetable crops	31	21	57	83	14	32	310	11	15	10	7	8
Fruit trees and shrubs	35	24	65	147	18	33	344	14	22	13	5	9
Ornamental plants	27	13	48	60	12	10	291	9	4	5	6	5

* One product may be registered to protect more than one crop group.

Source: own work / Źródło: praca własna

Table 2 shows the number of fungicides depending on the extent of protected crop species. These species were divided into four groups according to the application. Among the agricultural species the fungicide' labelling showed: cereals including: wheat, barley, oat, rye, triticale, spelt, maize, rice, cotton, grass, sugar beet, fodder beet, flax, fodder legumes, hop, oilseed rape, potato, soya, sunflower, tobacco. The most fungicides to protect agricultural crops can be found in Italy (241), and the least in Sweden (4) and the United Kingdom (6).

Among the vegetable species protection included: artichoke, asparagus, aubergine, bean, broad bean, cauliflower, cuckooflower, cucumber, cucurbit, cumin, dill, fennel, green beans, beetroot, broccoli, brussel sprouts, carrot, celery, chard, chickpeas, chicory, chive, courgette, endive, garlic, green peas, horseradish, jerusalem artichokes, kale, kohlrabi, lemongrass, lettuce, lamb's lettuce, mustard, onion, parsley, parsnip, patison, pepino, pepper, spring onion, pumpkin, radicchio, radish, rutabaga, salsify, scorzonera, shallot, sorrel, spinach, tomato, turnip, watercress, various cabbages, spices, medicinal and tea herbs: (angelica, anise, arugula, basil, calendula, camomile, coriander, chervil garden, digitalis, escarole, hyssop, lavender, leek, lentil, lovage, marjoram, marshmallow plant, melissa, milfoil, milk thistle, mint, oregano, ribwort-plantain, rosemary, rue herb, saffron, sage, St John's-wort, tarragon, thyme, valerian). Most fungicides approved for the protection of vegetables can be found in Italy (310), and the least in Sweden (7) and the United Kingdom (8).

Among organic crops, orchard species occupy an important place, often mentioned in the labeling: citrus fruits (bergamot, chinotto, clementine, grapefruit, lemon, lime, mandarin, orange, pomelo), berries (bilberry, blackberry, blueberry, cranberry, currant, gooseberry, raspberry, tayberry), stone fruits (apricot, sweet cherry, sour cherry, nectarine, peach, plum), pomefruits (apple, *Chaenomeles*, pear, quince), almond tree, banana, cantaloupe, edible chestnut, *Eriobotrya Japonica*, fig, grape, hazel, kaki, melon, *Mespilus germanica*, olive, peanut, pine nut, pistachio, pomegranate, pouteria, sesame, strawberry, walnut, watermelon. Italy (344) and France (147) dominate in terms of the number of fungicides for the protection of ecological orchards. Few products for this group of crops were recorded in Sweden (5) and the United Kingdom (9).

The group of ornamental plants grown organically is most often deciduous trees (beech, oak, poplar, ash, maple, alder, willow,) and coniferous trees (cedar, spruce, larch, pine, cypress), flowering species (chrysanthemum, pink, geranium, begonia, pelargonium, poinsettia, gerbera, lily,

daisy, salsify, verbena, oleander, rose, hortensia, cherry laurel), houseplants (*Cineraria* plants, cyclamen, philodendron, primrose), balcony species, lawns, public parks and gardens, also greenhouse plants and nurseries. The biggest number of fungicides for protection of ornamental plants are authorised in Italy (291) and 60 in France. Poland has only 4 and Slovakia and United Kingdom have 5 fungicides registered to protect ornamental plants.

The labels often do not have any definite crop varieties, and they are described in very general terms, e.g. different kinds of vegetables, orchards, ornamental plants and flowers or agricultural plants. Such a system helps to expand the scope of application of the fungicides.

This analysis allowed for the conclusion that fungicides qualified for the protection of organic farming in the European Union contain very diverse active substances. Most products contain copper compounds, sulphur and microorganisms. There are also registered products containing more than one active substance, e.g. copper + vegetable oil (1 product in Hungary), copper + sulphur (24 products in Italy, 2 products in France and 2 products in Hungary), copper + sulphur + vegetable oil (1 product in Hungary).

From the perspective of the entire European Union, protection of all economically important crop species is possible. However, we may notice clear differences in the availability of fungicides in different Member States. These differences are mainly caused by climate conditions and typical crops. Most products can be found in countries with large areas of organic farming, but there are also exceptions such as United Kingdom. Although it is ranked 6th in the European Union when it comes to the surface acreage of organic farming, it has only 10 registered fungicides. On the basis of the analysis of labels of the products approved for use in organic farming (the material is very comprehensive and is not presented in the tables) the following observations can be formulated in summarising the availability of plant protection products in the Member States:

1. In terms of availability of fungicides qualified for use in organic production, the most favorable situation is in Italy, where the range of registrations of various products recommended for use in organic farming covers almost all the major agricultural, vegetable, fruit and ornamental species.
2. In each of the analysed Member States there is a lack of fungicide protection for some applications in organic agriculture. For example:

- Poland and United Kingdom do not have the products to protect cereals including maize. In numerous Member States there are no products to protect organic maize for example in Croatia, Hungary and France,

- Belgium, France, Luxembourg, Sweden and UK lacks products to protect oilseed rape,
- in the Czech Republic there is a problem concerning the protection of some vegetable species (brassicas: cabbages, nightshades: pepper, aubergine),
- United Kingdom has limited possibilities to protect agricultural crops (only fungicides to the protection of organic hop and potato are available). Moreover not all of the vegetables are protected (only nightshades, cucurbits and celery have protection),
- in some countries the problem consists in the lack of the protection of berries for example: bilberry (CZ, DE, SE, SK, UK), blackberry (CZ, DE, HR, PL, SE, SK, UK), cranberry (CZ, DE, HU, IT, PL, SE, SK, UK), currant (CZ), gooseberry (PL, UK), raspberry (CZ, HR, SK).

Gaps in the availability of fungicides that can be used in organic agriculture are a problem for farmers, as these conditions hinder ecological agricultural production and competition in the common market with farmers from other Member States.

4. Conclusions

1. It can be noticed that there are significant differences in the availability of fungicides in different Member States. The biggest number of fungicides to protect organic crops is approved in Italy, France and Czech Republic. The least in Sweden and United Kingdom. Italy has the broadest protection capacity for each group of organic farming: agricultural, vegetable, fruit and ornamental.

2. The number of available preparations is generally higher in countries with a greater area of organic farming. The exception is United Kingdom, where despite a sizeable acreage of ecological farms, only 10 fungicides are available.

3. Fungicides qualified for the protection of organic farming in the European Union contain different active substances. Most products contain copper compounds, sulphur or microorganisms. There are also registered formulations containing more than one active substance.

4. Differences in the availability of ways to protect organic farming in the Member States hinder equal competition in the common market.

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