Tadeusz MICHALSKI[1], Anna BIECZYŃSKA[2], Piotr SZULC[1], Ireneusz KOWALIK[3]
University of Life Sciences
[1] Department of Agronomy, [2] Postgraduate student, [3] Institute of Biosystems Engineering
ul. Wojska Polskiego 28, 60-623 Poznań, Poland
e-mail: tamich@up.poznan.pl

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PROBLEMS OF SEED PRODUCTION FOR ORGANIC FARMING

Summary

The paper presents current data on the area of organic farms all over the world and in Europe as well as factors influencing the development of this farming system. Among many factors affecting the development of organic production, issues related to the cultivation of varieties are very important in the economic, social and legal context, including methods of breeding allowed for organic farming, conditions for their registration and admission to cultivation and the specificity of certified seeds production. Legal regulations have an impact on the agricultural practices and directions of transformation in organic farming. However, law and procedures must be changed and updated due to the science development and in response to the growing needs of the population. Comparing the conditions and possibilities of breeding varieties and seed production in an organic and conventional system, practically at each stage, organic production is in a worse position. In the light of the possibilities offered by modern genetics, the methods allowed in breeding varieties for ecological purposes, limited to only some techniques are insufficient". However, they give the opportunity to bring specific values for all modern agriculture as well as the development of science, especially epigenomics.
***Key words**: organic seed material, breeding of varieties, area of organic farming*

PROBLEMY PRODUKCJI NASIENNEJ DLA ROLNICTWA EKOLOGICZNEGO

Streszczenie

W pracy przedstawiono aktualne dane dotyczące powierzchni gospodarstw ekologicznych na świecie i w Europie oraz czynniki wpływające na rozwój tej formy gospodarowania. Spośród wielu czynników wpływających na kształtowanie się ekologicznej produkcji, bardzo ważne w kontekście ekonomicznym, społecznym i prawnym są zagadnienia dotyczące hodowli odmian, w tym metod prac hodowlanych dopuszczonych dla rolnictwa ekologicznego, warunków rejestracji odmian i dopuszczenia ich do uprawy oraz specyfiki produkcji kwalifikowanych nasion. Regulacje prawne mają wpływ na praktykę produkcji oraz kierunki przemian w nasiennictwie ekologicznym. Prawo i procedury muszą być jednak zmieniane i aktualizowane wraz z rozwojem nauki i w odpowiedzi na rosnące potrzeby ludności. Porównując warunki i możliwości hodowli odmian i produkcji nasiennej w systemie ekologicznym i konwencjonalnym, praktycznie na każdym z etapów produkcja ekologiczna znajduje się we gorszej sytuacji. W świetle możliwości, jakie oferuje współczesna genetyka, metody dozwolone w hodowli odmian na cele ekologiczne ograniczone są tylko do niektórych technik są niewystarczające. Dają one jednak możliwości wniesienia określonych wartości dla całego współczesnego rolnictwa, a także rozwoju nauki, zwłaszcza epigenomiki.
***Słowa kluczowe**: ekologiczny materiał siewny, hodowla odmian, powierzchnia upraw ekologicznych*

1. Introduction

In response to the ongoing degradation of the natural environment and the declining quality of food products, Europe and other developed countries have turned on agriculture according to the principles of sustainable management, in particular organic farming. The area of organic farming in the world is systematically growing. According to data from the Research Institute of Organic Agriculture (FiBL), in 2016, organic agriculture covered 57,8 million hectares, increasing by 15% compared to 2015. Organically cultivated 13,5 million ha in Europe million ha constitute about 25% of the world's area. The area in Europe has increased by 73% over the last decade [11, 21]. In the European countries, the most organic crops occur in Spain (2 million ha) and in Italy (1,8 million ha). Above one million organic arable lands are also found in France and Germany (1,54 and 1,25 million ha respectively). In the following six European countries: Austria, Sweden, Poland, Turkey, Great Britain and the Czech Republic, organic cultivation occupy about 0,5 million hectares. In Poland, according to FIBL data, 536,6 thousand hectares were organic cultivated in 2016 [12, 13].

Poland, taking the seventh place in Europe in terms of organic farming area is not one of the leading countries according to the share of organic agriculture in the total area used for agriculture. In 2016, 3,7% of agricultural land area in Poland was used organic which is slightly better than in the whole Europe (2,7%), but clearly worse than the percentage of cultivation in the European Union which amounted 6,7%. Furthermore, in Poland, in contrast to Western European countries, no further increase in the share of sown areas is observed. Among the European countries, the highest percentage of organic farming occurs in Liechtenstein (30,2%), Austria (21,3%) and in Sweden and Estonia - both above 16% [13].

Despite increased interest and dynamic development, organic farming is not yet a self-sufficient production system. There is a lack of research centers and organizations supporting organic production. There are also no properly developed branches of processing. Due to the lower productivity, it is necessary to support the development of organic farming in the economic sphere. One of the basic problems is the fact that it is predominantly based on sowing material from conventional agriculture. The development of organic plant breeding and seed production for organic farming in Central and Eastern Europe is small and seed production takes place in a few countries, such as Latvia, Estonia, Slovenia and Hungary [3, 4, 7, 10, 16, 17].

The lack of appropriate genotypes for cultivation is one of the main problems of organic farming [1, 10]. The aim of this study is to present ways of obtaining genotypes and methods of seed production appropriate to the needs of organic farming. The factors limiting the development of breeding new varieties and seed production in conditions that meet the standards of organic production will be presented.

2. Material and methods

The following chapters present the current status and factors affecting the development of breeding varieties, methods of breeding allowed for organic farming and the specificity of producing certified seeds for this farming system. As the criterion for the selection of themes, the significance of factors influencing the formation of organic seed production was assumed in a specific economic, social and legal context. They affect the production practice and directions of transformation in organic farming. The unquestionable limitation is connected with legal regulations which are a form of social consent for a certain type of procedures, changed and updated in response to the growing needs of the population. Showing the possibilities offered by modern genetics in comparison to traditional methods allowed in breeding varieties for ecological purposes highlights the scale of the problem but also the possibility of bringing specific values for all modern agriculture and scientific development. A number of sources were used to write the paper, in particular publications of governmental and non-governmental organizations, materials from companies and associations related to the agricultural industry and the seed market, as well as presentations from conferences and symposia regarding the organic farming sector and development of organic seeds market in Poland, Europe and the world.

3. Results and discussion

In contrast to the intensive crop production, which in some way degrades the natural environment, organic farming is based on production using the naturally existing potential and its self-stabilization. The basis of organic farming is fertile and biological active soil, which nourishes crops and maintain proper nutrients balance. The varieties grown in this farming system should provide the satisfying yield and good plant health. Apart from crop rotation and targeted cultivation, they are the main tools in combating pests control and yield growth [14, 15].

Features that should be exhibited by species and varieties in organic farming are: high yielding in conditions of limited resources, resistance to biotic and abiotic stress, good vigor of growth, competitiveness in relation to weeds and health. Plant varieties adapted to the conventional system in organic farming do not bring comparable yields. Therefore, there is an increasing interest in the creation of new varieties of species used in organic farming [6, 14].

Comparing the conditions and possibilities of breeding varieties and seed production in both production systems – organic and conventional, organic production is placed in a worse position. In particular, it applies to the following stages [15]:

- development of cultivar breeding - only traditional methods of breeding and selection are allowed, exclusion of genetic engineering techniques, lack of expenditures and sources of financing,
- multiplication of seed for the needs of agricultural production - lack or small amount of basic and certified material accepted under the principles of organic farming and with comparable yield, guaranteeing production free from GMOs, increased difficulty in obtaining seeds with good features, such as vigor, immunity,
- storage and preservation of seed material - poorly developed technological processes that meet the conditions of organic production, poor availability or high price,
- quality control and certification - no separate regulations - the need to meet the requirements as for the conventional products market,
- trade in organic seed, logistics, marketing - poorly developed market for the purchase of organic crops, the need to contract and look for outlets that means increased investment expenditures.

3.1. Advances in genetics and breeding of varieties for organic farming

Creative breeding - is the creation of new breeding varieties in selection and multiple generative multiplication processes, as a result of which the parental plant genes are combined to obtain a line of plants with the desired traits, for example increased resistance or higher yielding parameters. The IFOAM standards for organic breeding of varieties assume that the selection should take place in organic conditions, while the genome and cell are indivisible and must maintain their natural reproductive capacity. Genetic engineering is excluded, and that is why the breeding techniques must be public. The farmer's culture, the exchange of genetic material and the prohibition of patenting of created forms and varieties are promoted [10, 14, 16]. Such conditions are not compatible with the methods and purposes of plant breeding in large breeding units. That is why the interest of specialized units is small, and the farmer's productionincluding the entire net: breeding, seed production and sales is too weak.

Knowledge about genes and modern technical methods give more and more possibilities to use genetic resources of nature. Paradoxically, however, modern plant breeding for the needs of conventional agriculture, using a narrowed gene pool, undermines to a large extent the foundation on which it rests. Genetic diversity represented in the group of elite varieties is only a small fraction of the entire gene pool of crop plants. It leads to the so-called genetic erosion, and there are justified concerns about the loss of genetic diversity in the long term [6]. Plant breeders should be aware of this and expand the genetic pool available for the creation of new varieties. In the concept of an expanded gene pool created for the needs of modern genetics, three concentric overlapping groups of genes are distinguished for the classification of genetic resources [7]. In the first, narrowest gene pool, full cross-breeding of plants is possible, there are no problems with sterility of plants, there is a natural segregation of genes. Hybrids are obtained from the gene pool interaction of the first and second groups. The inbred lines used here are harder to obtain, have less fertility, reduced vigor, but give rise to high fertility and high yield in the first crossbred generation. In the third-level pool, plants are poorly related, there is a great difficulty in their crossing, most are infertile, rarely used in breeding, require the use of advanced techniques.

Organic farming fully recognizes basically only cross-breeding within the first-degree pool, half-breed hybrids are conditionally accepted depending on how they originate, while integrating genes from the third pool from an ecological point of view is unacceptable, due to a breach of plant integrity.

Genetic variation in plants to obtain better cultivation traits can be induced in many ways. Unfortunately, only a small part of available techniques respects the integrity of the plant and the three basic rules adopted in organic farming: (a) technical interventions in the genome are unacceptable; (b) the indivisibility of the cell is respected and (c) the natural ability of plants to reproduce are maintained [1, 14, 16, 17]. Table 1 presents the most important breeding methods and their suitability from the point of view of organic farming.

With the development and dissemination of modern reproductive techniques, genetic resources may soon become almost limitless, but this raises controversies and fears. Taking into account the pace of plant breeding development, many laboratory techniques are relatively new, and therefore not very proven in terms of long-term impact on the population created this way. There are raised concerns

Table 1. Main methods used in the breeding of varieties with specification of characteristics in terms of their suitability in organic farming (own elaboration based on [15])

Tab. 1. Ważniejsze metody stosowane w hodowli odmian z wyszczególnieniem cech je charakteryzujących pod kątem przydatności w rolnictwie ekologicznym (opracowanie własne w oparciu o [15])

Breeding technique Technika hodowli	Interference on genom level *Ingerencja na poziomie genomu*	Interference on cell level *Ingerencja na poziomie komórki*	Ability of propagati on is affected *Wpływ na zdolność rozmnażania*	Crossing the crossing barriers *Przekraczanie barier krzyżowalności*	Usefulness in organic farming *Przydatność w rolnictwie ekologicznym*
Crossing within one species *Krzyżowanie w obrębie jednego gatunku*	No	No	No	No	Yes
Crossing of remote forms Krzyżowanie form oddalonych	No	No	No	tak	Yes (?)
Bridge crossing of remote forms *Krzyżowanie pomostowe form oddalonych*	No	No	No	No	Yes (?)
Polyploidy induction *Poliploidyzacja*	Yes	No	No	No	No
Cytoplasmic male sterility (CMS) *Cytoplazmatyczna męska sterylność (CMS)*	No	No	Yes/No	No	?
Selection with markers (MAS) *Selekcja za pomocą markerów (MAS)*	No	No	No	No	Yes
Double haploid method *Metoda podwojonych haploidów*	?	possible	No	No	No
Protoplast fusion *Fuzja protoplastów*	?	Yes	possibly (triploides)	possibly (CMS)	No
Cytoplast fusion *Fuzja cytoplastów*	No	Yes	No	possibly (CMS)	No
Chemical mutagenesis *Chemiczna mutageneza*	Yes	Yes	No	No	No
Tilling (induced mutagenesis) *Tilling (indukowana mutageneza)*	Yes	Yes	No	No	No
Eco-Tilling (searching for natural mutations) *Eco-Tilling (wyszukiwanie naturalnych mutacji)*	No	No	No	No	Yes
Oligonucleotid dericted mutation *Mutacja sterowana oligonukleotydami*	Yes	Yes	No	No	No
Zinkfinger Nucleasen I + II *Nukleaza z motywem palca cynkowego I+II*	Yes	Yes	No	No	No
Zinkfinger Nucleasen III *Nukleaza z motywem palca cynkowego III*	Yes	Yes	No	possible	No
Cisgenetics *Cisgeneza*	Yes	Yes	No	No	No
Transgenes *Transgeneza*	Yes	Yes	possible	Yes	Yes
RNA Interferenz (RNAi) *Wyciszanie genów (RNAi)*	Yes	Yes	No	No	No
Minichrosomen *Minichromosomy*	Yes	Yes	No	Yes	Yes

Table 2. Systems for the production of organic seed material (own elaboration based on [16])
Tab. 2. Systemy produkcji ekologicznego materiału siewnego (opracowanie własne na bazie [16])

No.	Plant breeding *Hodowla roślin*	Variety testing system *System oceny odmian*	Seed propagation *Namnażanie materiału siewnego*
1.	Conventional breeding *Hodowla konwencjonalna*	conventional *konwencjonalny*	conventional - seed untreated kon-wencjonalne – nasiona niezapra-wiane
		conventional *konwencjonalny*	organic *ekologiczne*
2.	Breeding for organic agriculture *Hodowla dla rolnictwa ekologicznego*	organic *ekologiczny*	organic *ekologiczny*
3.	Organic plant breeding *Hodowla ekologiczna*	organic *ekologiczny*	organic *ekologiczny*
4.	Old cultivars (Gene Banks) *Stare odmiany uprawne (Banki Genów)*	organic *ekologiczny*	organic *ekologiczny*
5.	Breeding for mixed cropping* *Hodowla dla upraw mieszanych**	organic* *ekologiczny**	organic* *ekologiczny**

* also possible in the conventional system / *możliwy także w systemie konwencjonalnym*

about their possible negative consequences from the point of view of human existence.. In industrialized agriculture, the economic characteristics of varieties are important, while their origin loses its importance. Conversely, in organic farming it is assumed that efficiency will be increased by supporting the mechanism of changing the expression of genes activated under the influence of the environment [15]. It is possible only in the selection taking placeuder organic farming conditions. Varieties that adapt to difficult habitat conditions use mechanisms of gene expression or gene silencing induced by environmental factors. Current research indicates that these mechanisms have a much greater impact on changing the habit and development of organisms than was thought. It is certainly the direction of research, which may also be an opportunity for organic farming, because the genetic variability caused by epigenetic factors is a much more complex process than hereditary genetic variation and the development of research in the area can bring new light to scientific knowledge and use of these mechanisms in practice [16].

It is also assumed that it is possible to limit biotic and abiotic stresses by introducing wild plant resistance genes. The possibilities of introducing such genes, however, are limited, due to the limitation in organic breeding to typically biological methods. However, attempts are being made to exploit the advantages of the method by, for example, selection among F_2 forms, use of male sterile forms (CMS), or association of remote forms such as local populations with wild species. Moreover, the EU Directive, omitting the use of cell fusion techniques, has created a legal loophole, in which a number of varieties being a product of breeding techniques close to GMOs are used by organic farmers.
Watching objectively, allowing at least some modern techniques for the production of varieties, such as hybridisation or limited transgenesis, would be beneficial for the extension of genetic diversity and the rapid introduction of desirable traits in organic farming.

3.2. Sources of origin and testing of varieties

The varieties that go into organic farming can have very different origins, often having little to do with the production conditions applicable in this system. Sources of the origin of varieties can be divided into five groups (Table 2). The first group - there are varieties derived from conventional plant breeding, selected for the purpose of conventional cultivation and tested using seed dressings, herbicides and mineral fertilizers. The second group consists of varieties from specialized farms where breeding programs are supported by selection activities within organic farming for obtaining a specific product. Varieties derived from organic plant breeding programs constitute another group, where breeding, selection and testing take place only under organic conditions, to take full advantage of the benefits of plant-environment interaction. For the sustainable use of genetic resources and the widening of agronomic diversity it is important to use old varieties and populations collected in gene banks and traditional local varieties [18]. The fifth - the future but rarely pursued farming direction is related to the search for genotypes useful for mixed cropping or intercropping. It is a difficult direction, because it must take into account both plant-plant interaction, but also plant-soil microbe interaction and plant-microbe-fauna interaction. Mixed crops are a recommended method both in organic farming and in integrated crop cultivation.

It is assumed that new varieties are the most effective carrier of agricultural progress. Therefore, organic farms, like conventional ones, should use the effects of breeding works as widely as possible. Few specialized breeders use only methods that meet the conditions adopted for organic farming. The greater part of the seed material used in organic farming comes from conventional breeding which only at the last stage of propagation is classified as "oeganic". In addition, if organic material is not available on the market, it is allowed to use seeds commonly available on the market (conventional) in organic farming. Unfortunately, agricultural practices and selection priorities for organic farming are partly different than for conventional farming. Thus, relying on the varieties selected for the conventional system results in the loss of many genotypes that could be successfully used in organic farming [9, 14, 18]. Many genotypes, which would achieve good results in organic farming, are rejected already during the selection at the level of the breeder, as well as during the registration process of varieties - directed at the conventional system. Comparison of the results of the same breeding lines tested under organic and conventional farming conditions may be the evidence [15] (Fig. 1).

Satisfactory yields in the organic system were found in more than a dozen genotypes, but only a few of them met the assessment criteria for conventional production. Observation of the type of dependence resulted in the registration of the first hybrid of maize KWS 5133 Eko, which already at the stage of cultivation presented a great suitability for organic farming [2].

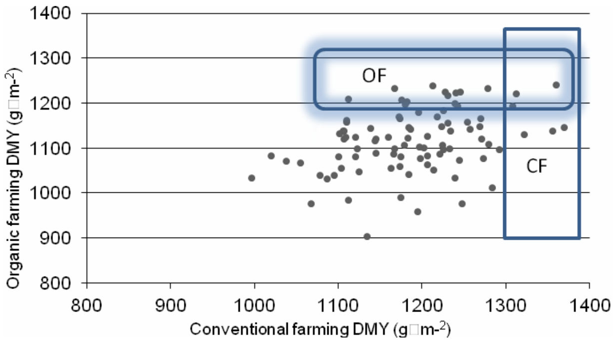

Fig. 1. Dry matter yield of 151 maize breding materials tested in organic farming (OF) and conventional farming (CF). An example of lost opportunities if genotypes are chosen only within conventional agriculture (own elaboration based on [16])

Rys. 1. Wydajność suchej masy 151 form hodowlanych kukurydzy przebadanych w rolnictwie ekologicznym (OF) i konwencjonalnym (CF). Przykład utraconych szans, jeśli genotypy są wybierane tylko w ramach konwencjonalnego rolnictwa (opracowanie własne na bazie [16])

In Poland as well as in many other countries, no breeding works are carried out for the needs of organic farming only, while the method of searching among numerous conventional varieties, varieties with greater suitability for cultivation in ecological conditions is used. After registering the variety and gathering information about its biology and requirements, it can be targeted to a group potentially useful for organic farming [4, 5, 8, 18]. Initial selection of varieties is facilitated by the results of Post-registration Variety Testing System (PDO), especially for those plants where two horizontal cultivation intensities are used in experiments. The study of selected varieties for the conditions of organic farming for more than ten years is conducted by the Institute of Soil, Fertilization and Soil Science State Research Institute (IUNG-PIB) in Puławy in Poland. The results of IUNG experiments indicate that the importance of selecting varieties in organic farming is greater than in conventional farming [5, 9]. Similar research is also carried out by the Institute of Plant Breeding and Acclimatization State Research Institute in Radzików, where the suitability of not only modern but also old varieties of wheat, oats, barley and potatoes as well as several species already abandoned in cultivation is tested [18]. The studies allowed the recommendation for organic farming and the inclusion of a large but still limited number of varieties and some old genotypes once grown in Poland on the official list of PIORIN. Recently, the evaluation of varieties in the organic farming system has also been developed at the Central Research Center for Cultivar Testing (COBORU), which gives the opportunity to study a larger pool of genotypes. It creates an opportunity to enter in Poland into the official register of varieties authorized for cultivation in organic farming, as is the case eg. in Austria [14]. In Germany, the study of cereal varieties in terms of organic cultivation began in 2012. Currently, according to Bundessortenamt, the official list of varieties contains organic varieties of barley and oats.

3.3. Economic aspects of breeding and seeding for organic farming

Breeding of new varieties is a long-term and extremely expensive process. In consequences of the concentration and breeding for conventional farming, selected genotypes are addressed usually to intensive „high input" agriculture, not able to adapt and with loss of biological diversity. Cultivars are increasingly often patented, not suitable for re-sowing and dependency on genetical engineering. The global commercial market, protected seed with property rights is estimated at ca. 30 billion USD. Therefore, top ten seed companies control 70% of the global market.

Organic agriculture needs: cultivars with transparency of breeding methods, adapted to organic conditions (resistance, weed suppressing, nutrient efficiency); varieties that maintain fertility and those that the farmer can cultivate in the following years; varieties with good taste and nutritional quality.)

In the case of organic crops, one of the factors limiting the emergence of new varieties is releted to the low rate of return on expenditures, which results from the limited sown area of specific species. According to a survey, 54 to 75% of respondents believe that the shortage of cash is the main factor limiting the further development of specialized programs for organic plant breeding [1, 20]. The main reasons for failures are: an unsustainable economic model and the lack of a financial return on investment. Another major obstacle (22% of respondents) consists in an unstable policy and the lack of adaptation of registration rules for organic varieties.

In spite of quite large areas on which the organic system is implemented, in reality the areas on which specific species and crop forms are grown are small in practice. It creates a kind of economic barrier for the development of breeding works and later the seeding of selected varieties. Taking into account the demand and practice of seed exchange, the largest recipients are annual plants grown on arable land. Meanwhile, in the world's organic farming the dominant form of use is permanent grassland, occupying 66% of the area, i.e. 38 million ha. Arable lands amounts to 18% (10 million ha), and long-term crops 8% (4,5 million ha) [20]. In Europe and Asia, the share of arable land in the structure of organic farming is much larger: in Europe they account for 43%, while in Asia almost 50% of the total area used organically. The share of arable land is important because the needs and possibilities of implementing modern varieties are definitely the largest for annual plants cultivated on arable land and smaller for perennial crops.

If we assume that the basic criterion for the demand for specialized seed varieties includes the size of the sown area, then the greatest interest of growers should be aroused by cereals, which in ecological production occupy 4,1 million ha, and in Europe slightly over 1 million ha (Table 3, Fig. 2). If we count together the areas of organic farming and areas in conversion to organic farming, the area of cereal sowing accounts for approx. 1,4 million ha (Table 3, Fig. 2). Of the cereals, wheat is most commonly grown - in Europe it is about 36% [13]. If so, the size of wheat crops is approx. 0,5 million ha, which guarantees the return of expenditure on bred specific variety . It would have to be an universal crop for the conditions of the whole of Europe. The sowing areas of other cereals, and especially the oat, which is popular for organic farms, are even smaller.. Therefore, organic farming in cereal cultivation is based on varieties from conventional farming, proven in ecological conditions. It is worth noting that, contrary to the above statements,, the most common organic varieties are produced and bought in the group of vegetables, which in Europe occupy only 25000 ha. However, the specifics of their production is that you have to buy seeds every year, every year, that is why their sale is correspondingly greater.

Table 3. Top European Union countries with the largest cereals areas in organic farming in 2016 [21]
Tabela 3. Kraje Unii Europejskiej z największymi obszarami zbóż w rolnictwie ekologicznym w 2016 r. [21]

Countries *Kraje*	Organic + conversion area *Powierzchnia ekologiczna + w konwersji*	Including: under conversion *W tym: w konwersji*	
	1000 ha	1000 ha	%
Germany	242,0	5,8	2,4
France	217,4	87,3	40,2
Spanien	216,5	81,6	37,7
Sweden	104,9	15,4	14,7
Austria	102,3	0,0	0,0
Poland	101,1	20,0	19,8
Romania	75,2	15,7	20,9
Denmark	58,3	9,4	16,1
Finland	54,2	7,8	14,4
United Kindom	38,3	1,6	4,2
Hungary	33,1	13,0	39,3
Bulgaria	31,5	22,3	70,8
Czech Republic	27,6	5,2	18,8

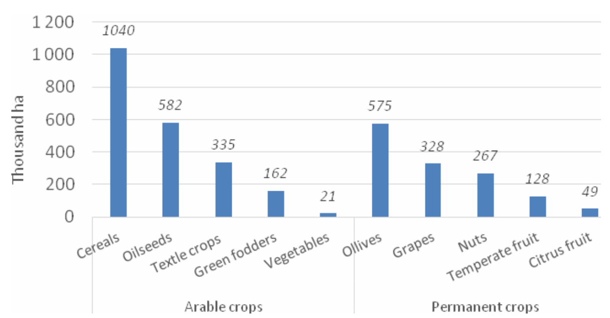

Fig. 2. Use of organic cropland in Europe by crop groups in 2016 [21]
Rys. 2. Wykorzystanie ekologicznych pól uprawnych w Europie według grup upraw w 2016 r. [21]

The research and innovation policy must promote programs to support research in the breeding of freely pollinated cultivars, protect genetic resources and support implementation in local communities. According to a number of authors the future of organic breeding should be seen in the creation of regional cultivars adapted to the requirements of the local habitat with a lower cost, as a common good in cultivation contracted with producer communities, without official registration [1, 10, 17]. It is important that it is not sold as a common good. Therefore, the EU legal provision prohibits the marketing of seeds and plant propagating material as a variety without its registration. On the other hand, the evaluation criteria are not adapted to the registration of organic varieties [10] and their official admission to trading.

The healthiness of plants is an important problem. To prevent the development of pathogens on plants, the special care should be taken not only for their genetically conditioned resistance (selection of the right variety) but also for the high quality of seed. Sowing of vital and healthy seeds is an extremely important element of organic farming due to greater competition and lack of possibilities to control pests. The dynamics of pathogens population development starts with seeds, because the faster the pathogen is on the plant, the faster it spreads. Therefore, prevention in seed production is important. The seeds themselves require costly sanitary procedures, which involve the use of one or several simultaneously purifying methods. These methods can be divided into physical - using the purifying effect of water, air, temperature, electrical, chemical - using natural organic substances (eg. to combat pathogenic fungi) or biological - using antagonistic organisms.

The most important phytosanitary techniques include: treating seeds with hot air or hot water, vacuum-steam method, brush method, exposure to smoke, electron beam treatment and infrared treatment [20]. Despite some risk of seed damage, priority is given to physical protection methods. Individual treatments applied to the seed do not bring the expected results, hence various combinations of several consecutive treatments are carried out. Unfortunately, in each of the methods, the parameters of its application are extremely important, and it requires the use of specialized and expensive equipment [3, 20]. Considering the decentralization of farming and organic seed production, having the right equipment for cleaning and conditioning seeds is not very real even for a group of farmers. For better efficiency production of seeds and seed dressing may be useful whole range of organic substances, in particular plant extracts. Although the results of the conducted research are very optimistic, their use in organic farming requires separate procedures and often costly small-scale, not necessarily cost-effective toxicological tests.

Treatment of seeds with methods allowed in organic farming does not have the same effectiveness as conventional chemical dressing. That is why research into new, usable substances is constantly being carried out.
In addition, it has been shown that by combining different methods and substances, they become much more effective - so-called 'hurdle effect' [3]. This also applies to seed batches where diseases or pests have been found. Therefore, the treatment of organic seed material is usually carried out with the use of compound mixtures, which ensures greater efficiency and versatility.

4. Conclusions

EU Regulation EG No. 834/2007 requires that in organic farming propagation material from organic production should be used while the use of conventional material in the case of the lack of market availability of material produced in ecological conditions is allowed. Seed production in the organic system takes place but its size does not cover the growing demand. As a result, organic production takes place on the principle of adapting plants from the conventional system to the conditions of organic farming. The solution to varietal problems could be the local registration of such varieties or the creation of a separate registration system for organic varieties, which would take into account the history of its origin and the origin of parental plants.

The development of advanced technologies is more and more dynamic, but EU regulations on breeding techniques allowed in organic farming are not very clear. Organizations of biodynamic producers themselves have imposed restrictions on acceptable breeding techniques. These limitations make it difficult and sometimes even impossible, to achieve the progress of specific and significant improvement of such traits as: resistance to the most dangerous pathogens, "low-input" or tolerance to drought. For example, the exclusion of hybridization technique greatly worsens the possibility of yielding varieties for organic farms. In the authors' opinion, some methods such as hybridization, limited transgenesis or molecular markers would be very useful for extending genetic diversity and quickly introducing desirable traits in organic farming.

Organic seed market is naturally associated with the idea of 'fair-trade' - the idea of supporting local communities and small producers - just as the local occurrence of plants and their varieties is natural. Decentralization of production and the release of the market thus becomes a natural process, corresponding to the territorial social dimension. However, regional varieties and amateur varieties are not legally protected, so their commercial use is possible without additional costs. On the one hand, the type of "open source" breeding arises, but it does not support local breeders and does not yet build the facilities for further breeding in this way. Legislative work and the updating of regulations must therefore keep up with the needs of the market, but also with the development of new technologies.

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