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FINANCING STREAMS OF POST-REGISTRATION VARIETY TESTING: A CASE STUDY FROM POLAND

Key words: post-registration variety testing (PRVT), PDO, agricultural progress, financing of progress, sources of financing, knowledge transfer to agriculture

ABSTRACT. This paper addresses the measures taken to implement progress in agriculture, with particular emphasis on the role played by Post-Registration Variety Testing (PRVT). Special attention was paid to assessing the structure of financing streams for PRVT in Poland, how they evolve over time and how they differ between locations. The Reports on the Implementation of the Post-Registration Variety Testing (PRVT) Program in 2010-2021 were used as source materials. Studies were carried out using 2010 constant prices. This paper found an increase in the number of PRVT research projects and experiments over the study period, which contributed to promoting biological progress, although the uses of PRVT findings differed between regions. Focus was also placed on the restructuring of financing for post-registration testing, with two leading streams being identified, namely the state budget and funds delivered by third parties, including private operators. The authors emphasized the importance of earmarked subsidies allocated to PRVT in the state budget, and the role they play in stimulating the transfer of knowledge and in promoting advancements and preserving biodiversity in Polish agriculture. The conclusion also points out the importance of PODs also in terms of the suitability of varieties for production in particular regions and under given technological conditions, which is in line with, among other things, the goals of the UN's 2030 Agenda for Sustainable Development, i.e. SDG 12 (ensuring sustainable consumption and production patterns) and SDG 15 (protecting, restoring and promoting sustainable use of terrestrial ecosystems, sustainably managing forests, combating desertification, halting and reversing land degradation, and halting biodiversity loss).

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INTRODUCTION

The natural environment in the 21st century is already officially viewed as being in a critical condition, and yet the recovery measures still lack sufficient legal backup, are insufficiently financed, and are often implemented only on a voluntary basis. These issues affect different regions across the globe, whether located in developed or developing countries. Finding ways to break the deadlock of how to use the environment while caring for it and improving production efficiency becomes the goal of many institutions around the world, including in Europe. In the EU, the preparation of and the commitment to implement what is referred to as the European Green Deal Strategy [Adamowicz 2021] is a formal expression of concern for nature viewed as a common good [Goldman 2013, Skowrońska 2020, Dziekański et al. 2021]. Being a kind of an environmental and social manifest [Borkowski 2021] but also an executable document, the strategy takes on particular importance in the context of the considerations on the future development of European (including Polish) agriculture [Prus 2019, Wiśniewski, Marks-Bielska 2022]. The way to realize the challenges outlined by the Green Deal is, among other things, to improve the mechanism for improving production efficiency by making better use of production inputs to implement new varieties, e.g., with higher nitrogen absorption, or higher disease and pest resistance, which can reduce the use of both chemical fertilizers and pesticides, and maintain or even improve current production levels [Wicki 2018, Tratwal et al. 2019]. As an important aspect, the strategy is committed to preserve biodiversity both in production activities (crops and farm animals) and in a much broader, environmental, context (wild plants and animals). Ultimately, this is supposed to contribute to significant improvements in the protection of the natural environment [Musiał, Szumiec 2021].

However, pursuing these noble ideas requires some coordinated support, including funds, from the government (politicians and decision makers), intensive work by research and implementations bodies, and – most of all – an active involvement from farmers in implementing the suggested solutions. Examples of coordinated measures taken in this area include post-registration variety testing. In Poland, it is carried out by specialized operators (including the Research Center for Cultivar Testing in Słupia Wielka) which are largely financed by the state and actively contribute to a free transfer of knowledge to the agricultural sector. Hence, the purpose of this paper is to identify and analyze changes in the level of the financing streams for post-registration variety testing in Poland in 2010-2021.

VARIETY TESTING VS. THE EUROPEAN BIODIVERSITY STRATEGY TO 2030

In accordance with the assumptions behind the European Green Deal (EGD) and the European Strategy for Biodiversity, agricultural production should be environmentally-friendly, economically viable and socially acceptable at the same time [Gacek 2017]. One of the ways of pursuing such ambitious goals is by improving the efficiency of systems for knowledge transfer to agriculture, including in the area of implementing and controlling varietal progress. Post-Registration Variety Testing (PRVT) is a multi-stakeholder experimental system comprising collaborating entities and organizations directly or indirectly interested in agricultural development both at country level and regionally (local government units, farmers' self-government, central administration, advisory service providers, breeding and seed companies, scientific bodies, growers' unions etc.) [COBORU 2022a]. It is the EU's unique enabler of organizational and economic synergies derived from the collaboration of nearly all national research and experimental bodies [Walkowski 2012, Gacek 2017]. At the same time, it allows to implement and control the maximization of biodiversity in fields while also enabling adequate crop management, especially in monocultures (but also in mixed and other cropping schemes). Its tasks mostly include recommending varieties suited to different environmental and cropping conditions, which is ultimately supposed to prevent the degradation of farming sites and protect native species. In practice, post-registration plant testing and experiments under the PRVT program provide a basis for establishing a list of varieties recommended to be farmed at regional (voivodeship) level [COBORU 2022b]. Note that the results of PRVT experiments are valuable research materials for a number of scientific papers addressing crops of economic importance, i.e. sugar beet [Studnicki et al. 2019], winter wheat [Bujak, Tratwal 2011, Mądry et al. 2017, Iwańska et al. 2020], winter triticale [Tratwal et al. 2019, Derejko et al. 2020] and potato [Piekutowska et al. 2021]. The works cited above illustrate the multi-layered structure of research based on findings from the PRVT program.

The list of varieties recommended to be farmed at voivodeship level makes it easier for farmers and agricultural producers to choose the crop varieties best suited to the local farming conditions. This applies both to the relationship of varieties to selected elements of technology and their adaptation to the expected intensity of production (more or less intensive depending on environmental and organizational conditions) [Wicki 2008, 2009]. Today, this is an aspect of particular importance in view of the measures taken to reduce environmental degradation, and having in mind that climate change can be observed to become more and more intense which corresponds to the sustainable development goals formulated in the Agenda 2030 Sustainable Development Goals (Goals 12. "Responsible consumption and production" and 15. "Living on land"). In addition, the scope described

above is certainly consistent with the main assumptions behind the European Biodiversity Strategy to 2030. It also has an indirect impact on shaping sustainable agriculture, and provides an opportunity to restore an adequate balance of life on earth [EC 2020].

The outcome of measures related to implementing the biodiversity strategy depends on the combined effect of different factors, including:

- economic aspects (especially the striking recent changes in the economic situation, including the consequences of the COVID-19 pandemic which have an impact on global changes to the food safety model and on the reorientation of commodity flows; the economic crisis; progress in agricultural robotization etc.);
- legal aspects (especially the amendments to the Common Agricultural Policy, its underpinning environmental programs or new forms of payments);
- climate aspects (climate change which continues to be too often called into question and sidelined);
- implementation practice [AGROBANK 2020].

In practice, the financing for measures taken to preserve biodiversity – including funds allocated to post-registration variety testing – is the issue that stands out.

MATERIAL AND METHODS

According to the assumption made when creating it, the Post-Registration Variety Testing (PRVT) system was supposed to be financed mostly with funds supplied by parties particularly interested in monitoring the reactions of crop varieties to different site and agri-technical conditions. The PRVT program is carried out by the Research Center for Cultivar Testing in collaboration with its statutory partners, namely voivodeship-level local government and agricultural chambers that form the farmers' self-government. The above makes PRVT the European Union's unique system focused on addressing practical farming needs, and an example of aligning variety testing with the assumptions of sustainable agricultural development [Niedbała et al. 2022]. Also, it is consistent with measures taken to implement the European Biodiversity Strategy to 2030 of May 20, 2020.

The Reports on the Implementation of the Post-Registration Variety Testing (PRVT) Program in 2010-2021 were used as source materials in pursuing the goal of this study. In order to eliminate the impact of price changes, analyses were conducted using constant 2010 prices.

As part of preparing this paper, the authors carried out a desk research into secondary materials and relevant literatures. This allowed to collect highly reliable empirical materials for further examination and analysis. The calculations were performed with Statistica 13.3. The description of the results of this study was supplemented with graphical outputs (tables and graphs).

PRESENTATION OF THE RESULTS OF THE STUDY

Variety testing under the PRVT program is directly focused on the farmers' needs in an effort to make it easier for them to choose the best varieties for cropping. Such varieties are suited to local farming conditions, which does not only allow making the best use of land resources but most of all enables a practical implementation of biological advancements in agriculture. There is huge potential in this area, especially since the post-registration experiments are carried out throughout Poland; this is a way to guarantee that local cropping conditions are taken into account. PRVT participants include different experimenters (with 96 of them in 2021). For a number of years now, the Experimental Sites and Centers for Variety Evaluation of the Research Center for Cultivar Testing (47), plant breeding units (22), agricultural consultancy centers (10) and other bodies (10) have been the main actors in it [COBORU 2022c].

According to the analysis of available data, the number of experiments is on a consistent rise, going from 216 in the first year (1998) of PRVT [Niedbała et al. 2022], to 958 in 2010 and to 1,024 successful tests in 2021. However, the peak (1,046) was reached in 2016 (Figure 1). As the number of experiments grow, so does the number of crop species and varieties subject to post-registration testing. In 2010, tests were performed for 23 plant species, with a total of 577 varieties involved. In turn, as much as 732 varieties of 32 crop species (including 3 vegetable and wine grape species) were subject to tests in 2020. Most of the varieties tested were the ones entered to the National Register [COBORU 2022d], to the EU's Common Catalog of Varieties of Agricultural Plant Species (CCA) and to the

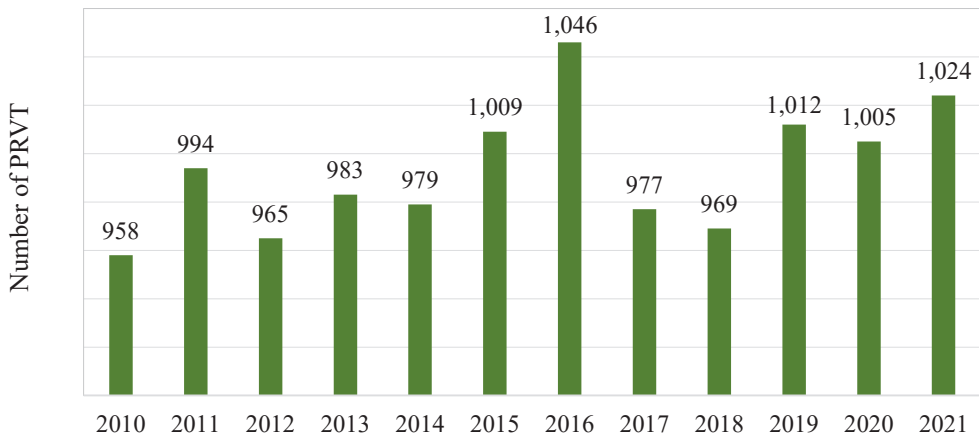


Figure 1. Number of PRVT experiments in 2010-2021

Source: own study based on COBORU [2022c]

Common Catalog of Varieties of Vegetable Species (CCV). Also, an examination was carried out to determine whether the 204 varieties registered in other European Union states are suitable for cropping in Poland.

Polish regions differ in how they use the resources of hands-on knowledge on crop varieties. The analysis of data on PRVT numbers and locations reveals two leading Polish voivodeships, i.e. Wielkopolskie (97) and Dolnośląskie (93) as well as those which make the least use of PRVT, i.e. Świętokrzyskie (41) and Lubuskie (36) voivodeships. Note that the scope of PRVT differs between locations in function of the economic importance of species and varieties tested and of financing streams for the test procedures. The involvement of local stakeholders (including the Marshall's Office, the Agricultural Chamber and breeding companies) in the PRVT process also plays a certain role.

The PRVT program, especially including experimentation activities performed as per the applicable methodology, require adequate financial resources to cover the costs. Necessary funds are sourced from different streams; a total of over PLN 90.6 million (more than 100.5 million in current prices) was spent on PRVT over the period considered. These funds went consistently up over the decade covered by this study (2010-2021), as illustrated by the polynomial trend line calculated by the authors (Figure 2).

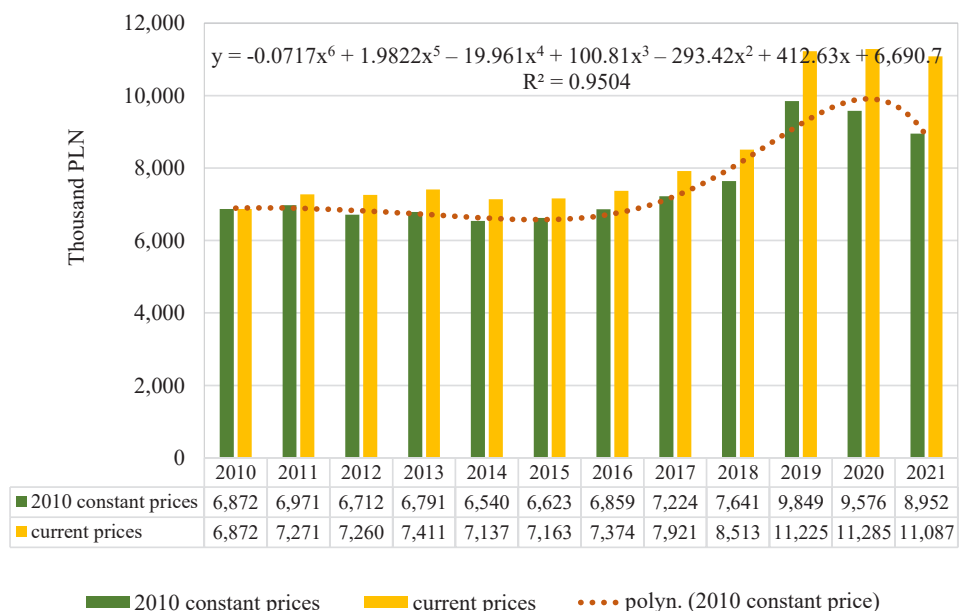


Figure 2. 2010-2021 spending on the PRVT scheme

Source: own study based on COBORU [2022c]

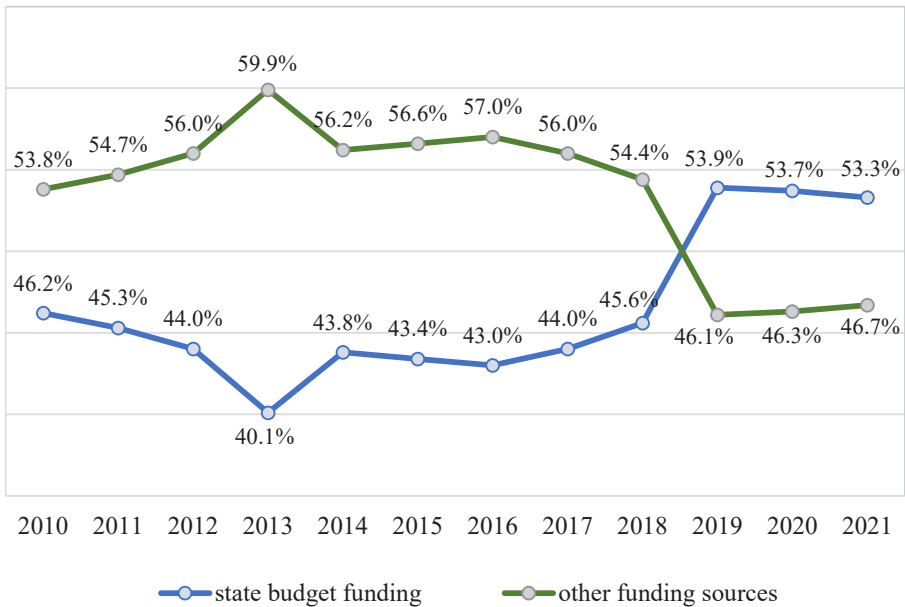


Figure 3. 2010-2021 funding structure on the PRVT scheme
Source: own study based on COBORU [2022c]

The average annual growth rate of financial expenditure was 2.4% (nominal values of 4.4%), the PRVT operational spending in 2021 was by 30.3% (61.3% in current prices) higher than in 2010. The greatest year-over-year increase (by 28.9%) in funds allocated to PRVT was recorded in 2019.

PRVT may be financed with different streams, i.e. budgetary (internal) funds and extra-budgetary funds (external resources provided by statutory partners and private operators or persons) [Wicki 2005]. In 2010-2018, external financing streams prevailed in the PRVT funding structure. This started to change in 2019 when an earmarked subsidy was granted from the state budget to cover over 50% of costs of tests carried out by the Research Center for Cultivar Testing (Figure 3).

The remaining part mostly comes from statutory partners, especially including voivodeship-level local government which allocated a total of PLN 12.4 million to PRVT over the study period. It needs to be emphasized that the annual amount of funds delivered by local government units is over PLN 1 million (the smallest level of PLN 935,207 was recorded in 2012). The greatest subsidy of PLN 1,217 thousand was delivered in 2016. Based on the analysis of differences in financing levels between regions, it was concluded that the amounts differed between local government units, varying in the range

Table 1. Co-financing partners of PRVT experiments in 2010-2021

Specification	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	%											
Voivodeship-level local government	30.5	27.6	25.0	24.2	30.6	28.4	29.8	29.2	25.9	25.6	27.4	27.4
Agricultural chambers	1.5	1.3	1.8	2.2	2.5	2.5	2.6	2.5	2.9	2.0	2.2	2.4
Polish Maize Producers Association	4.5	4.4	3.4	3.7	4.8	5.1	4.9	5.5	5.7	5.0	8.9	9.4
Sugar industry	2.8	2.7	2.3	2.3	2.7	2.5	2.3	2.0	2.0	1.7	1.3	1.3
Polish Institute of Soil Science and Plant Cultivation of the National Research Institute	6.7	5.7	1.4	-	-	-	-	-	-	-	-	-
Breeding companies (winter rape, soya beans)	-	-	-	8.0	8.2	7.2	6.5	6.1	6.6	5.4	13.2	11.1
Own funds of bodies in charge of experiments	52.8	56.9	65.4	58.8	50.2	53.4	53.0	53.8	55.9	58.8	45.6	49.3
Other funds sourced locally	1.2	1.4	0.7	0.8	1.0	0.9	0.9	0.9	1.0	1.5	1.5	1.5

Source: own study

of PLN 16,000 to PLN 175,000 in 2010 ($M_c = \text{PLN } 80,000$), and from PLN 20,185 to PLN 121,111 ($M_c = \text{PLN } 80,740$) in 2021. The above confirms that local government gradually increase their involvement in transferring knowledge about varieties to local agriculture.

However, the greatest contribution to extra-budgetary PRVT funds (Table 1) is made by bodies in charge of carrying out the experiments (who employ their own resources for that purpose). They mostly include breeding and seed centers, agricultural consultancy centers, research institutes, tertiary education establishments and other bodies. In some voivodeships, the PRVT program also relies on other co-financing streams, i.e. funds provided by private entities (manure companies, manufacturers of plant protection products, agricultural producers and commune-level local government).

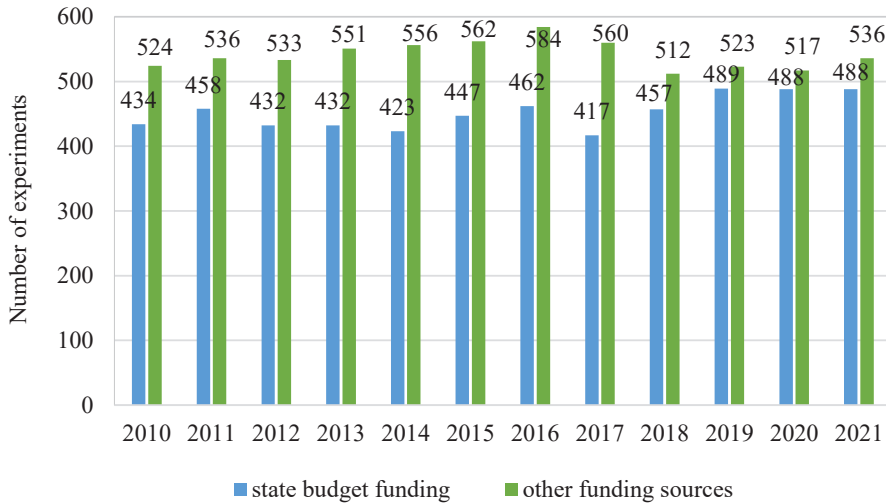


Figure 4. Financing streams for PRVT experiments in 2010-2021

Source: own study based on COBORU [2022c]

In the structure of financing parties for PRVT research and experiments, there is growing share of oilseed (winter rape, soya beans) companies and of the Polish Maize Producers Association. This can be explained by changes in the national cropping mix which demonstrates a growing share of grain maize. As and if possible, the farmers' self-government (in particular the Agricultural Chambers) also contributes to financing the experimenting activities. Even though they do not provide impressive amounts of support (ranging from several to over a dozen thousand zlotys per year), note that it also has a symbolic dimension as an expression of acceptance for, and assistance in, knowledge transfer to agriculture and measures taken to preserve biodiversity. As a consequence, having in mind the financing streams of PRVT research and experiments, the share of experiments financed with extra-budgetary funds becomes noticeably greater than of those relying on budgetary resources (Figure 4).

Due to the introduction of an earmarked subsidy from the state budget, the difference between the number of research projects financed with budgetary funds and that of research projects financed with extra-budgetary resources has decreased over the last three years. The above gives hope for an increased transfer of knowledge that promotes progress and preservation of biodiversity in Polish agriculture.

Also, at a macro level, it can be concluded that the PRVT program provides financial benefits from the proper selection of varieties for cropping. They can turn into significant advantages in the case of cereal production, for instance, which is one of the key Polish

agricultural sub-sectors and is of strategic importance to EU's food economics. Considering the area of land under cereals in Poland (over 2.5 million ha and an average price of PLN 135.8 per 100 kg² in the case of wheat), under the assumption that the sowing of recommended varieties would drive growth in yields, e.g. by 10 kg/ha or 50 kg/ha, the financial benefits would amount to PLN 33.9 million or PLN 169.7 million, respectively. Note that the differences in yields for cereal varieties used in PRVT experiments can even go beyond 500 kg/ha [COBORU 2022c]. In that case, the farmers could derive even greater practical benefits from the right selection of varieties.

CONCLUSIONS

Polish Post-Registration Variety Testing is an original, and Europe's only, system for agricultural experimentation. Building upon collaboration between research and experimentation bodies and statutory partners (including voivodeship-level local government and Agricultural Chambers), it allows not only to deliver recommendations for crop varieties suited to local farming conditions but also to inform of the results and to support their practical uses.

This study found a growing number of research projects and experiments carried out under the PRVT program, on the one hand, but also revealed some considerable differences between country regions in the way their outcomes are used, on the other. Farmers based in the Wielkopolskie and Dolnośląskie voivodeships demonstrate the greatest interest in and make the largest use of PRVT outcomes. In turn, the relatively smallest use of findings from research and experiments was found in the Świętokrzyskie and Lubuskie voivodeships.

The study placed particular focus on financing streams for PRVT research and experiments, including the earmarked subsidy from the state budget introduced in 2019. The authors believe the latter may contribute to the efficiency of transferring knowledge and biological progress to agriculture and, in the long run, may help preserving agricultural biodiversity. The above does not reduce the importance of involvement from and funds provided by external parties, including feed companies or industry associations (rape and maize producers) and primarily agricultural organizations (agricultural chambers and farmers' self-government). Also, external stakeholders are, and should remain, an important driver of development in the PRVT program.

² Average price as of October 14, 2022 [WieściRolnicze.pl 2022].

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ŹRÓDŁA FINANSOWANIA POREJESTROWEGO DOŚWIADCZALNICTWA ODMIANOWEGO: STUDIUM PRZYPADKU Z POLSKI

Słowa kluczowe: porejestrowe doświadczalnictwo odmianowe (PDO), postęp w rolnictwie, źródła finansowania, finansowanie postępu, transfer wiedzy do rolnictwa

ABSTRAKT

W artykule podjęto kwestię działań na rzecz wdrażania postępu w rolnictwie, a w szczególności roli, jaką do odegrania w tym zakresie ma porejestrowe doświadczalnictwo odmianowe. Ocenie poddano strukturę źródeł finansowania porejestrowego doświadczalnictwa odmianowego w Polsce oraz jego zróżnicowanie w czasie i przestrzeni. Materiał źródłowy stanowiły sprawozdania z realizacji programu „Porejestrowego doświadczalnictwa odmianowego (PDO)” z lat 2010-2021. Do analiz przyjęto ceny stałe z 2010 roku. Stwierdzono, że w badanym okresie liczba badań i doświadczeń PDO wzrastała, przyczyniając się do szerzenia postępu biologicznego w rolnictwie, jednak wykorzystanie wyników tych badań było zróżnicowane regionalnie. Wskazano na zmianę struktury finansowania doświadczalnictwa porejestrowego, wskazując na dwa wiodące jego źródła, tj. środki z budżetu państwa oraz środki pochodzące od pomiotów zewnętrznych, w tym prywatnych. Podkreślono znaczenie dotacji celowej z budżetu państwa na działania PDO oraz jej znaczenie, jako stymulatora transferu wiedzy, w tym na rzecz postępu oraz zachowania bioróżnorodności w rolnictwie polskim. W konkluzji wskazano także na znaczenie POD również w kontekście przydatności odmian do produkcji w poszczególnych regionach i przy danych warunkach technologicznych, co wpisuje się m.in. w cele Agendy 2030 na rzecz zrównoważonego rozwoju ONZ, tj. SDG 12 (zapewnienie wzorców zrównoważonej konsumpcji i produkcji) oraz SDG 15 (ochrona, przywracanie oraz promowanie zrównoważonego użytkowanie ekosystemów lądowych, zrównoważone gospodarowanie lasami, zwalczanie pustynnienia, powstrzymanie i odwracanie procesów degradacji gleby oraz powstrzymanie utraty różnorodności biologicznej).

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