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Self-sufficiency in cereal and potato production in Central and Eastern Europe: 2005–2019

Abstract: The article's main objective is to discuss changes in self-sufficiency levels in cereal and potato production in eleven selected Central and Eastern European (CEE) countries belonging to the EU, defined as the ratio of domestic consumption of certain agricultural products to domestic production. The research period covered the years 2005 to 2019. The article focuses on the technical and economic self-sufficiency of the countries analysed. It was found that CEE countries show a significant degree of diversity in terms of self-sufficiency of cereal and potato production. The most successful in these terms were Lithuania and Poland while the least – Slovenia.

Keywords: agricultural development; food security; food self-sufficiency; plant production

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Introduction

The traditional food security concept is to achieve the greatest possible self-sufficiency in food production in a given country. However, in conditions of progressive globalisation, this has been replaced by a strategy based on economic security. This situation applies in particular to highly developed countries whose share in the global market is significant. Therefore, the current globalisation processes may lead countries to abandon their production favouring external supply (Kowalczyk, Sobiecki, 2011). However, some countries, especially underdeveloped ones, emphasise the food supply's internal sources that require maintaining agricultural production at a sufficiently high level (Borch, Kjaernes, 2016; Wilkin, 2001).

The financial and economic crisis of 2006–2009, which triggered a significant increase in food prices, was of great significance for the deepening of hunger in the world. This made food security a key challenge for agriculture in the EU since, according to the estimates of the UN Food and Agriculture Organization, demand for food is going to double by 2050 (Lyon, 2010).

The present-day development of the global economy and that of the EU places great emphasis on maintaining food security. In the EU, food security policy covers a whole chain of actions, which include animal breeding, promoting food hygiene, disseminating food information, preventing food contamination, taking care of plant health and animal welfare, and producing food for consumption.

In Poland, one of the main objectives of the *Strategy for Sustainable Development of Rural Agriculture and Fisheries 2030* is also to ensure food security and is related to enabling farms to be capable of restoring production potential and maintaining non-productive functions (*Strategia zrównoważonego rozwoju wsi…*, 2030).

The primary measure related to food security is food self-sufficiency which has been dealt with by many researchers, among others: F. Kapusta (2011), A. Baer-Nawrocka (2014), J.C. Bureau and J. Swinnen (2018), and S. Kubala (2018). Studying the level of self-sufficiency is extremely important for several reasons. C. Servolin (2005) indicated that sufficient food is the most basic need in all national economies and indicates the degree of agricultural development. This, in turn, implies the need for enterprising management of farms that will be able to restore production potential and maintain essential non-production functions. At the same time, a significant event in the EU's history was the enlargement of its structure to include countries located in the central-eastern part of Europe. This made it possible to open new markets for producers while at the same time increasing the level of competition between individual markets. Therefore, this article's main objective is to examine self-sufficiency levels in cereal and potato production in selected CEE EU countries.

Food security in a theoretical perspective

The concept of food security appeared in the early 1970s in texts on food policy (FAO, 2003). Food security includes food self-sufficiency and its physical and economic availability (Grębowiec, 2012). The changing approach to defining this concept has arisen, among other things, from the variability of food policy at both national and international levels (Mikuła, 2012).

The official definition of 'food security' was first proposed at the 1974 World Food Conference in Rome. According to it, food security is the "availability at all times of adequate, nourishing, diverse, balanced and moderate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (FAO, 2003). In 1996, at the World Food Summit held in Rome, it was agreed that "food security, at the individual, household, national, regional and global levels [...] exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (*Rome Declaration…*, 1996).

In Poland, food security issues have been included in the national security strategy which defines them as "a situation in which all households have real access to the food

needed by all people and are not at risk of losing this access" (*Sektorowa strategia bezpieczeństwa*…, 2008). In 2019 Poland was ranked 24th on the Global Food Security Index with 75.6 points, which is an advance from 26th position in 2018 (75.4 points) (Global Food Security Index, 2020).

Every society should strive for food security in three dimensions: international, state and household (Johnson, 2002; Kapusta, 2012). Considerations here concern the dimension of state food security. According to Kapusta, for state food security to be guaranteed, four conditions must be simultaneously met (Kapusta, 2012):

1. physical availability of food – the national food economy ensures that the minimum physiological demand is covered; the task of imports is to provide food beyond the minimum demand,
2. durability and reliability of food supply,
3. economic availability of food – that the economically weakest households and their members have access to necessary food (thanks to various forms of food aid),
4. health suitability of each food type and the quantity consumed (necessary energy level, proportions of nutrients, no unacceptable impurities).

One of the most critical aspects of food security is the physical availability of food. This comes down mainly to ensuring an adequate supply of this strategic commodity. Hence, it is a series of products necessary to meet a state's inhabitants' minimum physiological needs. Food self-sufficiency in this context is understood as balancing trade in foreign agricultural and food products while covering the demand for basic products on its own (Carletto, Zezza, Banerjee, 2013; Nietupski, Szybiga, 2002).

Food security is dependent on many factors, all of which influence its level. The most frequently mentioned include the level of agricultural development, nature of demographic processes, fluctuations in food and energy markets, technical progress, labour productivity in agriculture, rapid development of biofuels, infrastructure, natural and climatic conditions and occurrences of natural disasters, limited land availability, loss of biodiversity, food waste, changes in consumption patterns, increased global demand for food, political instability, inequality before the law and corruption (Kraciuk, 2013; Kwasek, Obiedzińska, 2013). F. Burchi, J. Fanzo and E. Frison point to three main determinants for food security and food safety, presented in Table 1.

Table 1. Food security and food safety determinants

Food and nutrition security		
food availability	**food access**	**food utility**
– food production – food imports – food aid – storage and processing	– household incomes – food prices – social transfers and loans – functioning of markets – transport/distribution	– quality of nutrition (knowledge, tradition) – housing and sanitary conditions – quality of healthcare – quality of childcare

Source: Burchi, Fanzo, Frison (2011: 358–373)

Food self-sufficiency as a measure of food security

Food self-sufficiency has long been synonymous with food security and used as one of its measures, but its importance in ensuring food security has changed over the years due to changes in individual countries' economic life (Anderson, Strut, 2012; Baer, 2002). The EU's Common Agricultural Policy (CAP) was an EU programme that from the very beginning had social objectives and focused on helping agricultural producers (Tomczak, 2009), and was initially related to ensuring food self-sufficiency for the societies of European countries (Poczta, 2011). Intensification of agricultural production in the EU contributed to achieving this goal (Sadowski, Girzycka, 2012).

In the literature, food self-sufficiency can be understood as:

1. the possibility of covering food needs from national resources alone, with a total elimination of imports,
2. satisfying the food needs of the population from domestic production even with large-scale imports, which should be compensated for by appropriate exports. (The population should be guaranteed basic food products from domestic production, and the missing food and agricultural raw materials should be purchased abroad balancing imports with exports) (Gulbicka, Kwasek, Obiedzińska, 2015)

Food self-sufficiency can also be considered on a global scale. It depends not only on agricultural production and freedom of trade but also on processing and distribution developments. Today, food production in the world is sufficient to feed its population (Bne Saad, 2013). In some regions, however malnutrition is caused by imperfect food distribution and unfavourable political and institutional conditions (Skrzypczyńska, 2011).

Food self-sufficiency can be understood differently in the context of an open or a closed economy. In a 'closed' economy, it is defined as an economy's ability to produce all or most of the food required. It is measured by the relation between the national production of agri-food products and its domestic consumption (Hałasiewicz, 2011). In countries with an 'open' economy, food self-sufficiency can mean the economic and physical availability of food on the internal market, regardless of whether it comes from domestic production or imports. It is most often measured by the balance of trade in agri-food products (Szczepaniak, 2012).

The importance of food self-sufficiency was recognised during the economic crisis in 2006–2007. As a result, a return to a high self-sufficiency policy is to be achieved by equating food consumption with domestic production. Particular attention was paid to the adverse effects of the dependence of a national population's nutrition on importing basic food products, contributing to a reduction in the degree of national food security (Gulbicka, 2009).

Sources and research methodology

Eleven countries from the CEE region were used as a research area: Bulgaria (BG), Croatia (HR), Czechia (CZ), Estonia (EE), Lithuania (LT), Latvia (LV), Poland (PL), Romania (RO), Slovakia (SK), Slovenia (SI) and Hungary (HU). The article considers two agricultural markets, cereal and potato, which are two of the largest production areas of agricultural raw materials of plant origin in the CEE region.

The research used simplified self-sufficiency indicators based on the measures proposed by K. Szybiga (2013) and F. Kapusta (2011) with a focus on technical and economic self-sufficiency. The first one was based on research into the foreign trade balance in terms of volume, calculation of indicators representing the volume of production in terms of the number of inhabitants, and the volume of consumption relative to production volume. Economic self-sufficiency was based on research into the foreign trade balance in terms of value.

The research was conducted in the CEE countries concerned for 2005–2019. Concerning indicators relating to the volume of consumption, it was limited to 2005–2017, due to the lack of statistical material. The statistical sources used come from Eurostat and World International Trade databases.

Results of the research

In the first stage of the research, an evaluation was made of the two agricultural raw materials' production volume as a per capita indicator in the selected CEE countries. The calculated values indicate significant disproportions (Table 2).

The cereal market has a relatively high production per capita volume, with average values for 2005–2019 ranging from 620 kg/person to 1170 kg/person. Smaller volumes are found on the potato market, where the average ranges from 75 kg/person to 138 kg/person.

While making a detailed analysis, it can be noticed that in the case of cereals, the index values are above the average in Hungary, Lithuania (except 2006), Bulgaria (except 2005 and 2007), Latvia (except 2005–2006 and 2008–2011), and Romania (except 2007–2009, 2012 and 2015). In other countries, these values were either higher than the average in individual years only (Croatia, Czechia, Estonia, Poland) or such cases were not recorded at all (Slovakia, Slovenia). There is much greater homogeneity in the potato market. Values higher than the average are reached by four countries every year: Lithuania, Latvia, Poland and Romania (of which since 2009 the highest level has been in Poland). On the other hand, the lowest values can be found in most of the research period in Bulgaria and Slovakia.

By studying changes between 2005 and 2019, various trends can be seen depending on the agricultural market in question. In practically all countries on the cereal market, there is an increase in production volume per capita with the highest values in Latvia, Lithuania and Estonia (increasing by 182.01%, 122.46% and 119.33% respectively). Romania is also characterised by a relatively high growth (increase in the index value by 70.96%). In Czechia and Hungary, however, there are downward trends. There is a fall in production per capita on the potato market in all countries between 2005 and 2019. The most significant decrease is recorded in Latvia and Slovenia (by 60.18% and 56.22% respectively), while the lowest in Romania and Croatia (by 19.97% and 32.97% respectively). The main reason for this was the increasing competitive pressure on countries exporting potatoes from Western Europe and limiting the fodder use of potatoes (Firlej, Kubala, 2018).

Other indicators showing the level of self-sufficiency are those relating to the foreign trade balance. On the cereal market (Table 3), most CEE countries export cereals rather than import, and this is how cereal harvest surpluses are used in the EU. The only

exception is Slovenia which in all the years analysed had a negative trade balance in terms of value and by unit. In Poland, imports exceeded exports in 2006–2008 and 2011. Comparing 2005 and 2019 in terms of value, all the countries improved trade balance, with Estonia and Romania to the greatest extent. In quantitative terms, a deterioration of the foreign trade balance was recorded only in Czechia.

Table 2. Production volume index per capita in individual CEE countries: 2005–2019 (kg/person)

Cereal market											
	BG	**HR**	**CZ**	**EE**	**HU**	**LV**	**LT**	**PL**	**RO**	**SK**	**SI**
2005	760	713	751	559	1606	584	838	705	905	667	289
2006	725	710	625	458	1436	520	565	571	741	545	246
2007	433	592	698	655	959	695	928	712	370	520	265
2008	959	871	809	645	1676	771	1065	726	815	770	288
2009	885	805	751	654	1355	769	1196	782	728	619	262
2010	981	699	657	509	1224	677	890	704	824	477	278
2011	1045	659	790	580	1370	681	1057	691	1032	689	297
2012	981	623	628	748	1044	1039	1550	737	638	562	280
2013	1286	745	714	739	1374	963	1506	735	1044	631	222
2014	1335	699	835	928	1677	1113	1741	825	1107	869	315
2015	1212	657	777	1168	1431	1521	2083	723	973	702	303
2016	1250	829	815	710	1688	1373	1773	772	1101	893	309
2017	1371	645	705	997	1427	1381	1782	825	1382	641	265
2018	1434	796	657	697	1523	1064	1424	692	1616	742	289
2019	1590	864	718	1226	1595	1648	1864	749	1547	761	309
Potato market											
	BG	**HR**	**CZ**	**EE**	**HU**	**LV**	**LT**	**PL**	**RO**	**SK**	**SI**
2005	49	63	99	109	65	293	261	272	175	56	72
2006	51	64	68	77	56	247	138	235	189	49	53
2007	39	69	80	101	56	291	176	309	176	54	65
2008	47	59	74	59	68	307	221	265	177	46	50
2009	31	63	72	67	56	243	206	246	196	40	51
2010	34	42	64	83	49	.	150	215	162	23	49
2011	32	39	77	83	60	119	190	239	202	40	47
2012	21	35	63	77	55	117	181	238	123	31	39
2013	26	38	51	70	49	117	142	187	164	30	30
2014	18	38	66	63	57	105	157	195	176	33	47
2015	23	41	48	61	46	103	134	162	136	27	44
2016	18	46	66	48	44	103	119	227	136	33	41
2017	32	38	65	48	35	107	81	236	159	28	37
2018	37	44	55	44	34	101	103	193	155	31	35
2019	28	43	59	61	34	117	118	171	140	34	32

Source: authors

Table 3. Balance of foreign trade in cereals in individual CEE countries in terms of value and by unit: 2005–2019

Value (million euro)											
	BG	**HR**	**CZ**	**EE**	**HU**	**LV**	**LT**	**PL**	**RO**	**SK**	**SI**
2005	162	–12	188	2	424	34	102	37	50	51	–42
2006	163	17	123	12	593	30	61	–39	102	120	–54
2007	38	42	171	28	1108	49	119	–278	–114	75	–82
2008	377	–19	200	26	1155	123	241	–461	331	4	–64
2009	300	71	276	14	838	116	233	209	378	160	–36
2010	494	61	220	20	1017	135	202	60	643	88	–37
2011	635	28	409	20	1231	72	182	–119	731	145	–67
2012	762	88	436	75	1373	313	435	253	960	172	–29
2013	1129	71	377	64	1165	233	499	511	1669	163	–52
2014	859	40	440	65	1044	233	515	668	1691	199	–55
2015	813	78	477	128	1193	337	547	836	1468	242	–35
2016	969	105	473	91	1016	279	549	729	1506	273	–32
2017	813	97	465	131	1359	281	565	490	1551	255	–30
2018	973	118	337	85	1003	160	337	419	1836	182	–32
2019	1293	136	290	177	1192	374	635	414	2190	184	–24
By unit (thousand tonnes)											
	BG	**HR**	**CZ**	**EE**	**HU**	**LV**	**LT**	**PL**	**RO**	**SK**	**SI**
2005	1852	–64	2086	43	3991	345	973	972	712	471	–330
2006	1725	178	1432	124	4931	258	565	135	1066	1225	–394
2007	368	274	1085	109	6870	268	531	–1600	–693	.	–401
2008	2266	51	1202	168	5837	650	1277	–1853	2120	.	–297
2009	2657	645	2449	154	6092	767	1687	1916	3053	806	–230
2010	3320	413	1713	141	6171	814	1207	795	4078	387	–196
2011	3322	168	2233	99	5177	345	824	–190	3477	400	–283
2012	3524	463	2308	315	5723	1350	1650	1359	3930	762	–126
2013	6187	447	2027	330	4858	1054	2213	2932	7959	884	–221
2014	5154	313	2797	398	4833	1233	2722	4154	8816	1202	–236
2015	4817	631	3158	758	6574	2010	2960	5000	7617	1475	–138
2016	6245	787	3568	602	.	1751	3328	4934	8515	1826	–135
2017	5108	743	3318	807	.	1614	3184	3289	8880	1707	–154
2018	5840	834	2253	424	.	780	1756	2738	10485	1046	–151
2019	7696	1103	1846	998	.	2089	3246	2847	.	1109	–72

Source: authors

In the EU, the leading exporters of potatoes are those in the North-Western Europe region (Firlej, Kubala, 2018). This is mainly due to its characteristics, as figures for crops harvested are relatively stable due to an increase in the volume of potato production despite the declining area of cultivation. In turn, these surpluses are mainly exported to CEE countries' markets, and therefore must have a negative balance in foreign trade. In value terms, the only countries with a surplus of exports over imports were Estonia (in 2010–2011), Latvia (2010) and Lithuania (2010–2015 and 2018). Specifically, such

a situation occurred in Czechia (2007), Estonia (2011 and 2013), Latvia (2010), Lithuania (2010–2019) and Slovakia (2006–2007). When analysing foreign trade balances between 2005 and 2019, a downward trend is observed in terms of value and by unit. In the first, the trade balance improved only in Lithuania, whereas in the remaining countries it deteriorated, with Czechia and Hungary experiencing the most significant deterioration (by 5670% and 738.46% respectively). On the other hand, the situation improved in Croatia, Estonia and Lithuania.

Table 4. Foreign trade balance for potatoes in individual CEE countries in terms of value and by unit: 2005–2019

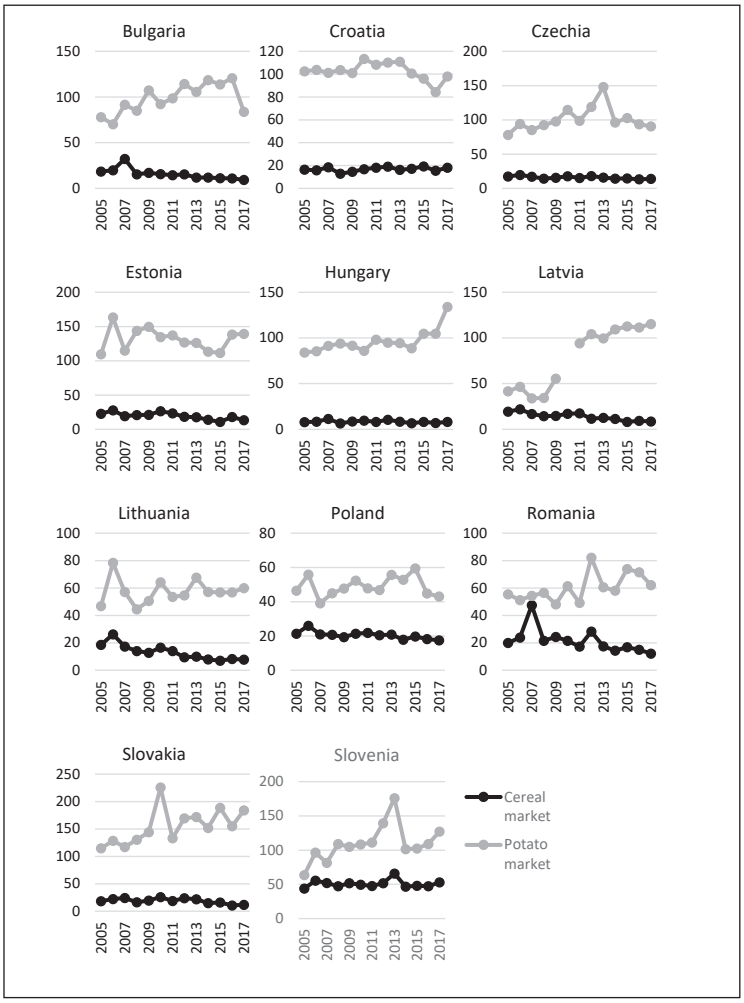
Value (million euro)											
	BG	**HR**	**CZ**	**EE**	**HU**	**LV**	**LT**	**PL**	**RO**	**SK**	**SI**
2005	–3	–7	–1	–1	–3	–1	–3	–20	–9	–5	–4
2006	–3	–11	–12	–1	–6	–1	–6	–28	–16	–11	–9
2007	–5	–10	–22	–1	–10	–2	–8	–58	–11	–15	–11
2008	–4	–10	–9	–1	–5	–1	–5	–25	–13	–7	–9
2009	–3	–7	–10	–1	–5	–2	–2	–25	–9	–9	–8
2010	–4	–9	–18	0	–9	0	1	–41	–10	–19	–7
2011	–5	–10	–29	0	–12	–2	1	–59	–21	–28	–8
2012	–4	–8	–5	–1	–4	–1	0	–24	–15	–12	–6
2013	–7	–14	–31	0	–7	–1	5	–32	–17	–22	–12
2014	–6	–9	–25	–1	–7	–2	2	–37	–18	–20	–9
2015	–6	–11	–21	–1	–7	–2	0	–25	–15	–17	–6
2016	–7	–12	–34	–1	–14	–3	0	–37	–32	–26	–8
2017	–9	–7	–28	–2	–16	–3	0	–23	–26	–21	–12
2018	–8	–11	–28	–2	–21	–3	1	–32	–27	–21	–12
2019	–13	–14	–58	–1	–22	–4	–2	–82	–64	–30	–11
By unit (thousand tonnes)											
	BG	**HR**	**CZ**	**EE**	**HU**	**LV**	**LT**	**PL**	**RO**	**SK**	**SI**
2005	–29	–25	–6	–10	–13	–3	–16	–75	–95	–54	–11
2006	–14	–36	–22	–3	–21	–3	–24	–99	–140	12	–24
2007	–26	–26	29	–3	–28	–6	–28	–157	–39	373	–23
2008	–17	–22	–41	–2	–21	–3	–15	–48	–45	–24	–21
2009	–22	–15	–66	–7	–23	–10	–9	–98	–46	–45	–22
2010	–18	–25	–104	0	–33	1	4	–199	–44	–82	–16
2011	–15	–17	–115	2	–33	–7	4	–166	–78	–70	–17
2012	–24	–16	–56	–1	–20	–6	3	–73	–155	–35	–17
2013	–35	–27	–122	1	–17	–1	26	–61	–125	–56	–28
2014	–31	–13	–171	–2	–27	–7	6	–150	–109	–58	–22
2015	–37	–21	–181	–1	–33	–8	6	–125	–106	–61	–17
2016	–33	–26	–167	–2	.	–12	7	–111	–162	–57	–21
2017	–47	–14	–163	–7	.	–13	6	–73	–116	–54	–31
2018	–39	–23	–166	–7	.	–11	9	–111	–136	–56	–20
2019	–39	–19	–200	–4	.	–10	8	–246	.	–57	–21

Source: authors

Differentiation in the consumption of particular agricultural products in relation to production for 2005–2017 is presented in Figure 1. In the production of cereals, only one third is intended for human consumption with the remaining used as animal feed. There is a chance to produce enough (not including beer) from domestic production in all the countries on this market.

Those with a surplus of potatoes every year were Poland, Lithuania and Romania. Until 2014 this was found in Hungary too, until 2013 (except 2010 and 2012) in Latvia, and until 2007 in Slovenia. After 2015 desirable indicator values (below 100) were found in Croatia; after 2016 in Czechia and 2017 in Bulgaria. In Estonia and Slovakia, annual values are above 100, which indicates that these countries did not meet local needs by domestic production. Since 2008, this situation has been found in Slovenia as well.

Figure 1. Consumption volume index per production volume in individual CEE countries: 2005–2017 (kg/kg)



Source: authors

Conlusions

Observing the changes taking place in the cereal and potato markets is extremely important due to the need to create or modify concepts that can significantly affect farm businesses' growth. Research on self-sufficiency has allowed the following conclusions to be drawn:

- CEE countries show a significant degree of diversity in terms of self-sufficiency in cereals and potatoes;
- on the cereal market, a secure food situation is found in practically all CEE countries covered by the analysis, except Slovenia which has a negative trade balance as well as the lowest production volume index value per capita;
- the most secure potato situation is found in such countries as Lithuania, Poland and Romania. These countries can satisfy demand with their production. A high level of self-sufficiency is also present in Latvia. A characteristic feature of the potato market is a decrease in the volume of production per capita, mainly due to increased competition with potato producers from Western Europe;
- taking both cereal and potato markets into account, Lithuania and Poland are the most successful in self-sufficiency. A relatively secure situation is found in Latvia and Romania. There is a great natural and economic potential in these countries that may increase competitiveness in individual agricultural markets. The opposite situation is found in Slovenia.

It should be remembered that despite the good position of Poland and other EU countries, food security and food self-sufficiency must be continuously checked and analysed appropriately. Governments should take appropriate action to prevent undesirable events, and the Common Agricultural Policy should remain the basis of the EU's food security policy. It is recommended that agricultural expenditure be maintained at a stable level, giving farmers a fair income and ensuring producers are protected from price volatility. It is also becoming essential to prevent food waste in the entire agri-food chain in the EU.

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