

GMOs IN THE POLISH FRUIT AND VEGETABLES CONSUMER AWARENESS

Lilianna Jabłońska, Stanisław Żuchowski, Dawid Olewnicki

Szkoła Główna Gospodarstwa Wiejskiego w Warszawie

Abstract. The use of GMOs brings numerous benefits at the same time raising fears of threats to human health and the environment. The aim of this study is to present the way GMOs are perceived by fruit and vegetables consumers, their attitude to genetic manipulations and knowledge of the presence of GMOs on the Polish food market. A survey conducted among 200 people served to accomplish this aim. The research shows that the majority of the respondents see GM foods as hazardous to health and they refuse to buy transgenic fruit and vegetables. At the same time 80% of them do not have sufficient knowledge about GMOs, their cultivation and presence on the market as GM food. This also refers to a group of people with a university degree. As many as 1/3 of the surveyed do not know whether GMOs are present on the Polish market, and only 9% indicated GMOs share of over 60% of the market, while nearly 70% of the respondents pointed to the presence of transgenic fruit and vegetables, listing a number of their species. This shows the need for widespread education and dissemination activities.

Key words: GMO, fruit, vegetables, consumer

INTRODUCTION

Genetically Modified Organisms (GMOs), also referred to as transgenic organisms, are the result of modifications in the gene resources carried out with genetic engineering techniques (Lemanowicz, 2012). They replace traditional breeding methods, which also consist of reorganization of genetic package of a given

organism (Malepszy, 2009a), but are time-consuming, very expensive and not always effective (Malepszy, 2009b; Niemirowicz-Szczyt et al., 2012). Genetically modified food is food produced on the basis of genetically modified organisms or food containing components derived from GMOs, this is (Jeżewska-Zychowicz and Babicz-Zielińska, 2009). These are products that are GMOs and which can be directly consumed (e.g. fruit and vegetables), products containing the processed GMOs (e.g. tomato puree made of genetically modified tomatoes), food produced with the use of GMOs (e.g. meat from animals fed with nourish containing transgenic soya beans), and GMOs derivatives, which do not contain unprocessed components of modified organisms (e.g. oils from rapeseed having the herbicide resistance gene) (Mielcarz, 2007; Kondratowicz et al., 2009).

The origins of GMOs date back to the second half of the twentieth century, and the first recorded, transgenic organism allowed to grow, was a tomato “Flavr Savr” with a prolonged post-harvest durability (USA 1994), but after some time it was withdrawn from the market (Lisowska, 2011; Niemirowicz-Szczyt et al., 2012). The whole set of new transgenic plants has been produced since that time and their crop acreage increased from 43 million hectares in 2000 (Maciejczak, 2010) to 148 million hectares in 2010 (James, 2010). Currently, this acreage is estimated to 200 million hectares, and the USA, Brazil, Argentina, India and Canada are the largest producers, while in Europe Spain makes 80% of the whole EU area (James, 2010). In the group of

✉ prof. dr hab. Lilianna Jabłońska, Samodzielna Pracownia Organizacji i Ekonomiki Ogrodnictwa, Szkoła Główna Gospodarstwa Wiejskiego, ul. Nowoursynowska 159, 02-776 Warszawa, Poland, e-mail: lilianna_jablonska@sggw.pl

genetically modified plants the most important are: soybeans (~50%), corn (~31%), cotton (~14%) and rape (~5%). Less common are some types of genetically modified peppers, tomatoes, pumpkin, potatoes, sugar beet, papaya, alfalfa and poplar (Niemirowicz-Szczyt et al., 2012). Currently, at least a fractional supplement consisting of GMOs is present in the vast majority of food products. A few or even several thousands of products in the world, including Poland, contain transgenic soybeans “Roundup Ready” or its derivatives. This variety has not been banned on the EU market turnover. It is estimated that more than 60% of the processed food contains components of transgenic origin (Lubiatowska-Krysiak and Twardowski, 2008).

Plants genetic modifications can bring a wide range of benefits, including fertility intensification, increase of vulnerability to adverse climatic conditions, resistance to substances contained in plant pesticides, resistance to pests, mechanical damage and physiological diseases (Berger and Filimonow, 2004). Meanwhile there is still some criticism over GMOs, highlighting possible risks associated with their application, for example difficult to predict complications linked to the transfer of modified genes in the consumed food, causing allergies, gastrointestinal diseases, and even cancer, or their negative influence on the environment (Kosicka-Gębska and Gębski, 2009). However, there is no scientifically confirmed evidence of GMO’s harmful impact on human organism or the environment (Malepszy and Światoński, 2012), and the existing controversies are the result of consumers ignorance of how transgenic food affects human (Pyryt et al., 2008). The low level of consumer’s knowledge about biotechnology and GM food, as well as the impact of knowledge on awareness and attitude towards GM foods have been shown in studies conducted in different countries (Boccaletti and Moro, 2000; Baker and Burnham, 2001; McCluskey et al., 2003; Kimenju et al., 2005; Bukenya and Wright, 2007), however, US and Asian consumers are more accepting of GM than European with significant minorities in most countries having concerns (Chern et al., 2003; Hoban, 2004; Huang et al., 2006; Colson and Rousu, 2013). In Poland, the empirical studies of consumer attitudes towards GM foods were carried out to a small extent, and in relation to GM fruit and vegetables are not encountered. The aim of this study is to present the way GMOs are perceived by fruit and vegetables Polish consumers, their attitude to genetic manipulation and knowledge of

the presence of GMOs on the Polish food market. Test results will indicate whether and to what extent dissemination activities should be undertaken so that the society could consciously join the debate about GMOs.

METHODOLOGY

The study investigated the consumers approach to genetically modified fruit and vegetables, analysing consumers’ opinion on GMOs safety to human health, the level of concern prior to the acquisition of a transgenic product while shopping, as well as clients’ readiness to purchase such products being aware they are GMOs. As the attitude to GMOs comes from common knowledge, we examined the consumers’ opinion about the presence of GM foods and transgenic fruit and vegetables on the Polish market, as well as their knowledge of the types of the latter in trade. The knowledge of possibilities of GM crops cultivation in Poland and on species whose transgenic varieties are most commonly grown in the world, were analysed. In addition, we examined the level of self-evaluation of consumers’ knowledge on GMOs, as well as the sources of this knowledge. All of these issues were analysed in relation to age, gender and education, applying simple mathematical-statistical methods. Percentage rates were used, and in addition, after the initial analysis, the correlative convergence was identified, expressed with two contingency coefficients of correlation: the Yule’s ϕ and C Pearson, at significance level $\alpha = 0.05$. Due to the small number of respondents with vocational education, this group was omitted in statistical analyses.

In the analysis we took the advantage of a survey results conducted at the end of 2014, through direct interviews (2/3 of the population) and via website www.eBadania.pl (1/3 of the population). Sampling was casual, so it is not fully representative, but the test results may be useful for further in-depth research on the subject. 200 out of 213 completed questionnaires were included in the analyses after the preliminary verification. The respondents came from different parts of Poland and lived in both rural (27%) and urban areas with a population of less than 50 thousand (32%), 50–200 thousand (15%) and more than 200 thousand (26%) (Table 1). Among them, 61% were women and 39% men. It was an age-diverse population, with the largest share of people aged 18–30 (39%) and the smallest of those over 60 (16%). As regards education, the group

Table 1. Characteristics of the investigated population (%)
Tabela 1. Charakterystyka badanej populacji (%)

Specification Wyszczególnienie		Odsetek Percentage (%)	Specification Wyszczególnienie		Odsetek Percentage (%)
Total – Ogółem		100	Education level Wykształcenie	vocational – zawodowe	11
Sex – Płeć	woman – kobieta	61		secondary – średnie	40
	man – mężczyzna	39		higher – wyższe	49
Age (years) Wiek (lata)	18–30	39		Place of residence Miejsce zamieszkania	country – wieś
	31–45	21		<50 000	32
	46–60	24		50–200 000	15
	>60	16		>200 000	26

Source: own elaboration.
 Źródło: opracowanie własne.

of respondents was also varied, involving graduates of vocational schooling, 11% (including 1 primary school graduate) and the secondary and university levels of 40% and 49% respectively. All surveyed were fruit and vegetables consumers, with up to 44% of the respondents for whom these products were very important in their daily diet, with 24% who recognized them quite important and 23% as important, and only 9% of those who gave a little importance to these products. A relatively larger group of consumers constituted women and people over 46, since more than 50% of them recognized the role of these products as very important.

RESEARCH RESULTS. TRANSGENIC FRUIT AND VEGETABLES VERSUS CONSUMER'S HEALTH AND SAFETY

According to as many as 79% of the respondents, genetically modified plants are dangerous to human health (Table 2). This opinion was given by more women than men (84% and 74%), as well as more younger people (91% of those aged 18–30 and 82% of 31–45-year-old respondents) than older (68% and 76% aged 46–60 and over 60 respectively). Men and the elderly are slightly more likely to consider GMOs to be safe, yet much more often than women and younger people they admit that they have no knowledge in this subject. These concerns are confirmed by the answer to the question of whether respondents would buy fruit

and vegetables being aware they are genetically modified. As many as 75% of respondents, including 78% of women and 72% of men, would not purchase such products. There is no relation to gender visible here, which was confirmed by the Yule's ϕ and C Pearson coefficients of only 0.06. Nevertheless, the part of people declaring their unwillingness to purchase genetically modified fruit and vegetables increases with age, but selected contingency factors which are below 0.40 (Yule's ϕ – 0.20, C Pearson – 0.31) indicate a weak relationship between these characteristics. At the same time 15–20% of older people have no opinion as for GMOs harmfulness to health, which is suggested by increased caution over the subject in this age group. Given the education, it is clear that the higher its level, the greater the percentage of respondents recognizing GM plants as safe for health, though it is generally not high. It is believed so by as many as 15% of people with higher education, with 6% of secondary and no graduate of a vocational school. 85% of the latter, and 77–78% of secondary and higher educated respondents consider these products far too dangerous. At the same time, only 7% of those with a university degree have no opinion in this respect, and as regards secondary and vocational school graduates, lack of opinion is expressed by 17% and 15% respectively. In this case, similarly to gender, Yule's ϕ and C Pearson coefficients equalled 0.19 and they demonstrated poor relation. The increase in opinion on the harmlessness of the GMOs

Table 2. GMOs and health security in the consumers opinion (%)
Tabela 2. GMO a bezpieczeństwo zdrowia w ocenie konsumentów (%)

	%									
	Total Ogółem	Sex – Płeć		Age – Wiek				Education – Wykształcenie		
		F	M	18–30	31–45	46–60	>60	V	S	H
Are GM plants dangerous to human health Czy rośliny GM są niebezpieczne dla zdrowia człowieka										
Yes – Tak	79	83	74	91	82	68	76	85	77	78
No – Nie	9	7	11	6	7	12	9	–	6	15
I don't know Nie wiem	12	10	15	3	11	20	15	15	17	7
Does the buyer of fruit and vegetables fear that they are genetically modified Czy kupujący owoce i warzywa obawia się, że są modyfikowane genetycznie										
No – Nie	11	9	14	24	14	9	3	1	12	13
Very rarely Bardzo rzadko	13	11	16	27	18	2	14	6	8	17
Rarely – Rzadko	15	15	15	28	7	5	10	12	10	19
Often – Często	32	34	28	17	29	48	28	45	35	27
Very often Bardzo często	29	31	27	4	32	36	45	36	35	24
Would you buy fruit and vegetables knowing they are genetically modified Czy kupiłby owoce i warzywa, wiedząc, że są modyfikowane genetycznie										
Yes – Tak	25	22	28	40	26	20	14	9	18	35
No – Nie	75	78	72	60	74	80	86	91	82	65

Note: V – vocational, S – secondary, H – higher; F – Female, M – Male. Source: own elaboration.

Uwagi: V – podstawowe, S – średnie, H – wyższe; F – kobieta, M – mężczyzna. Źródło: opracowanie własne.

along with the level of education results in increase in willingness to buy genetically modified fruit and vegetables. While only 9% of those ready to buy these products belong to people with the lowest level of education, graduates of secondary schools make 18% and those with a university degree 35%. However, the dependence of the two variables is little (Yule's ϕ and C Pearson = 0.19). Along with the increase of the level of education, the share of people who are afraid that purchased fruit and vegetables are genetically modified, decreases as well. Those who never or rarely have such concerns make 1% and 6% respectively of the group with the lowest educational level, 12% and 8% these are respondents with secondary, while 13% and 17% with a university degree. Meanwhile such

concerns are raised very often by 36%, 35% and 24% of these respondents respectively.

PRESENCE OF GM FRUIT AND VEGETABLES ON THE MARKET ACCORDING TO THE CONSUMERS

Only according to half of the respondents (51%) food on the Polish market contains GMOs (Table 3). Whereas 32% have no knowledge on this subject, and as many as 17% believe that food is free from GMOs. A similar relation was observed regardless of gender and age. However, women were a little more likely to indicate the presence of GMOs, and men claimed lack of knowledge in this respect. Lack of knowledge to the greatest extent

Table 3. Presence of GMOs on the Polish market in the consumers' opinion (%)
Tabela 3. Obecność GMO na polskim rynku w opinii konsumentów (%)

	%									
	Total Ogółem	Sex – Płeć		Age – Wiek				Education – Wykształcenie		
		F	M	18–30	31–45	46–60	>60	V	S	H
Does the food present on the Polish market contain GMOs? Czy żywność na polskim rynku zawiera GMO?										
Yes – Tak	51	53	49	53	48	52	50	43	54	50
>60%	9	10	9	8	7	12	10	13	8	10
50%	17	18	15	19	18	15	16	22	19	24
<40%	25	25	25	26	25	25	24	8	27	23
No – No	17	16	17	19	14	15	19	13	11	23
I don't know Nie wiem	32	31	34	28	38	33	31	44	35	27
Are genetically modified fruit and vegetables present on the Polish market? Czy na polskim rynku są owoce i warzywa modyfikowane genetycznie?										
Yes – Tak	68	72	63	69	67	74	66	61	68	71
No – No	10	7	13	9	13	8	10	10	11	9
I don't know Nie wiem	22	21	24	22	20	18	24	29	21	20
Is the cultivation of genetically modified food allowed in Poland? Czy dozwolona jest w Polsce uprawa roślin modyfikowanych genetycznie?										
Yes – Tak	54	56	52	51	55	57	53	68	57	45
No – Nie	46	44	48	49	45	43	47	32	43	55

Note: V – vocational, S – secondary, H – higher; F – Female, M – Male. Source: own elaboration.

Uwagi: V – podstawowe, S – średnie, H – wyższe; F – kobieta, M – mężczyzna. Źródło: opracowanie własne.

was declared by those with the lowest level of education (44%), but at the same time the relatively smallest percentage of those convinced of the presence of GMOs (43%) is found in this group. The share of respondents with no knowledge clearly decreases along with the level of education (35% – secondary and 27% – university degree), whereby if the percentage of those identifying the presence of GMOs in food among respondents with secondary and higher education is similar (54% and 50%), twice as much of the latter were convinced about GMO-free food (11% and 23%).

Among those convinced of the presence of GMOs on the Polish market, most claimed that these products make a minority. This group represents 25% of

all respondents and there was no differentiation here according to gender or age. The least educated people make an exception here as such opinion was given by only 8% of them (Table 3). 17% of respondents identified GMOs in half of all foods, more women (18%) and people over 45 (19 and 18%), as well as those with the lowest and highest education (22% and 24% respectively). Only 9% of respondents share an opinion that most of the products on the market (over 60%) these are transgenic foods. More of elderly people and graduates of the vocational and higher education believe so.

When it comes to genetically modified fruit and vegetables, the percentage of consumers convinced of these

products presence on the Polish market is larger than in relation to the total number of products and equals to 68% (Table 3). According to barely 10% of respondents these products are not present at all, and 22% have no knowledge in this respect. Women are more convinced about the existence of GM fruit and vegetables (72%), while relatively more men do not have any opinion on this subject (24%). At the same time the share of people indicating the presence of GM fruit and vegetables increases along with the level of education (61%, 68%, 71%), while the percentage of those who declare lack of knowledge decreases. Such confidence in the presence of GM fruit and vegetables on the Polish market takes place due to the lack of knowledge about genetic modifications made in this group of plants. Although, as has

already been specified, global production of transgenic types of tomatoes, peppers and pumpkin is recorded in reference publications, respondents claim that apart from tomatoes, indicated by 61%, on the Polish market there are also transgenic strawberries, cucumbers, lettuce, apples, grapes and bananas mentioned by 42%, 27%, 22%, 22% and 21%, respectively, as well as carrots (15%), cabbages (13%), celeries (6%), raspberries (4%) and plums (3%). It should be emphasized that most of these species come almost entirely from domestic production, and in accordance with the Regulation of the Council of Ministers of 2013 (www.piorin.gov.pl), GM plants cultivation in Poland is not allowed. But according to the research, as many as 54% of respondents do not know these regulations, and the share of these

Table 4. Level of one's knowledge on GMOs and its sources according to the consumers
Tabela 4. Poziom własnej wiedzy o GMO i jej źródłach w opinii konsumentów

	%									
	Total Ogółem	Sex – Płeć		Age – Wiek				Education Wykształcenie		
		F	M	18–30	31–45	46–60	>60	V	S	H
Self-assessment of knowledge about GMOs Ocena własnej wiedzy o GMO										
Very high Bardzo duża	1	1	–	–	1	–	–	–	–	1
High – Duża	19	24	12	22	18	19	16	9	13	28
Low – Mała	50	49	50	46	52	50	59	56	48	50
Very low Bardzo mała	20	18	26	21	22	19	17	18	29	12
No knowledge Brak wiedzy	10	8	12	11	6	12	8	17	10	9
Sources of knowledge Źródła wiedzy										
School – Szkoła	32	48	9	63	14	15	6	14	18	55
Media – Media	33	34	39	13	43	50	48	49	39	14
Literature Literatura	6	2	9	5	5	6	6	5	7	5
Internet	22	12	24	19	38	21	21	23	25	20
Other people Inne osoby	7	4	19	–	–	8	19	9	11	6

Note: V – vocational, S – secondary, H – higher; F – Female, M – Male. Source: own elaboration.

Uwagi: V – podstawowe, S – średnie, H – wyższe; F – kobieta, M – mężczyzna. Źródło: opracowanie własne.

people increases proportionally to the decrease of the level of education (from 45% through 57% to 68%), though the strength of the relation at this point is low (both coefficients equal 0.15) and independent of gender and age. According to these people, the cultivation of transgenic plants is possible in Poland. There is also little knowledge about the extent of cultivation of transgenic plants in the world. Corn is given the first place, mentioned by 70% of respondents, then there is a tomato to follow as the second one (36%), and only the third place is taken by soybeans indicated by 35% of people, and rape is given the sixth position (10%). No person suggested cotton.

The presented results indicate a lack of sufficient consumer awareness of GM plants, their cultivation and their presence on the market as GM foods. One positive aspect is that the respondents themselves are aware of this fact. According to 50% of them, their knowledge is little, very little in the opinion of 20% and 10% of people do not have any knowledge in this respect (Table 4). Only 19% rated their knowledge as high, and 1% as very high. Women declare bigger awareness, 24% of whom estimate it to be high, while such level of knowledge is declared by 12% of men, among whom very high is declared by 1%. On the other hand, 26% of men assess their knowledge as little and 12% declare no knowledge of this issue. It is interesting that the level of knowledge does not depend on the level of education, although high knowledge is recognised by only 9% of respondents with vocational education, 13% of secondary and 28% of those with a university degree. On the other hand, lack of knowledge was declared by respectively 17%, 10% and 9% of respondents. This deficiency of correlation is confirmed with Yule's ϕ and C Pearson coefficients, which amount to only 0.04.

The main sources of knowledge are: school (32% of respondents), traditional media (33%) and Internet (22%), whereas the importance of each of them slightly varies depending on gender, age and education. Among women and the youngest people, relatively greater significance is given to school (48% and 63% respectively), among men to the Internet (24%) and in the group of oldest – other people are considered an important source of information (19%). The significance of school clearly increases along with the level of education (14%, 18% and 55%) while the importance of the media decreases (49%, 39% and 14%).

CONCLUSIONS

The study shows that Polish consumer attitudes towards GM foods and the level of knowledge on these products are similar to those in other countries. The majority of respondents considers GM foods to be hazardous to health and would not purchase transgenic fruit and vegetables, yet buying them today only half of the surveyed fears these are GMOs. This negative attitude slightly more refers to women, elderly and less educated people. It is interesting that 35% of people with a university degree would purchase GM fruit and vegetables, although only 15% consider GMOs safe for health. Only half of those surveyed are convinced that food on the Polish market contains GMOs, and merely 9% pointed out GMOs share to over 60% of this market. Almost 70% of people are convinced of the transgenic fruit and vegetables presence on the market, pointing to a whole range of species, and the proportion of these respondents increases along with the level of education. The presented results depict a lack of sufficient consumer awareness of GM plants, their cultivation and their presence on the market as GM foods, which is admitted by 80% of respondents. In the group of upper educated as well. This shows the need for wider activities in presenting more knowledge of GMO to consumers, ranging from school education through dissemination by traditional media and increasingly widespread Internet. They should be addressed to all social groups regardless of gender, age or education, because these variables, in accordance to the percentages confirmed with the contingency factors, do not affect Polish consumers attitude to GMOs in food market, including the market for fruit and vegetables.

REFERENCES

- Baker, G. A., Burnham, T. A. (2001). Consumer response to genetically modified foods: market segment analysis and implications for producers and policy makers. *J. Agric. Res. Econ.*, 26(2), 387–403. Retrieved July 15th 2014 from: <http://www.jstor.org/>.
- Bukenya, J. O., Wright, N. R. (2007). Determinants of consumer attitudes and purchase intentions with regard to genetically modified tomatoes. *Agribusiness*, 23(1), 117–130. Retrieved July 15th 2014 from: <http://agritech-fore-sight.atrri.org.tw/archive/>.
- Boccaletti, S., Moro, D. (2000). Consumer willingness-to-pay for GM food products in Italy. *AgBioForum* 3(4),

- 259–267. Retrieved July 15th 2014 from: <https://mospace.umsystem.edu/>.
- Berger, S., Filimonow, J. (2004). GMO Żywność transgeniczna. *Bezp. Hig. Żywn.*, 2(13), 40–43.
- Chern, W. S., Rickertsen, K., Tsuboi, N., Fu, T. T. (2002). Consumer acceptance and willingness to pay for genetically modified vegetable oil and salmon: a multiple-country assessment. *J. Agrobiotech. Manag. Econ.*, 5(3). Retrieved July 15th 2014 from: <http://agbioforum.org/v5n3/v5n3a05-chern>.
- Colson, G., Rousu, M. C. (2013). What do consumer surveys and experiments reveal and conceal about consumer preferences for genetically modified foods? *GM Crops and Food. Biotech. Agric. Food Chain*, 4 (3), 158–165. Retrieved June 9th 2015 from: <http://www.tandfonline.com/doi/full/10.4161/gmcr.26322>.
- Hoban, T. J. (2004). Public attitudes towards agricultural biotechnology. The Food and Agriculture Organization of the United Nations. Retrieved May 11th 2014 from: <http://ageconsearch.umn.edu/bitstream/23810/1/wp040009.pdf>.
- Huang, J., Qiu, H., Bai, J., Pray, C. (2006). Awareness, acceptance of and willingness to buy genetically modified foods in Urban China. *Appetite*, 46(2), 144–151. Retrieved July 18th 2014 from: <http://www.sciencedirect.com/>.
- James, C. (2010). Global status of commercialized Biotech/GM Crops: 2010. ISAAA Brief No. 42, ISAAA: Ithaca, NY. Retrieved January 7th 2015 from: <http://www.isaaa.org/resources/publications/briefs/42/download/isaaa-brief-42-2010>.
- Jeżewska-Zychowicz, M., Babicz-Zielińska, E. (2009). Konsument na rynku nowej żywności. Wybrane uwarunkowania spożycia (s. 110–136). Warszawa: Wyd. SGGW.
- Kimenju, C., De Groote, H., Karugia, J., Mbogoh, S., Poland, D. (2005). Consumer awareness and attitudes toward GM foods in Kenya. *Afr. J. Biotech.*, 4(10), 1066–1075. Retrieved April 20th 2014 from: www.ajol.info/index.php/ajb/article/view/71325/60278.
- Kondratowicz, J., Burczyk, E., Dąbrówka, P. (2009). Żywność genetycznie modyfikowana – szanse i zagrożenia dla konsumentów. *Chłodnictwo*, 9, 52–54.
- Kosicka-Gębska, M., Gębski, J. (2009). Oczekiwania i obawy związane z wprowadzeniem do obrotu produktów i żywności pochodzących z modyfikacji genetycznych. *Zesz. Nauk. SGGW Ser. Probl. Roln. Świat.*, 9(24), 65–67.
- Lemanowicz, M. (2012). Żywność genetycznie modyfikowana – innowacyjna szansa czy zagrożenie dla współczesnego konsumenta. *Rocz. Nauk. SERiA*, 145(2), 128–132.
- Lisowska, K. (2011). Genetycznie modyfikowane uprawy i żywność – za i przeciw. *Chemik*, 65, 1193–1203. Retrieved January 15th from: <http://gmo.net.pl/doktor-katarzyna-lisowska-genetycznie-modyfikowane-uprawy-i-zywnosc-za-i-przeciw>.
- Lubiatońska-Krysiak, E., Twardowski, T. (2008). Agrobiotechnologia i przemysł rolno-spożywczy: perspektywy i ograniczenia w świetle opinii publicznej. *Biotechnologia*, 4, 1–66.
- Maciejczak, M. (2010). Modyfikacje genetyczne w rolnictwie w świetle nowej ekonomii instytucjonalnej. *Rocz. Nauk. SERiA*, 12(1), 110–115.
- Malepszy, S. (Ed.). (2009a). *Biotechnologia roślin* (wyd. 2). Warszawa: Wyd. Nauk. PWN.
- Malepszy, S. (2009b). Wywiad nt. GMO. Komitet Biotechnologii Polskiej Akademii Nauk. Retrieved January 7th 2015 from: <http://www.kbiotech.pan.pl/PL/uwagi-i-opinie/88-wywiad-gmo>.
- Malepszy, S., Świtoński, M. (2012). Postęp biologiczny w rolnictwie w erze genomiki i modyfikacji genetycznych. *Nauka*, 1, 25–35.
- McCluskey, J. J., Grimsrud, K. M., Ouchi, H., Wahl, T. I. (2003). Consumer response to genetically modified food products in Japan. *Agric. Res. Econ. Rev.*, 32/2, 222–231. Retrieved May 11th 2014 from: <http://ageconsearch.umn.edu/bitstream/31631/1/32020222.pdf>.
- Mielcarz, M. (2007). Szansa czy zagrożenie? Żywność modyfikowana genetycznie. *Cukier. Piekarn.*, 9, 60–62.
- Niemirowicz-Szczyt, K. (red.). (2012). *GMO w świetle najnowszych badań*. Wyd. SGGW: Warszawa.
- Pyryt, B., Kolenda, H., Dziekońska, A. (2008) Akceptacja konsumencka żywności modyfikowanej genetycznie. *Bromat. Chemia Toksykol.*, 3, 234–237.
- Rozporządzenie – nasiennictwo (n.d). Retrieved July 15th 2015 from: www.piorin.gov.pl/prawo/rozporzadzenia/nasiennictwo.

GMO W ŚWIADOMOŚCI POLSKIEGO KONSUMENTA OWOCÓW I WARZYW

Streszczenie. Zastosowanie GMO niesie wiele korzyści, budząc jednocześnie obawy przed zagrożeniami dla zdrowia człowieka i środowiska naturalnego. Celem niniejszej pracy jest przedstawienie sposobu postrzegania GMO przez konsumentów owoców i warzyw, ich stosunku do manipulacji genetycznych oraz wiedzy na temat obecności GMO na polskim rynku żywnościowym. Realizacji tego celu służyły badania ankietowe przeprowadzone na grupie 200 osób. Z badań wynika, iż *gros* badanych uznaje żywność GM za niebezpieczną dla zdrowia i nie kupiłoby transgenicznych owoców i warzyw. Równocześnie 80% nie ma dostatecznej wiedzy na temat roślin GM, ich uprawy i obecności na rynku jako żywność GM, co dotyczy również osób lepiej wykształconych. Aż 1/3 respondentów nie wie, czy na polskim rynku jest żywność GM, a jedynie 9% wskazało jej udział na ponad 60%, zaś prawie 70% wskazało na obecność transgenicznych owoców i warzyw, wymieniając wiele ich gatunków. Wskazuje to na potrzebę szerszych działań edukacyjnych i upowszechniających.

Słowa kluczowe: GMO, owoce, warzywa, konsument

Accepted for print – Zaakceptowano do druku: 29.03.2016