AGRONOMY SCIENCE
wcześniej – formerly
Annales UMCS sectio E Agricultura
VOL. LXXIII (4) 2018

 http://dx.doi.org/10.24326/asx.2018.4.6

Department of Vegetable Crops and Medicinal Plants, University of Life Sciences in Lublin,
S. Leszczyńskiego 58, 20-068 Lublin, Poland
*e-mail: agnieszka.najda@up.lublin.pl

HELENA ŁABUDA, HALINA BUCZKOWSKA, AGNIESZKA NAJDA*

Status of consumer beans production in Poland in 2004–2017 and health-promoting properties of seeds (*Phaseolus* ssp.)

Stan produkcji fasoli konsumpcyjnej w Polsce w latach 2004–2017
oraz właściwości prozdrowotne nasion (P*haseolus* ssp.)

Summary. The paper presents the status of consumer legumes production in Poland with particular reference to beans based on GUS data and studies from 2004–2017. Total area of consumer legumes in Poland fluctuated significantly and amounted to 27.3 thousand ha in 2008 to 91.0 thousand ha in 2015. The share of bean cultivation in this period was on average the highest amounting to 43.5%, for consumer pea 39.8%, and the lowest for broad bean 4.9%. Total production of consumer leguminous seeds showed a wide variety – from 56.4 thousand t in 2008 to 180,000 tons in 2016, and since 2010, there has been a clear upward trend in the production volume. The production of consumer bean seeds has also increasing since 2010 – from 33.4 thousand t to 59.6 thousand t in 2016. Health-promoting properties of bean seeds result from high content of dietary fiber, starch, group B vitamins, mineral components – potassium, calcium and magnesium with alkaline-forming properties and polyphenol compounds (phenolic acids and flavonoids) showing, among others, antioxidant, anti-cancer, anti-hepatotoxic, choleretic and antimutagenic properties.

Key words: *Fabaceae*, consumer legumes, dry seeds, bean, pro-health properties

INTRODUCTION

Over the last ten years, there has been a significant increase in the area of cultivation and production of legume seeds for fodder and consumption purposes among the EU-28 countries. According to the study of De Cicco [2017], the area of leguminous crops in the EU-28 changed between 1.5 and 2.1 million hectares, and in 2015 it was over 2.2 million ha. Legumes for seeds were grown in all EU-28 member countries with the exception of Malta. The largest area – a quarter of crops (22.5%) – was located in Spain,

18.6% in Poland, 12.4% in France and 9.8% in Great Britain. Total legume seed production in the EU-28 in 2015 was 5.1 million tons, which was on average 50.6% higher than the average production in 2010–2014, when it amounted to 3.4 million tons. The largest seed producers were France – 930 thousand tons (18.1%) and the United Kingdom – 920 thousand tons (17.9%), followed by Poland with production of 715 thousand tons (13.9%) taking the third place, and Spain fourth with production of 503 thousand tons (9.8%). According to Eurostat data, in the structure of legume production, the so-called '*other legume seeds* which include: common bean, runner bean, chickpeas, lentils and dry retches ones, constitute a significant position. Production of *other legume seeds* in 2015 was the largest in Poland (316 thousand tons) and Spain (242 thousand tons) and accounted for 41.6% and 31.8% of total production, respectively. Poland is one of the most important EU-28 countries in the production of consumer leguminous seeds; the most important species of this group are: common beans, peas and broad beans, and moreover runner beans, lentils, soybeans and chickpeas. Production of consumer legume seeds in Poland has increased significantly, while the use in the nutrition and consumption of seeds is still at a low level. As reported by Górnicka et al. [2011], the most popular and the most commonly consumed legume seeds in Poland are: peas, beans, broad beans and soybeans, and in recent years an increase in the consumption of lentils and chickpeas has been observed. The authors showed that the average consumption of dry legume seeds in Poland in the period 1999–2008 amounted to 2.3 g/person/day, i.e. below 1 kg/person/year, whereas the recommended level should be 5–15 g/person/day, i.e. 1.8–5.5 kg/person/year. According to the literature, plant seeds from the *Fabaceae* family should be more often included in the daily diet due to their nutritional value and the content of valuable biologically active substances and non-nutritive components with beneficial effects on human health. Particular attention is paid to bean seeds, the most popular high-protein product in human nutrition worldwide. Increasing the share of bean and other legume seeds is recommended in the diet of people with obesity, metabolic problems, diabetes and also preventively in the prophylaxis of cardiovascular diseases or cancer [Champ 2002, Ribeiro and Salvadori 2003, Venn and Mann 2004, Costa et al. 2006, Diaz-Batalla et al. 2006, Duranti 2006, Korus 2008, Greń 2012, Ros and Hu 2013, Rebello et al. 2014, Rosales-Serna et al. 2015, Ganesan and Xu 2017].

OBJECTIVE OF THE STUDY

The aim of this paper was to present the status of consumer leguminous seeds production in Poland over several years, with particular reference to beans, and to indicate the desirability of wider use and consumption of bean seeds in a diet as a product of high nutritional and biological value.

MATERIAL AND METHODS

The work uses data and statistical studies of the Central Statistical Office (GUS) on the area of cultivation, production and yield per hectare of consumer legumes in 2004–2017, i.e. results of *Plant production. Statistical information and studies* published by GUS in

2005–2018. The obtained data was used for graphical and tabular presentation of the status of consumer legume production in Poland, with particular reference to beans.

RESULTS AND DISCUSSION

Production of consumer legume seeds in Poland in 2004–2017

The analysis of data published annually in detailed studies by the Central Statistical Office (GUS) indicates that beans, peas and broad beans are considered consumer legumes. Of these species, beans and peas are the most important in terms of the area of cultivation and production of consumer seeds, while broad beans are of less importance. Over the years 2004–2017, the total area of consumer legumes in Poland fluctuated significantly and amounted from 27.3 thousand ha in 2008 to 91.0 thousand ha in 2015 (Tab. 1). In 2016–2017, the area of consumer legumes was slightly smaller and amounted to 71.3–73.5 thousand ha; however, it almost doubled the area of cultivation in 2004–2009. During fourteen years, the share of the area of particular plant species in the total area of consumer legumes varied; for beans it changed from 25.2% to 57.2% and on average, it was the largest – 43.5%, for peas it was in the range from 30.7% to 53.2%, with average of 39.8%, whereas for broad beans it was the smallest – 4.9%, on average and varied from 1.7% to 8.1%.

Table 1. Cropping area of total edible pulses in Poland in between 2004 and 2017 and share of area cropping for bean, edible peas and broad bean (%)

Years	Cropping area of edible pulses (1000 ha)	Share of bean, edible peas and broad bean in area cropping of total edible pulses (%)		
		bean	edible peas	broad bean
2004	35.7	57.2	36.2	5.2
2005	32.5	48.9	46.2	4.1
2006	38.3	55.9	39.7	3.3
2007	35.2	57.0	38.2	3.5
2008	27.3	55.4	39.2	4.9
2009	27.8	51.3	38.3	8.7
2010	43.7	40.8	38.3	6.4
2011	37.4	46.9	38.2	6.7
2012	34.5	39.0	44.7	8.1
2013	39.6	37.5	30.7	6.2
2014	53.2	32.8	30.7	4.8
2015	91.0	28.4	41.7	4.1
2016	73.5	33.1	53.2	1.7
2017	71.3	25.2	42.2	2.1
Mean	–	43.5	39.8	4.9

Beans grown for consumer seeds occupied an area of 13.5 thousand ha in 2012 to 25.8 thousand ha in 2015 (Tab. 2). The area of bean cultivation generally exceeded the area under consumer pea, except for the years 2015–2017, when peas covered larger area. The area of broad bean cultivation changed from 1.2 thousand ha in 2007 and 2016 to 3.7 thousand ha in 2015. Total consumer legume production in the period 2004–2017 showed a wide variation from 56.4 thousand tons in 2008 to 180,000 tons in 2016 (Fig. 1). Since 2010, there has been a clear upward trend in the volume of consumer leguminous products. Production of consumer bean seeds in this period also increased from 33.4 thousand tons in 2010 to 59.6 thousand tons in 2016 (Tab. 2). The share of bean seed production in the total leguminous production was the highest in 2004–2009 and was in the range of 43.2–52.8% (Fig. 1), while in 2015–2017, it was the smallest (23.7–33.1%), despite of the fact that the production of seeds in these years was the largest. During this period, the production of peas increased more than twice – to 82.8 thousand tons (2017), and up to 91.3 and 95.7 thousand tons in 2015 and 2016, while the production of other legumes up to 21.6–36.5 thousand tons [GUS 2016, 2017, 2018]. The increase in the production of total consumer legumes in 2015–2017 (Fig. 1) was associated with a two-fold increase in the area of consumer peas growing to 30.1–30.8 thousand ha and growing area of other legumes for seeds up to 21.8–23.5 thousand ha compared to previous years. Production of beans for consumer seeds during the period of analyzed fourteen years was characterized by lower variability – it increased similarly to peas in 2015–2017, but to a lesser extent (Tab. 2).

Table 2. Cropping area, seed production and yield per hectare of edible pulses (bean, edible pea s and broad bean) in Poland in between 2004 and 2017

Years	Cropping area (1000 ha)			Seed production (1000 t)			Yield of seeds (t ha^{-1})		
	bean	edible peas	broad bean	bean	edible peas	broad bean	bean	edible peas	broad bean
2004	20.4	12.9	1.9	38.0	32.8	4.9	1.86	2.54	2.65
2005	15.9	15.0	1.3	28.7	33.9	3.3	1.81	2.26	2.49
2006	21.4	15.2	1.3	27.7	28.9	2.3	1.30	1.90	1.80
2007	20.1	13.5	1.2	38.8	32.4	3.1	1.94	2.41	2.46
2008	15.1	10.7	1.3	29.8	23.4	3.0	1.98	2.19	2.26
2009	14.3	10.7	2.4	28.5	24.9	5.5	2.00	2.35	2.30
2010	17.8	16.7	2.8	33.4	38.1	6.5	1.87	2.27	2.33
2011	17.5	14.3	2.5	34.9	36.9	6.3	1.99	2.58	2.50
2012	13.5	15.4	2.8	29.3	45.0	7.1	2.17	2.72	2.54
2013	14.8	12.1	2.5	31.3	33.2	5.8	2.11	2.74	2.34
2014	17.5	16.4	2.6	38.4	44.4	6.5	2.20	2.72	2.54
2015	25.8	38.0	3.7	40.7	91.3	7.0	1.57	2.40	1.88
2016	22.3	37.6	1.2	59.6	95.7	3.1	2.68	2.55	2.51
2017	18.0	30.1	1.5	49.9	82.8	4.0	2.77	2.75	2.75

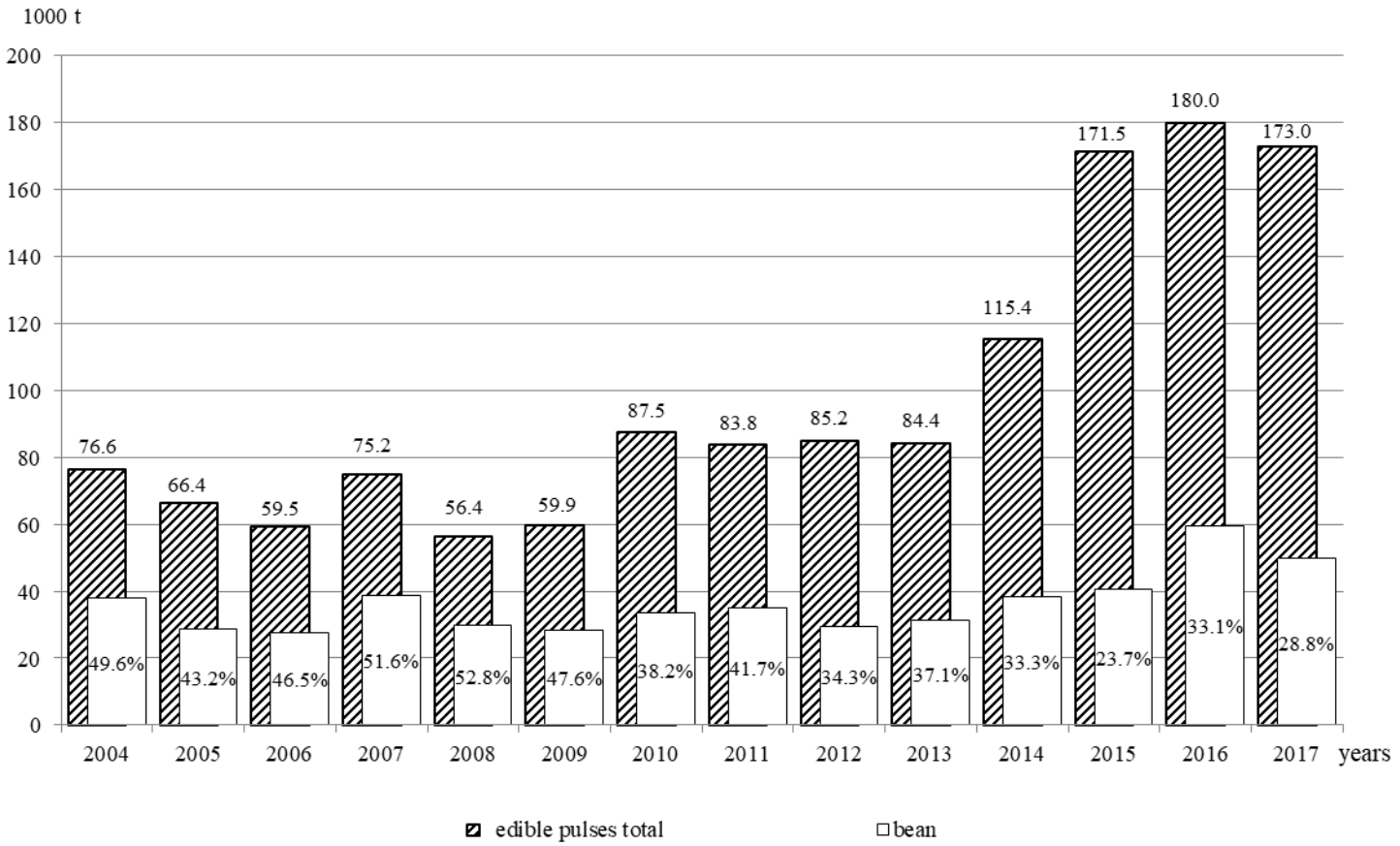

Fig. 1. Production of total edible pulses in Poland (1000 t) in between 2004 and 2017 and share of bean seed production (%)

The size of consumer leguminous seeds production depends to the largest extent on the seed yield per unit area. Plants of the *Fabaceae* family are highly sensitive to weather conditions during the growing season, water shortage in the period after seed sowing and during the flowering and pod setting stages. Moisture conditions and the course of soil and air temperature have a modifying effect on the rate of emergence, plant growth, duration of development stages, flowering abundance, availability of pollinating insects (important in pollinated species: broad bean, horse bean, runner bean), number of pods set on the plant and growth, filling and ripening of pods and seeds [Kulig and Zając 2007, Klimek and Zając 2009, Łabuda 2012, Reichert et al. 2015]. Legumes are characterized by low yield stability. As it appears from the Central Statistical Office (GUS) results presented in Table 2, yield of bean seeds from 1 ha over the fourteen years was significantly diversified: the lowest was in 2006 and 2015 and amounted to 1.30 t ha^{-1} and 1.57 t ha^{-1}, respectively, while the highest in 2016–2017 and amounted to 2.68–2.77 t ha^{-1}; in the remaining years it was in the range of 1.81–2.20 t ha^{-1}. In Polish climatic conditions, there are large fluctuations in the yield of beans grown for dry seeds [Łabuda and Papliński 2003]. The authors' research shows that the yield of seeds of beans varieties was significantly different in particular years – the smallest (0.93–1.45 t ha^{-1}) was obtained in the conditions of drought persisting from the beginning of June to the end of July, with exceptional heat (maximum temperature exceeded 35°C). The highest yield of bean seeds (3.72–4.70 t ha^{-1}) was obtained in the year when June and July were characterized by optimal rainfall, while the system of weather factors in August favored the ripening of pods and seeds, the average air temperature was 18.2°C and the sum of rainfall did not exceed 30 mm. Analysis of pea production in 2004–2017 shows that the average pea seed yield per ha was more stable than that of beans; the smallest amounted to 1.90 and 2.19 t ha^{-1} in 2006 and 2008, and in the remaining years, it was 2.26–2.75 t ha^{-1}. Similarly, the broad bean yield in the analyzed period changed to a lesser extent than that of beans, from 1.80 t ha^{-1} in 2006 to 2.75 t ha^{-1} in 2017. Peas and broad beans, unlike beans, are temperate climate plants, have lower thermal requirements, their seeds are sown earlier in March and April, and during the period of germination and emergence, they use water accumulated in winter and early spring.

The importance of beans in nutrition and nutritional value of seeds

In Polish climatic conditions, two bean species are grown: *Phaseolus vulgaris* L. (common bean) and *Phaseolus coccineus* L. (runner bean). Seeds of these species are widely used in household and processing. Common bean has the dominant importance in cultivation. Seeds depending on the varieties are white, dark-brown, beige with spots, maroon and black, and the weight of 1000 seeds is in the range of 300–720 g. The second of above mentioned species – runner bean – is characterized by large and very large white seeds and it is less widespread. The weight of one thousand seeds is 900–1000 g in dwarf and marrow varieties, and 1500–3000 g in the variety Piękny Jaś Tyczkowy [Łabuda 2000, Łabuda and Witek 2004]. Bean seeds are easily available, store well, can be frozen and preserved. Diversity of the size and color of bean seeds allows for its wide use in the production of various preparations, extracts, and dietary supplements [Korus 2008, Oomah et al. 2010, Greń 2012, Kahraman and Order 2013].

Bean seeds are characterized by very high content of protein, carbohydrates, minerals and B group vitamins, including folates. Consumption of 50 g bean seeds covers the daily requirement for this vitamin. Seeds are an excellent source of dietary fiber, the nutritional importance of which and physiological role is increasingly appreciated [Górecka et al. 2011, Płocharski et al 2017]. According to Kunachowicz et al. [2017], 100 g dry bean seeds provide the following components: general protein – 21.4 g, total carbohydrates – 61.6 g including starch 40.8 g, sucrose – 2.7 g, dietary fiber – 15.7 g, fat – 1.6 g, minerals: potassium – 1188 mg, calcium – 163 mg, magnesium – 169 mg, phosphorus – 437 mg, iron – 6.9 mg, zinc – 3.77 mg, copper – 2.0 mg, manganese – 2 mg and iodine – 2 μg. Beans seeds are also an abundant source of group B vitamins; in 100 g there are: thiamine – 0.670 mg, riboflavin – 0.230 mg, niacin – 2.20 mg, vitamin B6 – 0.53 mg, folate – 187 μg. In 100 g of bean seeds, there is 0.19 g total saturated fatty acids, 0.12 g monounsaturated fatty acids and 0.91 g polyunsaturated fatty acids – n-3 0.58 g and n-6 0.33 g. Bean seed protein is characterized by high aspartic acid (2827 mg 100 g^{-1}), glutamic acid (3493 mg 100 g^{-1}) and exogenous lysine (1701 mg 100 g^{-1}) as well as leucine (1799 mg 100 g^{-1}) and arginine (1342 mg 100 g^{-1}). It can be a good complement to cereal protein deficient in these amino acids.

Bean seeds there contain so-called non-nutritious ingredients such as trypsin inhibitors, tannins, phytates and oligosaccharides (with flatogenic properties). Proper technological processing in the preparation of bean seeds during the processing affects the reduction of these compounds content in seeds. Bean seeds can be used as a source of functional products [Troszyńska et al. 2000, Krupa and Soral-Śmietana 2003, Piecyk et al. 2005, Bieżanowska-Kopeć et al. 2006, Wieczorek et al. 2016].

Health-promoting properties of bean seeds

The health-promoting properties of consumer bean result mainly from the presence of dietary fiber in the seeds, polysaccharides – starch, oligosaccharides from the raffinose family (raffinose and stachyose) and polyphenolic compounds – phenolic acids and flavonoids. Beans are also an abundant source of minerals such as potassium, calcium, sodium and magnesium with alkaline-generating properties. Potassium is a mineral component of the greatest importance for water and electrolyte management and acid-base balance of the human body. Dietary fiber, a non-nutrient food component, includes polysaccharide and non-saccharide compounds that are not degraded by digestive enzymes in the human digestive tract, but are subject to bacterial degradation only in the large intestine. Dietary fiber is a ballast substance regulating the functioning of the digestive tract, it binds many substances including cholesterol, bile acids, buffer the excess of hydrochloric acid in the stomach, creates a favorable substrate for development of the desired bacterial flora in the large intestine. Similarly to dietary fiber, oligosaccharides present in bean seeds are not digested in the digestive tract and are an excellent medium for colonies of beneficial intestinal bacteria, the so-called *bifidobacteria*. The content of oligosaccharides in regular bean seeds (raffinose + stachyose) was 2.09–2.92% depending on the cultivars, and 2.09–2.31% in the runner bean [Kosson 1988]. Bean seeds, due to the high content of starch resistant to digestion in the small intestine, are characterized by a low glycemic index IG, and are recommended in nutrition as beneficial for maintaining proper blood glucose level and also in the fight against obesity [Dolna et al. 2006, Zalega and Szostak-Węgierek 2013]. Polyphenolic compounds (phenolic acids and flavonoids)

found in dry bean seeds have potentially beneficial effect on human health. Polyphenolic compounds have antioxidant, anti-diabetic, anti-inflammatory, anti-carcinogenic, anti-mutagenic, and anti-obesity properties [Kozłowska and Szostak-Węgierek 2014, Fan and Beta 2016, Ganesan and Xu 2017].

Flavonoids give color to flowers, fruits and seeds, have the properties of absorption and protection against excessive ultraviolet radiation, and have healing properties. Flavonols and their glycosides, quercetin and kaempherol, are the most frequent flavonoids in plants. Quercetin has antioxidant, anti-cancer and blood vessels sealing properties [Kohlmünzer 2007, Kobylińska and Janas 2015]. The content of polyphenolic compounds in beans changes depending on the color of the seeds and the anatomical part – seed husk, cotyledons. At the same time, in the varieties of beans with colored seeds, these compounds are located primarily in the seed husk. In addition, it was also confirmed that seedling extracts of bean varieties with colored seeds are characterized by greater antioxidant activity than white-seeded ones [Drużyńska 2002, Drużyńska and Klepacka 2004, Łabuda and Papliński 2007, Stasiak and Ulanowska 2008, Oomah et al. 2010].

REFERENCES

Bieżanowska-Kopeć R., Pisulewski P.M., Polaszczyk S., 2006. Wpływ procesów wodno-cieplnych na zawartość składników biologicznie czynnych w nasionach fasoli (*Phaseolus vulgaris* L.) [Influence of water-thermal processes on the content of biologically active components in bean seeds (*Phaseolus vulgaris* L.)]. Żywn. Nauka Technol. Jakość 2(47), 82–89.

Champ M.J., 2002. Non-nutrient bioactive substances of pulses. Br. J. Nutr. 88(3), 307–319.

Costa G. E. A., Queiroz-Monici K. S., Reis S. M. P. M., de Oliveira A. C., 2006. Chemical composition, dietary fiber an resistant starch contents of eaw and cooked pea, common bean, chickpea and lentil legumes. Food Chem. 94, 327–330.

De Cicco A., 2017. Dry pulses in EU agriculture – statistics on cultivation, production and economic value. Statistics Explained (http://ec.europa.eu/eurostat/statisticsexplained/) – 20/12/2017.

Diaz-Batalla L., Widholm J.M., Fahey G.C., Castaño-Tostado E., Paredes-Lopez O., 2006. Chemical component with health implications in wild and cultivated Mexican common bean seeds (*Phaseolus vulgaris* L.). J. Agric. Food Chem. 54, 2045–2052.

Dolna A., Ciok J., Szponar L. 2006. Oznaczanie indeksu glikemicznego wybranych potraw typowych dla kuchni polskiej [Determination of glycemic index of selected dishes typical of Polish cuisine]. Żyw. Człow. Metab. 33(3), 199–212.

Drużyńska B., 2002. Polyphenolic compounds of bean seed coats (*Phaseolus vulgaris* L.) and their antioxidant properties. Pol. J. Food Nutr. Sci. 11/52(1), 35–39.

Drużyńska B., Klepacka M., 2004. Właściwości przeciwutleniające preparatów polifenoli otrzymanych z okrywy nasiennej fasoli czarnej, różowej i białej (*Phaseolus*) [Antioxidant properties of polyphenol preparations obtained from the seed coat of black, pink and white bean (*Phaseolus*)]. Żywn. Nauka Technol. Jakość, 4(41), 69–78.

Duranti M., 2006. Grain legume proteins and nutraceutical properties. Fitoterapia 77, 67–82.

Fan G., Beta T., 2016. Proximate composition, phenolic profiles and antioxidant capacity of three common bean varieties (*Phaseolus vulgaris* L.). J. Chem. Nanotech. 2(3), 147–152.

Ganesan K., Xu B., 2017. Polyphenol-rich dry common beans (*Phaseolus vulgaris* L.) and their health benefits. Int. J. Sci. 18, 2331, doi:10.3390/ijms18112331.

Greń A., 2012. Aktywność antyoksydacyjna preparatów morwy białej, fasoli zwykłej oraz miłorząbu japońskiego w cukrzycy generowanej podaniem streptozotocyny [Antioxidant activity of white mulberry, common bean and ginkgo biloba in diabetes generated with streptozotocin administration]. Post. Fitoter. 4, 220–224.

Górecka D., Janus P., Borysiak-Marzec P., Dziedzic K., 2011. Analiza spożycia błonnika pokarmowego i jego frakcji w Polsce w ostatnim dziesięcioleciu w oparciu o dane GUS [Analysis of dietary fiber intake and its fractions in Poland in the last decade based on GUS data]. Probl. Hig. Epidemiol. 92(4), 705–708.

Górnicka M., Pierzynowska J., Wiśniewska M., Frąckiewicz J., 2011. Analiza spożycia suchych nasion roślin strączkowych w latach 1999–2008 w Polsce [Analysis of dry legume seeds consumption in 1999–2008 in Poland]. Bromat. Chem. Toksykol. 44(4), 1034–1038.

GUS, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018. Wyniki produkcji roślinnej. Informacje i opracowania statystyczne [The results of plant production. Statistical information and studies]: 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017. GUS, Warszawa.

Kahraman A., Order M., 2013. Correlations between seed color and nutritional composition of dry bean. Ratar. Povrt. 50(2), DOI:10.5937/ratpov50-3959.

Klimek A., Zając T., 2009. Produkcyjność grochu (*Pisum sativum* L.) na tle postępu hodowlanego [Pea productivity (*Pisum sativum* L.) on the background of breeding progress]. Post. Nauk Roln. 1, 77–90.

Kulig B., Zając T., 2007. Biologiczne i agrotechniczne uwarunkowania produkcyjności bobiku [Biological and agrotechnical conditions for the faba bean production]. Post. Nauk Roln. 1, 63–80.

Kobylińska A., Janas K.M., 2015. Prozdrowotna rola kwercetyny obecnej w diecie człowieka [The pro-health role of quercetin present in the human diet]. Post. Hig. Med. Dośw. 69, 1732–2693.

Kohlmunzer S., 2007. Farmakognozja [Pharmacognosy]. 5th edition. Wyd. Lek. PZWL, Warszawa.

Korus J., 2008. Ekstrudaty z fasoli jako nowe produkty przekąskowe [Bean extrudates as new snack products]. Przem. Ferm. Owoc. Warz. 9, 30–31.

Kosson R., 1988. Flatulence-causing galactooligosaccharides of *Phaseolus coccineus* L. and *Phaseolus vulgaris* L. Acta Soc. Bot. Pol. 57(4), 493–497.

Kozłowska, A., Szostak-Węgierek D., 2014. Flavonoids – food sources and health benefits. Rocz. Państw. Zakł. Hig. 65(2), 79–85.

Krupa U., Soral-Śmietana M., 2003. Nasiona fasoli – źródłem odżywczych i nieodżywczych makroskładników. [Bean seeds – a source of nutritive and non-nutritive macronutrients]. Żywn. Nauka Technol Jakość 2(35), Supl., 98–111.

Kunachowicz H., Nadolna I., Iwanow K., Przygoda B., 2017. Tabele wartości odżywczej produktów spożywczych i potraw. Baza danych [Tables of nutritional value of food products and dishes. Database]. 4th edition: extended and updated. Instytut Żywności i Żywienia, Warszawa 2017.

Łabuda H., 2000. Fasola zwykła *Phaseolus vulgaris* L. i fasola wielokwiatowa *Phaseolus coccineus* L. (w) Polowa uprawa warzyw [Common bean *Phaseolus vulgaris* L. and runner bean *Phaseolus coccineus* L. (in) Field vegetable growing], M. Orłowski (ed.). Brasika, Szczecin, 317–331.

Łabuda H., 2012. Flowering and characteristics of useful traits of some faba bean (*Vicia faba* L. *var. major* Harz) cultivars and breeding lines. Acta Agrobot. 65(4), 139–148.

Łabuda H., Papliński R., 2003. The yield and seed weight of some bean cultivars in relation to weather conditions. Folia Hort. Ann. 15(1), 3–10.

Łabuda H., Papliński R., 2007. The content of phenolic acids in white and color seeds of the *Phaseolus* sp. cultivars. Herba Pol. 53(3), 302–307.

Łabuda H., Witek Z., 2004. Charakterystyka ważniejszych cech użytkowych kilkunastu odmian fasoli na suche nasiona [Characteristics of more important functional traits of several dozen varieties of beans for dry seeds]. Folia Univ. Agric. Stetin., Agricultura, 217–221.

Oomah B.D., Corbe A., Balasubramanian P., 2010. Antioxidant and anti-inflammatory activities of bean (*Phaseolus vulgaris* L.) hulls. J. Agric. Food Chem. 58, 8225–8230.

Piecyk M., Klepacka M., Worobiej E. 2005. Zawartość inhibitorów trypsyny, oligosacharydów oraz fosforu fitynowego w preparatach białkowych otrzymanych z nasion fasoli (*Phaseolus vulgaris*) metodą krystalizacji izolacji klasycznej [The content of trypsin inhibitors, oligosaccharide and phytate phosphorus in protein preparations obtained from bean seeds (*Phaseolus vulgaris*), method of crystallization of classical insulation]. Żywn. Nauka Technol. Jakość 3(44), 92–104.

Płocharski W., Markowski J., Rutkowski K.P., Konopacka D., 2017. Wartości odżywcze i zdrowotne owoców i warzyw [Nutritional and health values of fruits and vegetables]. Instytut Ogrodnictwa, Skierniewice.

Rebello C.J. Greenway F.L., Finley J.W., 2014. A review of the nutritional value of legumes and their effects on obesity and its related co-morbidities. Int. Asoc. Study Obesity 15, 392–407, doi: 10.1111/obr.12144.

Reichert J.M., Rodrigues M.F., Awe G.O., Riguelme U.F.B., Kaiser D.R., Reinert D.J., 2015. Common bean in highly variable weather conditions, on sandy soils, and food security in a subtropical environment. Food Energy Secur. 4(3), 219–237.

Ribeiro L.R., Salvadori D.M.F., 2003. Dietary components may prevent mutation-related diseases in humans. Mut. Res. 544(2–3), 195–201, DOI:10.1016j.mrrev.2003.06.919.

Rosales-Serna R., Gutièrrez-Uribe J.A., Reyes-Barraza E., Mayek-Pèrez N., Serna-Saldivar R.O., 2015. Genetic relationship among common bean cultivars with enhanced accumulation of bioactive compounds. J. Agr. Sci. (Cambridge) 7(9), 106–116.

Ros E., Hu F.B., 2013. Consumption of plant seeds and cardiovascular health: Epidemiological and clinical trial evidence. Circulation 128, 553–565.

Stasiak A., Ulanowska A., 2008. Aktywność przeciwutleniająca nowych odmian fasoli (*Phaseolus vulgaris* L.) [Antioxidant activity of new varieties of beans (*Phaseolus vulgaris* L.)]. Żywn. Nauka Technol. Jakość 1(56), 74–82.

Troszyńska A., Honke J., Kozłowska H., 2000. Naturalne substancje nieodżywcze (NSN) pochodzenia roślinnego jako składniki żywności funkcjonalnej [Natural non-nutritive substances (NSN) of plant origin as ingredients of functional food]. Post. Fitoter. 2, 17–22.

Wieczorek C., Sionek B., Przybylski W., Lahuta L.B., 2016. Wpływ obróbki kulinarnej nasion roślin strączkowych na zawartość rozpuszczalnych węglowodanów [The effect of culinary processing of legume seeds on the content of soluble carbohydrates]. Zesz. Prob. Post. Nauk Roln. 584, 139–150.

Venn B.J., Mann J.I., 2004. Cereal grains, legumes and diabetes. Eur. J. Clin. Nutr. 58, 1443–1461.

Zalega J., Szostak-Węgierek D. 2013. Żywienie w profilaktyce nowotworów. Część 3. Diety o właściwościach przeciwnowotworowych [Nutrition in the prevention of cancer. Part 3. Diets with anticancer properties]. Prob. Hig. Epidemiol. 94(1), 59–70.

This research was financially supported by the Polish Ministry of Science and Higher Education under statutory funds (OKW/DS/1) of the Department of Vegetable Crops and Medicinal Plants, University of Life Science in Lublin, Poland.

Streszczenie. W pracy przedstawiono stan produkcji w Polsce jadalnych roślin strączkowych, ze szczególnym uwzględnieniem fasoli, na podstawie danych i opracowań GUS z lat 2004–2017. Powierzchnia uprawy strączkowych jadalnych ogółem w Polsce ulegała dużym wahaniom i wynosiła od 27,3 tys. ha w 2008 r. do 91,0 tys. ha w 2015 r. Udział uprawy fasoli w tym okresie był średnio największy i wynosił 43,5%, mniejszy był grochu jadalnego – 39,8%, a

najmniejszy bobu – 4,9%. W analizowanym okresie produkcja nasion strączkowych jadalnych charakteryzowała się dużym zróżnicowaniem – od 56,4 tys. ton w 2008 r. do 180,0 tys. ton w 2016 r., a od 2010 r. zaznaczyła się wyraźna tendencja wzrostowa w wielkości produkcji. Produkcja nasion fasoli konsumpcyjnej również zwiększała się od 2010 r. – od 33,4 tys. ton do 59,6 tys. ton w 2016 r.

Prozdrowotne właściwości nasion fasoli wynikają z dużej zawartości błonnika pokarmowego, skrobi, witamin z grupy B, składników mineralnych – potasu, wapnia i magnezu o właściwościach zasadotwórczych oraz związków polifenolowych (fenolokwasów i flawonoidów), wykazujących m.in. właściwości antyoksydacyjne, antynowotworowe, antyhepatotoksyczne, żółciotwórcze, antymutagenne.

Słowa kluczowe: *Fabaceae*, strączkowe jadalne, suche nasiona, fasola, właściwości prozdrowotne

Received: 10.10.2018
Accepted: 5.12.2018