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COMPETITION FOR SPACE BETWEEN CEREALS AND OIL CROPS IN TERMS OF ITS WORLDWIDE DYNAMICS

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Abstract. Cereals and oil crops are primary crops worldwide both in terms of their production and cropped area. Production of these two groups in the last four decades has been developing dynamically and – as it is indicated by forecasts – will continue to do so in the future. Development of cereal and oil crop production results from the constantly growing food demand for processing products of both these types of crops, as well as the non-food demand, developing significantly in recent years. Plant production may be increased through an increase in yields or in cropped area, or at the simultaneous effect of both these factors. The constantly growing demand for cereal and oil products and the limited land resources may cause competition for space between these two groups of crops. The aim of this study was to conduct investigations in order to verify whether such competition actually takes place.

Key words: cereals, oil crops, production, competition for space

INTRODUCTION

Cereals and oil crops are major product groups in agriculture. At present the biggest cropped area is that of cereals and oil crops. In 2007 it was 700 million hectares for cereals and 250 million hectares for oil crops. As it was reported by Klepacki [2007], in the contemporary world we have a cereal civilisation, since a vast majority of energy and protein used to sustain the world population comes from cereal grain. In turn, oil crops

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are a group of plants, which economic role has increased considerably and will continue to do so in the future. In the past seeds of oil crops were treated mainly as raw material for the production of edible or technical oils. In the course of the last 40 years they have become a major source of fodder protein, for which we may observe a considerable and increasing demand. Another dynamically developing direction of production is the use of cereals and oil crop materials for energy purposes. The situation in the markets of cereals and oil crops has a significant effect on the other sectors of agriculture and food economy. Changes in the production of cereals and oil crops results in consequences affecting both food and feed markets, and thus – also markets of meat and dairy products [Sznajder 1997; Żmija 1996; Stańko 2002]. Taking into consideration the above, it may be assumed that in view of the increasing demand for cereal and oil crop materials, production of both these groups of crops will be increasing.

Plant production may be increased through an increase in yields or in cropped area, or at the simultaneous effect of both these factors. An increase in yields is determined by a set of external factors, among which a decisive role is attributed to biological progress [Hayami and Ruttan 1985; Wilkin 1986]. In turn, an increase in cropped area is connected with the problem of limited land resources and the relatively low elasticity of this production factor. Thus it may be expected that a simultaneous increase in cropped area for both the above mentioned groups of crops might be connected with competition for space. However, a question may arise whether globally competitiveness in the past referred to thee competition for cultivated area between cereals and oil crops, or rather production of both these crops was increased at the expense of other crops. Thus the aim of this study was to present changes in world economy depending on the area cropped to cereals and oil crops, and to make an attempt at their economic justification.

Investigations were conducted in relation to the situation worldwide and covered the period of 1961–2007. The starting point for the analyses comprised statistical data published annually by FAOSTAT. Their results may lead to further analyses describing this problem in relation to the regional situation.

DEVELOPMENT OF CEREAL AND OIL CROP PRODUCTION

An introduction to the considerations concerning trends in changes, depending on the area cropped to cereals and oil crops, comprises the characteristic of the development of production for both analysed groups of crops. Figure 1 presents evaluations of parameters of linear and exponential trends describing cropped area, yields and total harvested crops of cereals[1]. Properties of these models made it possible to characterise the development of a given phenomenon in absolute and relative values [Pietraszewski et al. 1989].

In the years 1961–2007 production of cereals increased from 877 million ton to 2342 million ton. Production of these crops increased mainly thanks to an increase in yields, which in the analysed period increased from 13.5 dt/ha to 33.5 dt/ha. In terms of

[1] The group of cereal crops include maize, wheat, rice, barley, rye, sorghum, millet, buckwheat and mixtures of grain crops.

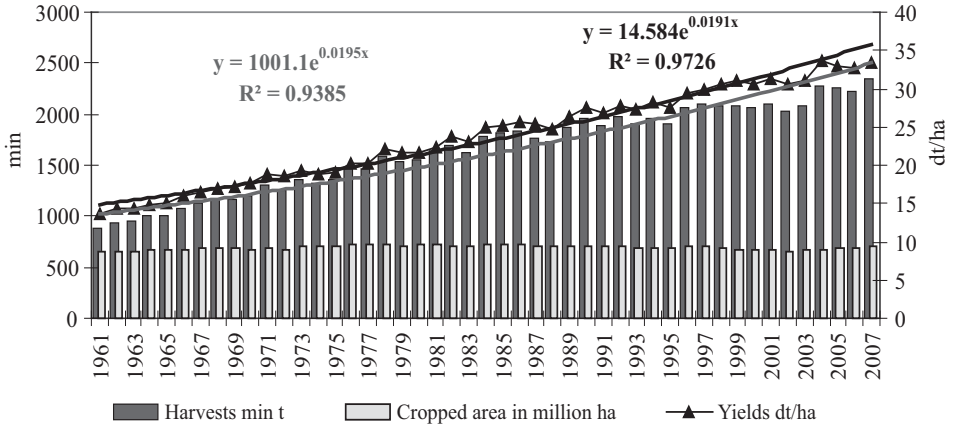

Fig. 1 Harvests, cropped area and yields of cereals worldwide in the years 1961–2007
Rys. 1. Zbiory, powierzchnia uprawy i plon roślin zbożowych w świecie w latach 1961–2007

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

cropped area in the analysed period we may distinguish three periods in the development of cropped area. In the first period, covering the years 1961–1981, we may observe an upward trend in the area cropped to cereals from 648 million ha to 726 million ha. The years 1982–2002 were connected with a downward trend in the area cropped to cereals, to 661 million ha in 2002. The next years were related with a repeated increase in the area of cereals to 700 million ha in 2007.

Development trends presented in Figure 1, concerning harvests, cropped area and yields of cereals, were described using a linear and an exponential function. Evaluations of parameters of these functions (b_0 and b_1), together with their standard deviations (s_0 and s_1) as well as their goodness of fit, measured by the coefficient of determination (R^2) were listed in Table 1. As it could have been expected, due to fluctuations in the area cropped to cereals both models showed a very low degree of fit. In turn, on the basis of evaluations of estimated parameters concerning the volume of production, we may say that harvests grew on average by 30 million ton annually (in Table 1 the value of 30.108), which amounts to an almost 2% mean annual increase (in Table 1 the value of 1.966). A decisive effect on the increase in the volume of production in case of cereals was also found for the increase in yields. This is also indicated by the fact that in the analysed period yields of cereals went up on average by 43.6 kg/ha annually, which in relative numbers amounted to mean annual increase of 1.9%.

An analogous analysis was conducted for oil crops. Figure 2 presents fluctuations in total cropped area, yields and harvests for oil crops[2]. Yields of crops and production,

[2] Statistics of FAO distinguish over 20 plant species, from which edible oils are produced. These include soybean, peanuts, coconut palm, oil palm, from which palm oil is produced and oil from palm seeds, olive tree, shea butter tree, castor oil plant, sunflower, rape, tung oil tree, jojoba, safflower, sesame, mustard, poppy, melon, Chinese tallow-tree, from which two oils are obtained, i.e. Chinese vegetable tallow oil and stillingia oil kapok, cotton, flax, hemp, etc.

Table 1. Evaluations of parameters of linear and exponential trends describing cropped area, harvests and yields of cereals worldwide in the years 1961–2007
Tabela 1. Oceny parametrów trendu liniowego i wykładniczego, opisujące powierzchnię, zbiory i plony roślin zbożowych w świecie w latach 1961–2007

Values	b_0	s_0	b_1	s_1	R^2	Growth rate
Linear function						absolute
Area in million ha	687.161	5.740	0.233	0.215	0.025	
Harvests in million t	961.934	20.199	30.108	0.756	0.972	30.108
Yields in dt/ha	13.836	0.171	0.436	0.006	0.990	0.436
Exponential function						relative
Area in million ha	685.684	5.894	1.000	1.000	0.027	
Harvests in million t	1020.833	20.502	1.020	1.001	0.939	1.966
Yields in dt/ha	14.899	1.013	1.019	1.000	0.973	1.930

$S(b_0)$, $S(b_1)$ – mean errors of estimates of structural parameters

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

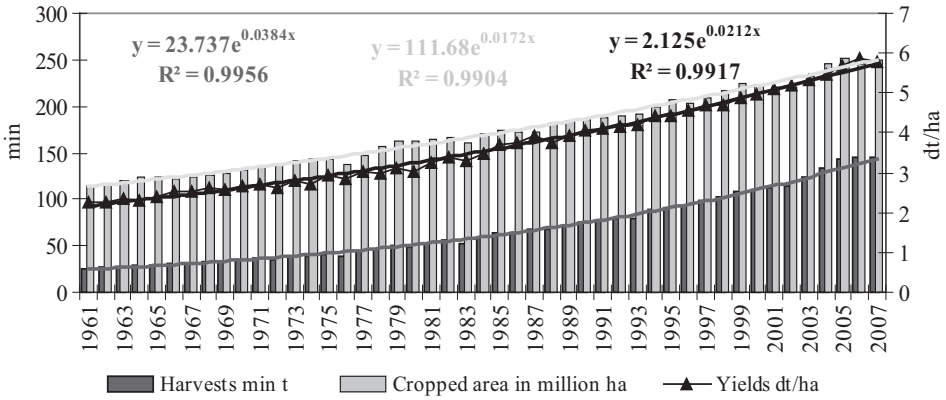

Fig. 2. Harvests, cropped area and yields of oil crops worldwide in the years 1961–2007
Rys. 2. Zbiory, powierzchnia uprawy i plon roślin oleistych w świecie w latach 1961–2007

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

due to the differences in oil contents in raw materials and unit yields per 1 ha, were expressed in oil equivalents[3]. Similarly as in case of cereals, estimations were also performed for models of growth trends, characterising both changes in the volume of production for oil crops as well as their yields and cropped area. Results of linear and exponential estimations are presented in Table 2. Evaluations of estimated parameters

[3] Physical yields of oil raw materials were converted into yields of oil.

Table 2. Evaluations of parameters of linear and exponential trends describing cropped area, harvests and yields of oil crops worldwide in the years 1961–2007
Tabela 2. Oceny parametrów trendu liniowego i wykładniczego, opisujące powierzchnię, zbiory i plony roślin oleistych w świecie w latach 1961–2007

Values	b_0	s_0	b_1	s_1	R^2	Growth rate
Linear function						absolute
Area in million ha	105.364	1.865	2.957	0.070	0.976	2.957
Harvests in million t	10.250	2.716	2.521	0.102	0.932	2.521
Yields in dt/ha	1.897	0.057	0.078	0.002	0.967	0.078
Exponential function						relative
Area in million ha	113.615	1.007	1.017	<E-03	0.990	1.733
Harvests in million t	24.666	1.010	1.039	<E-03	0.996	3.913
Yields in dt/ha	2.171	1.008	1.021	<E-03	0.992	2.143

$S(b_0)$, $S(b_1)$ – mean errors of estimates of structural parameters

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

and the value of coefficients of determination indicate very good fit of these functions to empirical data.

In the years 1961–2007 production of oil crops, expressed in oil equivalents, increased from 25.7 million ton to 144.8 million ton. With each successive year harvests of oil crops increased on average by 2.5 million ton (in Table 2 the value of 2.521), while in relative figures this increase amounted to 3.9% (in Table 2 the value of 3.913). An increase in production occurred at the simultaneous increase in cropped area, from 113.6 million ha to 250.6 million ha, as well as yields from a unit area, from 2.3 dt/ha to 5.8 dt/ha (Figure 2). Each year yields of oil crops increased on average by 7.8 kg, which amounts to 2.1%. In turn, cropped area of these plants increased each year by almost 3 million ha, which in relative figures amounted to 1.7%.

Based on the information presented in Figs. 1 and 2 as well as Tables 1 and 2 it may thus be observed that in the years 1961–2007 production of cereals increased by 270% (on average by 1.97% a year), while production of oil crops expressed in oil equivalents increased by 563% (on average by 3.9% a year). The relative increase in the production of oil crops was thus more than two-fold than that for the production of cereals.

Conducted analyses indicate that in case of cereals in the investigated period an increase in the level of production was obtained mainly thanks to improved production efficiency for these crops. An almost 250% increase in yields (on average 1.930% year by year) resulted in a 270% increase in production. The other 20% of an increase in harvested crops may be attributed to an increase in cropped area or the positive effects of interactions of both above mentioned factors. In turn, for oil crops the level of harvests was considerably affected both by cropped area and yields. The mean annual growth rate for the production of oil crops, amounting to 3.91%, was accompanied by an increase in yields amounting to 2.14% and an increase in cropped area, which for these plants was 1.73%.

COMPETITION FOR SPACE

As it was shown in the previous part, in the years 1961–2007 an increase was observed both for the production of cereals and oil crops. In both cases this increase was obviously affected by biological as well as agrotechnical progress, which was reflected in the dynamic increase in yields of both groups of crops. However, it needs to be observed here that for oil crops an increase in production was also accompanied by an increase in cropped area. In case of cereals fluctuations were observed in cropped area. In the investigated period the mean area of 692.5 million ha was used for the production of cereals. This value in individual years deviated from the mean by 20 million ha. In turn, for area cropped to oil crops a regular upward trend could be seen, from 113.5 million ha in 1961 to 205.6 million ha in 2007. Thus a question may arise whether the area cropped to oil crops may be treated as competitive to changes in the area cropped to cereals. Or maybe changes in cropped areas for both analysed groups of crops were complementary in character, i.e. areas cropped to cereals and oil crops increased at the expense of other crops.

In order to answer the above questions, from the aggregate of cereals a rice was removed, and in the aggregate of an oil plants exclusively annual plants have been left. Described in this way analysis referred to plants being characterized by a similar production technology in case of which the competition for space was theoretically and practically possible.

To analysis of competition for space two models of functions were applied, i.e. linear and power functions. The strength and direction of the relationship between the area cropped to cereals and that of oil crops were investigated using the least square method. However, due to the above mentioned fluctuations in farmland area involved in the production of cereals the segment model was used [see e.g. Nowak. 1986 and 2004; Jurek and Guzik 1989]. First of all parameters of both models were estimated in relation to the dependence between total area cropped to cereals (the explained variable $\boldsymbol{y}$) and oil crops (the explanatory variable $\boldsymbol{x}$). The dependence based on the linear function is presented in Figure 3. Apart from the standard evaluation of fit for the entire model and evaluations of estimated parameters, intuitive turning points were also additionally verified based on the Fisher-Senedecor F-statistics [Jurek and Guzik 1999]. Results of estimations for linear and power models, together with the theoretically determined values of intuitive turning points (x_z, y_z), are presented in Table 3. Properties of power models made it possible to characterise the development of a given phenomenon in relative values. Evaluation of parameter b_1 determines a relative increment in the explained variable per 1% change in the value of the explanatory variable [Pietraszewski et al. 1989].

The application of the segment model, both with the linear and power segments, made it possible to indicate two turning points in the dependence between area cropped to oil crops and that of cereals, one in 1976 and the other in 2002. However, these dates may not be treated as too definite, since testing of marginal turning points also brought positive results and the final selection of turning points was determined by testing results concerning their significance [Jurek 1989].

In the years 1961–1976 cultivation area increased both for cereals and oil crops. That increase by 1 million ha for oil crops was accompanied by an increase for cereals by 1.1 million ha (in Table 3 the value of 1.118). In relative values a 1% increase in area

Table 3. Evaluations of parameters of linear and power models describing the dependence between area cropped to cereals (y) and that of oil crops (x) in the years 1961–2007

Tabela 3. Oceny parametrów modeli liniowych i potęgowych opisujących zależność między powierzchnią upraw zbóż (y) a powierzchnią upraw roślin oleistych (x) w latach 1961–2007

	Linear model				Power model			
	x_z	y_z	b_1 [s_1]	R^2	x_z	y_z	b_1 [s_1]	R^2
1961–1976	101.062	531.575	1.118 [0.201]	0.705	101.062	531.093	0.234 [0.042]	0.705
1977–2001	138.255	573.172	–0,906 [0.079]	0.847	139.170	572.316	–0.257 [0.025]	0.810
2002–2007	199.415	517.759	0,655 [0.201]	0.726	202.295	519.832	0.254 [0.077]	0.731

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

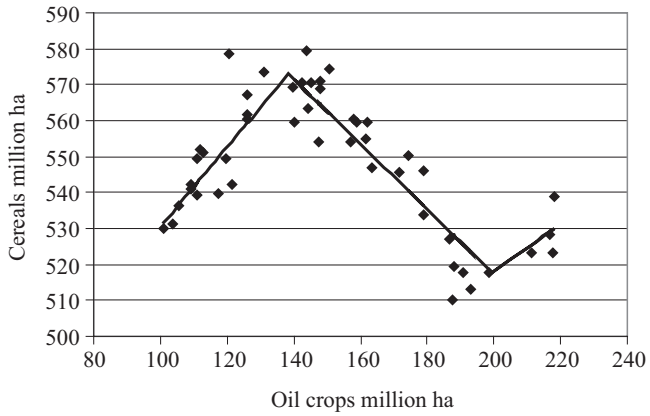

Fig. 3. Dependence between area cropped to oil crops and that of cereals worldwide in the years 1961–2007

Rys. 3. Zależność pomiędzy powierzchnią upraw oleistych a powierzchnią upraw zbóż w świecie w latach 1961–2007

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

cropped to oil crops was accompanied by a 0.2% increase (in Table 3 the value of 0.234) in cultivation of cereals. Thus in the years 1961–1976 we may talk of complementarity of cultivation for both groups of crops.

The situation changed around 1976, when the area cropped to oil crops was almost 138 million ha, while that for cereals was approx. 573 million ha (values for the theoretically determined turning point). From that time until approx. 2002 an increase in the area of oil crops was accompanied by a reduction in the area cropped to cereals. With an increase in the area of oil crops by 1 million ha the area cropped to cereals was reduced by 0.9 million ha (in Table 3 the value of 0.906). In relative values a 1% increase in the area of oil crops was accompanied by a 0.3% (in Table 3 the value of 0.257) reduction of area cropped to cereals. Such a situation remained until the area of oil crops reached approx. 199 million ha and that of cereals almost 518 million ha.

In the last years of the analysed period the area cropped to both groups of crops was increasing. On average an increase in the area of oil crops by 1 million ha was accompanied by an almost 0.7 increase (the value of 0.655 in Table 3) in the area cropped to cereals. In turn, the value of parameter b_1 estimated based on the power model indicates that the rate of changes in the area of oil crops was almost 4 times bigger than changes in the area of cereals (the value of 0.254).

AN ATTEMPT AT AN ECONOMIC JUSTIFICATION

Analysis of relationships between the area cropped to cereals and that of oil crops resulted in the identification of three periods, i.e. 1961–1976, 1977–2002 and 2002–2007, of which the first and the last turned out to be periods of area complementarity for both analysed groups of crops, while in the years 1977–2002 we may talk of competition between these two groups of crops for cultivated area. This situation is influenced by several economic phenomena. For the sake of clarity of the line of reasoning, this study was limited to the presentation of the relationship of the existing situation with the following elements: technical change in agriculture, changes in prices and related changed in the structure of foreign trade in these products and changes in area of utilization of cereals.

1. Technical change: yields

An improved level of yields is directly related with progress in science and technology. Intensity of conducted research and as a consequence the rate of introduced changes, are dependent on many external factors. Figure 4 presents relative changes in yielding for both groups of crops throughout the entire investigated period. As it may have been expected, yields of both groups of crops were growing; however, the rate of these changes varied in individual years.

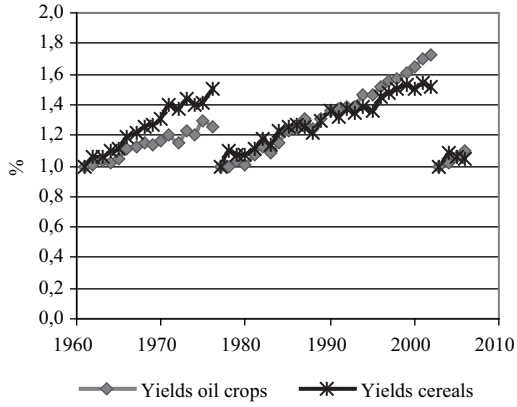

Fig. 4. Dynamics of changes in yielding of cereals and oil crops in analysed periods
Rys. 4. Dynamika zmian plonowania roślin zbożowych oleistych w analizowanych okresach

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

In order to emphasize trends in changes of yielding, Table 4 presents results of estimation based on the exponential function in reference to the period distinguished in the previous chapter. Values of estimated parameters b1 are determined by the mean rate of changes in yielding in the groups of crops per 1 year of the analysed period [Jurek and Guzik 1989]. In the years 1961–1976 yielding of cereals improved by 50%, from 13.5 dt/ha to 20.3 dt/ha, i.e. on average by 2.6% annually (in the Table the value of 0.0264). In turn, yields of oil crops increased by 25%, from 2.3 dt/ha to 2.8 dt/ha, i.e. on average by 1.7% annually. In turn, in the second and third period the growth rate for the increase in yielding of oil crops was already higher in comparison to that of cereals, amounting for oil crops to 2.3% and 2.4%, respectively, as well as 1.7% and 1.6% for cereals.

Table 4. Evaluations of parameters of exponential models describing changes in yielding of cereals and oil crops in the years 1961–2007
Tabela 4. Oceny parametrów modeli wykładniczych opisujących zmiany w plonowaniu roślin zbożowych i oleistych w latach 1961–2007

Analysed periods	cereals		oil crops	
	b_1 [s_1]	R^2	b_1 [s_1]	R^2
1961–1976	0.0264 [0.0015]	0.9584	0.0168 [0.0013]	0.9254
1977–2001	0.0169 [0.0007]	0.9600	0.0228 [0.0006]	0.9850
2002–2007	0.0159 [0.0064]	0.6075	0.0237 [0.0035]	0.9212

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

In the entire analysed period the rate of an increase in yielding for cereals was decreasing, while that for oil crops was growing. This situation may be connected with potential improvement of yielding in the discussed groups of crops. In case of cereals, due to the relatively higher level of yields relative increments in yields are more difficult to obtain that in case of oil crops, where the level of yields is relatively lower. However, it needs to be remembered that in the first period yields of cereals were growing faster than those of oil crops. Starting from the second period a faster growth rate was recorded for yielding of oil crops.

2. Changes in prices of oil crops and cereals

Economic decisions connected with the selection of crops are mainly dominated by a broader evaluation of the economic and market situation, which is reflected not only in the level of market prices, but also their changes. Figure 5 presents dynamics of changes in prices for cereals and oil crops in relation to those of 1961. The first period was characterised by the predominance of changes in prices for cereals over those of oil crops. After 1972 dynamics of changes in prices for both groups of crops increased. We may not definitely indicate the group of crops, which prices were growing faster. It may only be stated that prices of oil crops were more stable than those of cereals, which could have been an argument persuading producers to select this type of production and in the end to become the argument for selection an oil plants instead of cereals.

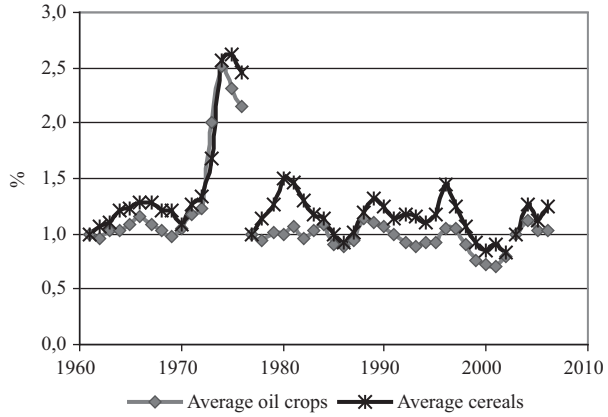

Fig. 5. Dynamics of changes in prices of cereals and oil crops in analysed periods
Rys. 5. Dynamika zmian cen roślin zbożowych i oleistych w analizowanych okresach

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

3. Changes in the structure of importers and exporters of cereals and oil crops

Changes in the competition for space between cereals and oil crops may also be connected with changes in the structure of importers and exporters on the world market of cereals and oil crops, i.e. the development of cultivation of these two types of crops and changes in the level of their demand in individual countries. Main changes on the world markets of cereals and oil crops include increased amounts of exported and imported cereals as well as oil crop materials, and the diversification of the market. In the analysed period we may point to the fact that EU countries since 1976 (that is the year preceding the first turning point) became net cereal exporters instead of net importers. This situation pertains particularly to Great Britain and Germany.

However, the much bigger quantity changes were observed in China, India and Brazil. China in 1961 imported the net amount of almost 12 million ton of cereals, while from the beginning of the 21st century the country has been a net exporter. In the last analysed year net export of that country was 2.5 million ton. Even more marked changes were recorded in India, a country which in 1961 imported a net amount of over 8 million ton of cereals and starting from the beginning of the 21st century net export of that country has been almost 8 million ton. Similar changes, although shifted by several years, were recorded in Brazil. So it is possible to tie the growth of importance of China of India and Brazil in the analysis of competition for space together with the second turning point.

Changes in the direction of competition for space in the last of analysed periods we can also chain with the no-consumer utilisalion of oil crops materials. Due to the potential directions in the utilisation of oil crop materials on the world market of oil crops a constantly growing demand has been observed. The biggest demand is found in the European Union, which has been a net importer of oil crop materials. Among net importers of oil crop materials, next to the EU, an important role is played by Japan and China, which in the last analysed period was characterised by the strongest dynamics of growth in the demand for oil crop materials.

4. Changes in dynamics of utilisation of cereals

Changes in the competition for space between oil crops and cereals was also affected by changes in the directions of utilisation of cereals. Figure 6 presents the dynamics of production and utilisation of cereals for food and fodder purposes in the years 1961–2003. Changes were shown in reference to the first years of the above mentioned periods. In the first year we may observe a bigger dynamics of utilisation of cereals for food purposes, while in the second period utilisation for fodder purposes predominated.

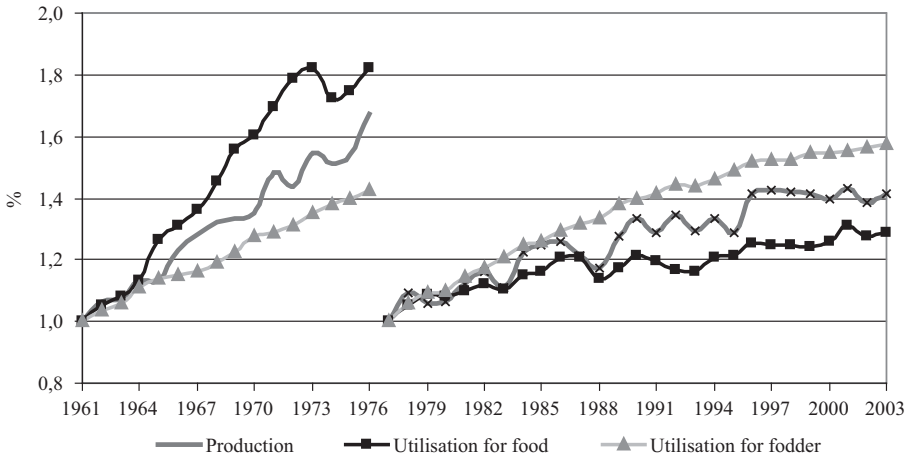

Fig. 6. Dynamics of production of cereals and their utilisation for food and fodder purposes in the years 1961–2003

Rys. 6. Dynamika produkcji zbóż oraz ich wykorzystania na cele spożywcze i paszowe w latach 1961–2003

Source: Own study based on FAOSTAT 2009.
Źródło: Opracowanie własne na podstawie FAOSTAT 2009.

CONCLUDING REMARKS AND CONCLUSIONS

Based on the conducted investigations it may be stated that there is no competition for space between both groups of crops in reference to the entire analysed period. It may only be indicated that such competition was recorded in the years 1976–2002, in which with an increase in the area cropped to these plants by 1 million ha the cultivation of cereals was reduced by 0.9 million ha. In turn, in the years preceding this period and following it a simultaneous increase was reported in the area cropped to both these groups of plants. It was found that in the first period an increase in the cultivation of oil crops by 1 million ha was connected with an increase in the cultivation of cereals by 1.1 million ha. In the last period, which was also considered complementary, an increase in the cultivation of oil crops was accompanied by 0.7 million increase in the area cropped to cereals.

It was attempted to link this situation with the following factors: technical change in agriculture, changes in prices and related changes in the structure of foreign trade, as well as changes in the dynamics of directions in the utilisation of cereals.

An upward trend was observed in the entire analysed period for the area on which oil crops were cultivated. This situation was obviously affected by the constantly growing demand and as a consequence shortages of this raw material on the world market. In turn, changes in the area cropped to cereals may be explained by changes in the dynamics of demand for cereal products. The first years of the analysed period are connected with the strong demand for cereals both for food and fodder purposes, resulting from economic growth in developed countries. After the demand for meat products in these countries had been satisfied, the area cropped to cereals was reduced. It is also of importance that in that period many developing countries (e.g. China, India, Brazil), from being net importers turned into considerable net exporters. Due to a lack of data concerning the utilisation of cereals after 2003 it is difficult to draw conclusions concerning the last analysed period. However, it may be assumed that the third period was connected with a repeated increase in the dynamics of demand for cereals for fodder purposes, caused by the economic development in developing countries, as well as an increase in the demand for cereals for energy purposes.

It was shown in the study that a more dynamic increase in the cultivation of oil crops in comparison to cereals was also connected with differences in the dynamics of increase in yields and fluctuations in prices. A faster increase in yields of oil crops and their smaller fluctuations in prices and as a consequence more reliable yields all contributed to an improvement of the economic standing of their producers. These factors also had an obvious effect on technical change in agriculture in that area.

Complementary periods need to be linked with external factors in the cultivation of both these plant groups. The development in the area cropped to cereals and oil crops in the first period took place mainly at the expense of forested areas. In turn, in the third period the area of cultivation for both these groups of crops was increased at the expense of both forests and other groups of crops, primarily grassland. In the years 2002–2007 the area of arable land increased by approx. 15 million ha, while the area of meadows and pastures decreased by approx. 43 million ha and the forested area by approx. 37 million ha[4].

We need to consider within this study also the effect of actions, which aim is to guarantee food and energy security. Food security was a priority in the economic policy of developed countries. As we may observe on the basis of the European Union and the United States, state interventionism in that area ended in food surpluses in the late 1970's. Food surpluses and the situation on the markets of energy raw materials have contributed to the development of the non-food utilisation of agricultural produce, thus justifying an increased demand for these products.

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[4] Figures reported in this study come from the FAOSTAT 2009 data base.

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KONKURENCJA POWIERZCHNIOWA ZBÓŻ I OLEISTYCH NA ŚWIECIE W UJĘCIU DYNAMICZNYM

Streszczenie. Na światowym rynku podstawową grupę roślin pod względem produkcji, jak i powierzchni upraw stanowią zboża oraz rośliny oleiste. Produkcja tych obu grup w ostatnich czterech dekadach mocno się rozwija i jak pokazują prognozy nadal się będzie rozwijać. Rozwój produkcji zbóż i roślin oleistych jest wynikiem ciągle rosnącego popytu spożywczego na produkty przerobu tych dwóch grup roślin, jak również mocno rozwijającego się w ostatnich latach popytu niespożywczego. Zwiększenie produkcji roślinnej może odbywać się przez wzrost plonów lub zwiększenie powierzchni upraw albo przy jednoczesnym wpływie obu tych czynników. Rozszerzenie powierzchni upraw jest związane z problemem ograniczonych zasobów ziemi. Ciągle rosnący popyt na produkty zbożowe i oleiste oraz ograniczoność zasobów ziemi mogą powodować konkurencję powierzchniową między tymi dwoma grupami roślin. W pracy podjęto badania mające na celu stwierdzić, czy taka konkurencja ma miejsce.

Słowa kluczowe: zboża, oleiste, produkcja, konkurencja powierzchniowa

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