RESEARCH ON AGRICULTURAL PRODUCERS' BEHAVIOUR IN THE MARKET OF MINERAL FERTILIZERS IN POLAND

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Abstract. *The paper outlines the problems associated with market decisions and their extra-economic determinants in the scope of purchase of mineral fertilizers by farmers. Every purchase of fertilizers for an agricultural holding is preceded by a selection made according to an individual, complex set of criteria and factors. The complexity of the entire decision-making process undertaken by farmers increases along with the development of the market of mineral fertilizers. This intensifies the need of identifying the factors affecting the decision of an agricultural producer regarding the purchase and use of a specific fertilizer. The main goal of this publication is to present the results of studies on the behaviour of agricultural producers in the market of mineral fertilizers in Poland. The correspondence analysis was used for analysing the determinants affecting the behaviours of farmers. The results of the studies have showed that the three most important factors affecting the purchase of fertilizers by farmers are the price of a fertilizer, its quality, and the nutritional requirements of crops. The results of the analyses have also indicated that all the investigated factors were dependent on the age of agricultural producers. Besides, the other major determinants of behaviours were the education of agricultural producers and the area of their agricultural holdings.*

Key words: *behaviours of farmers, mineral fertilizers, correspondence analysis*

Introduction

Different definitions of consumer behaviours can be met in the economics literature. For example, J.F. Engel, R.D. Blackwell and P.W. Miniard define consumer behaviour as the sum of activities associated with obtaining, using and disposing of products and services, including the decisions preceding and conditioning these activities (Engel, Blackwell, Miniard 1993).

The term "behaviour" in relation to the issues presented in this study covers internal problems of the functioning of agricultural holdings, including decisions as to the purchase of agricultural production means. The problems of market behaviours of farmers discussed in this study are the centre of attention of many scientific disciplines, inter alia sociology, psychology, economics, and agriculture. Behaviours of agricultural producers

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are shaped to a high extent by the influence of the natural and social environment. The character of a region in which agricultural producers keep their agricultural holdings may be significant in shaping their behaviours. The behaviours in the market of mineral fertilizers depend not only on psychological and social factors, but also on the knowledge of farmers and their rational, economically grounded choices.

In the scientific literature concerning the subject, there is a considerable shortage of scientific research on the behaviours of agricultural producers in the markets of agricultural production means. Currently, the majority of agricultural and economic studies on fertilizers and fertilization, conducted in research establishments, concern changes in the level of consumption of fertilizers in selected areas, the efficiency of fertilization or relations between the prices of mineral fertilizers and the prices of agricultural products (Farquharson, 2006; Daberkow, Huang, 2006; Law-Ogbomo, Emokaro, 2009; Piwowar, 2011; Piwowar, 2013). Much of the research about the economic determinants of input purchases by farmers (also for fertilizers) applies to Western Europe (Burrell, 1989; Hansen, 2004; Thijssen, 1992). Basing on the scientific literature concerning the subject, it can be concluded that no detailed studies aiming at the identification of the factors shaping the behaviours of agricultural producers in the market of mineral fertilizers in Central Europe have been carried out so far. Answers to the following questions are not known: *Which factors determine the choice of a specific fertilizer by an agricultural producer? Are these the factors of competitiveness in the market of mineral fertilizers, for example, the price, quality, brand, or perhaps the factors resulting from the crop cultivation technology used and the technical equipment held by agricultural holdings? What are the determinants of market behaviours of agricultural producers: the features of agricultural producers (e.g., age, education) or the features of agricultural holdings (inter alia, arable land area, localization of agricultural holdings)?* The answers to the aforementioned questions are important not only from the cognitive but also from the utilitarian point of view. Knowledge of the determinants of farmers' behaviours in the market of mineral fertilizers is important for companies, since the behaviour of agricultural producers should be taken into account and should provide a basis for managing the companies. As it is emphasized by Urban, "... the production of means of production for agriculture must be closely linked to the situation in the agriculture and to the directions of development in this sector of the national economy, as well as to the needs and behaviours of agricultural producers" (Urban, 2002). The significance of the research on farmers' behaviour in the scope analysed in this study results from the importance of mineral fertilizers in agricultural production. Mineral fertilizers constitute the most important crop yield enhancement factor in agricultural production and have considerable potential possibilities. The specific character and importance of mineral fertilizers in crop production make it worth paying attention to the issues related to their purchase by farmers.

The goal and methodology of the research

The main goal of this publication is to present the results of studies on the behaviours of agricultural producers in the market of mineral fertilizers in Poland. The author's own studies conducted among 319 agricultural producers provided a basis for this study. In accordance with the adopted methodological assumptions, agricultural producers who use agricultural lands with an area of at least 5 ha of arable land took part in this study. The method of selecting a sample and its size allows proposing a thesis that the studies were representative of agricultural holdings with an area over 5 ha in the investigated province. The studies were conducted in the area of three districts (Wrocławski, Strzeliński, and Kłodzki) of the Lower Silesian Province, which differ considerably in terms of both their socio-economic development level and the possibilities of agricultural development. Although distances between the analysed districts are small, the possibilities of their agricultural development differ substantially. The Wrocławski district is characterized by a typically suburban agriculture. The development of residential housing construction in rural areas of the Wrocławski district is the reason why agriculture keeps losing its importance. Nevertheless, it should be emphasised that in the Wrocławski district there are very good soil and climatic conditions for agricultural development. On the other hand, the Strzeliński district is a typically agricultural region. This is primarily connected with the presence of fertile soils. An additional factor conducive to the development of agriculture is a well-developed advisory and service potential for agricultural production. The relatively worst natural conditions for agricultural production occur in the Kłodzki district. A large part of this district is situated on mountainous and hilly areas. The rural areas of the Kłodzko Valley are characterized by high natural values offering big possibilities of the development of alternative sources of livelihood for the rural population, including, *inter alia*, agritourism. Selection of the districts was preceded by an analysis of their socio-economic development level on the basis of the taxonomic measure of development according to Hellwig's concept (Młodak, 2006).

The questionnaire surveys of farmers, carried out in 2009, were part of the research work leading to a deeper understanding of problems related to competition and competitiveness in the market of mineral fertilizers in Poland. It should be noted that Poland is one of significant producers of mineral fertilizers in Europe – the third in terms of the production volume of nitrogenous fertilizers and the second in terms of phosphoric fertilizers (Piwowar, 2012). Both quantitative and qualitative analyses concerning the behaviours of agricultural producers and the competition and competitiveness in the investigated market of agricultural production means were performed within the present study.

When analysing the behaviours of agricultural producers in the market of mineral fertilizers, the correspondence analysis method was widely used. A comprehensive

description of this method, including details concerning calculations and applications, can be found in Greenacre's publication entitled *Theory and applications of correspondence analysis* (Greenacre, 1984). The research methodology was also comprehensively described in works of other authors (Benzécri, 1973; Dervin 1988). The methodology of the analysis is based on the χ^2 test for independence. The multiple correspondence analysis was used in this study, because the subject of the author's interest was co-occurrence of categories of selected variables affecting the behaviours of agricultural producers in the market of mineral fertilizers. Analyses based on the Burt table (symmetric block matrix) were performed within the study in order to investigate the co-occurrence of categories of many variables. The so-called mean square contingency (mean square contingency coefficient φ^2) was used for measuring the independence. The complexity and multi-faceted character of the problems was conducive to the choice of the correspondence analysis as the main method for studying the factors that affect the purchase decisions of farmers in the investigated market. Considering the large number of variables, a graphical representation of data in a bivariate projection space was used in this study.

Eight factors were selected for analysing the behaviours of farmers: the price of a fertilizer, the brand of a fertilizer, the quality of a fertilizer, the technical equipment of agricultural holding, the crop cultivation technology, nutritional requirements of crops, the country of fertilizer production, and habit (tradition). The selection of factors was not accidental as the main assumption was to study different economic and extra-economic determinants affecting the behaviour of agricultural producers. The main theme of the considerations proposed in the study is the existence of relationships among the selected factors affecting the purchase of mineral fertilizers and the demographic and social features of agricultural producers, primarily age, education, the area and location of agricultural holding (one of the three districts selected for the study).

Results

The survey questionnaire, which was used as a measurement tool in this study, allowed assessing the influence of the selected factors on the decisions regarding the purchase of mineral fertilizers by agricultural producers (Fig. 1).

Analysis of the material collected in the questionnaires indicates that according to agricultural producer there are three most important factors contributing to making a decision on the purchase of a particular mineral fertilizer: the price of a fertilizer, its quality, and the nutritional requirements of crops. Subsequently, the agricultural producers mentioned the crop cultivation technology used in the agricultural holding, the brand of a fertilizer, the technical equipment of the agricultural holding, and the country of production of a fertilizer. According to the respondents, the least important factor is a habit (tradition). In particular, the latter fact is interesting, because there is a general

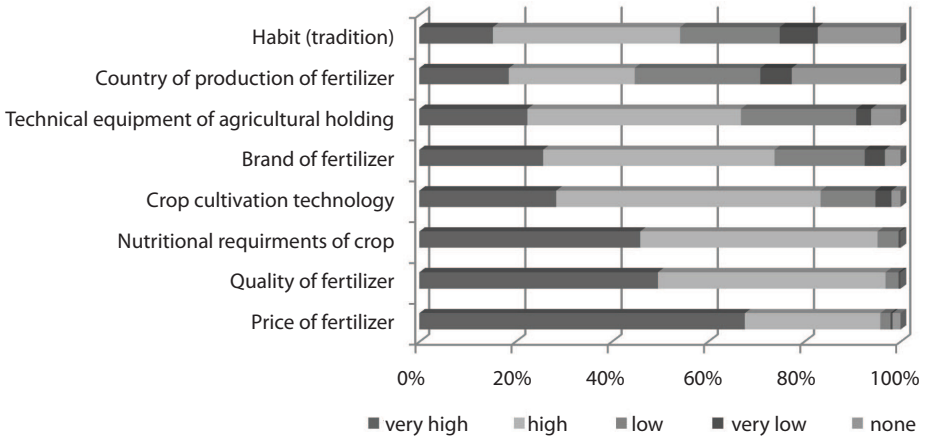


FIG. 1. **The impact of the selected factors on the farmers' decisions concerning the purchase of mineral fertilizers – according to the opinions of agricultural producers**

Source: own study based on the surveys carried out among farmers.

opinion that agricultural producers have a conservative approach to the issues connected with the purchase of agricultural production means. As it appears from Fig. 1, the three most important factors affecting the purchase of mineral fertilizers by producers (price, the quality of a fertilizer, and the nutritional requirements of crops) are of very high or high importance for almost all the farmers surveyed. An analysis of the co-occurrence of the statements associated with these factors and the features of respondents is therefore pointless (all investigated features showed the co-occurrence with a very high or high influence exerted by the analysed factors). The correspondence of the other five factors affecting the behaviour of agricultural producers with the demographic and social features of the respondents (farmers' statements related to the materiality of these factors were very differentiated) is interesting from the cognitive point of view.

The first of the conducted analyses aimed at identifying the relationship between the respondents' statements concerning the attachment to the tradition when selecting fertilizers and the features characterizing the farmers and their agricultural holdings. The main task of the testing was to determine which categories of attachment to tradition were most characteristic of the mentioned groups (age, education, the area of the agricultural holding, and the district where the agricultural holding was located). The results of this part of the studies are presented in Table 1.

The critical values read from the chi-square distribution tables for three pairs of features (habit – age, habit – education, habit – arable land area) are lower than the calculated χ^2 statistics values. This means that the hypothesis on the independence of the investigated features should be rejected, and thus it can be stated that the attachment to tradition (habit) as a factor shaping the behaviours in the market of mineral fertilizers

TABLE 1. **Statistical values χ^2, critical values $\chi^2_{\alpha=001}$* (in parentheses), and mean square contingency φ^2 for the following features: habit (tradition), age, education, arable land area, and district**

φ^2 \ χ^2	Age	Education	Arable land area	District
Habit	124.897 *(42.980)*	109.875 *(26.217)*	72.156 *(42.980)*	15.696 *(20.090)*

Source: own study

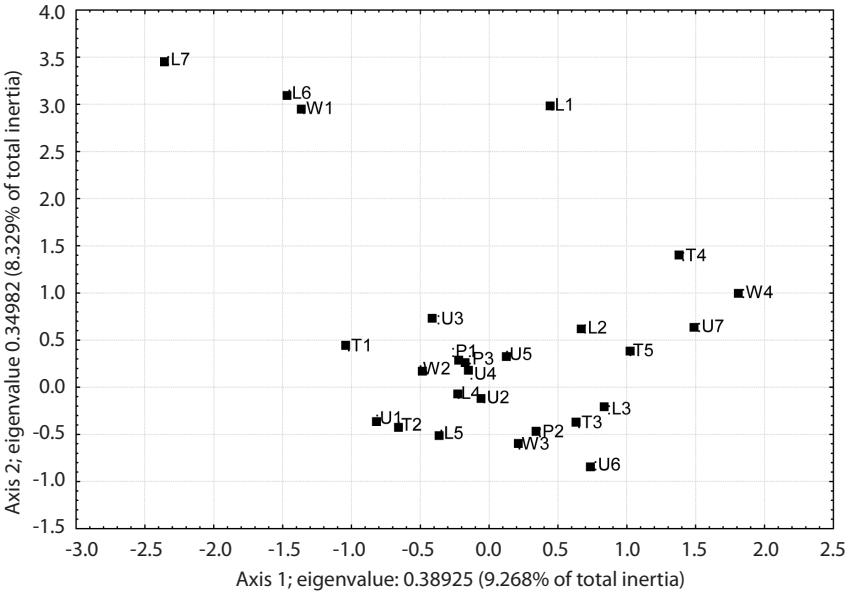
depends on the age and education of agricultural producers and the area of their agricultural holdings. The χ^2 statistics does not determine the strength of the correlation among the features. The value of the mean square contingency φ^2 was calculated for this purpose. When comparing the calculated values of this metric, one can see that the attachment of agricultural producers to the tradition (habit) when purchasing mineral fertilizers depends mostly on their age, education, and the area of their agricultural holdings.

Figure 2 shows the results of the analysis of the correspondence between the importance of the attachment to the habit (tradition) when selecting fertilizers and the investigated features of agricultural producers in the bivariate space.

A graphic presentation of simultaneous occurrences has shown that there is a co-occurrence among the variables. The analysis leads to the conclusion that the agricultural producers who attach considerable importance to tradition when purchasing fertilizers (T2) were characterized by the fact that they kept relatively smaller agricultural holdings (U1) and were advanced in years (L5). On the other hand, the agricultural producers declaring that the influence of the attachment to the habit (tradition) was low (T3) were much younger (L3). Additionally, from the analysis of the data it appears that those agricultural producers who declared a very low influence of the tradition on the selection of fertilizers (T4) had mainly higher education (W4).

The second of the analyses consisted in determining the co-occurrence between statements of agricultural producers concerning their attachment to the country where a fertilizer is produced and the variables characterizing the surveyed farmers. The χ^2 statistics values and the mean square contingency φ^2 for the data concerning the investigated features are presented in Table 2.

The calculated values of χ^2 statistics indicate that the hypothesis on the independence of the features should be rejected only in the cases of the of country of fertilizer production and age. Thus, it can be concluded that the country of fertilizer production as a factor shaping farmers' behaviours in the market of fertilizers depends on the age of agricultural producers.



Variable	Habit					Age							Education				Arable land area							District		
	very large	large	small	very small	none	<19	20–29	30–39	40–49	50–59	60–69	>70	primary education	vocational educ.	secondary educ.	higher education	5–9.99	10–14.99	15–19.99	20–29.99	30–49.99	50–99.99	100 and more	Wrocławski district	Strzeliński district	Kłodzki district
Symbol	T1	T2	T3	T4	T5	L1	L2	L3	L4	L5	L6	L7	W1	W2	W3	W4	U1	U2	U3	U4	U5	U6	U7	P1	P2	P3

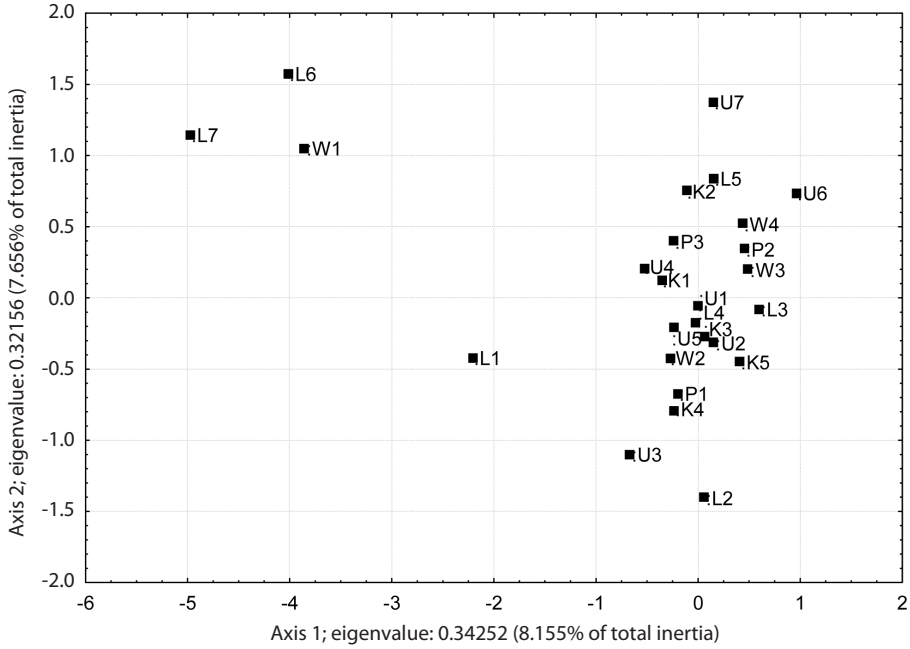
FIG. 2. **Graphic presentation of the results of analysis of the correspondence between the importance of farmers' attachment to habit (tradition) when selecting fertilizers and the investigated features of agricultural producers in a bivariate space**

Source: own study.

TABLE 2. **Statistics values χ^2, critical values $\chi^2_{\alpha=001}$ (in parentheses), and mean square contingency φ^2 for the following features: country of production of fertilizer, age, education, arable land area, district**

φ^2 \ χ^2	Age	Education	Arable land area	District
Country of production of fertilizer	92.193 *(42.980)*	15.735 *(26.217)*	26.132 *(42.980)*	15.839 *(20.090)*

Source: own study.



Variable	Country of production of fertilizer					Age							Education				Arable land area							District		
	very large	large	small	very small	none	<19	20–29	30–39	40–49	50–59	60–69	>70	primary	vocational	secondary	higher	5–9.99	10–14.99	15–19.99	20–29.99	30–49.99	50–99.99	100 and more	Wrocławski	Strzeliński	Kłodzki
Symbol	K1	K2	K3	K4	K5	L1	L2	L3	L4	L5	L6	L7	W1	W2	W3	W4	U1	U2	U3	U4	U5	U6	U7	P1	P2	P3

FIG. 3. **Graphic presentation of the results of the analysis of correspondence between the importance of the country where fertilizer is produced as a factor affecting the selection of fertilizer, and the investigated features of farmers**

Source: own study.

For the optimal representation of the co-occurrence of the variables, the bivariate projection space was adopted, similarly to the first analysis. The graphic presentation of the results of the correspondence analysis is shown in Fig. 3.

An analysis of the location of points in Fig. 3 leads to the conclusion that the agricultural producers having agricultural holdings with an area of 20–29.99 ha (U4) are characterized by a very high influence of the factor of the country of fertilizer production on the purchase of the fertilizer (K1). In addition, the K1 point is located close to the P3 point (Kłodzki district), which indicates the existence of a relationship between

TABLE 3. **Statistical values χ^2, critical values $\chi^2_{\alpha=001}$ (in parentheses), and the mean square contingency φ^2 for the following features: technical equipment of agricultural holdings, age, education, arable land area, district**

χ^2 / φ^2	Age	Education	Arable land area	District
Technical equipment of agricultural holdings	48.563 *(42.980)*	46.648 *(26.217)*	76.102 *(42.980)*	29.007 *(20.090)*

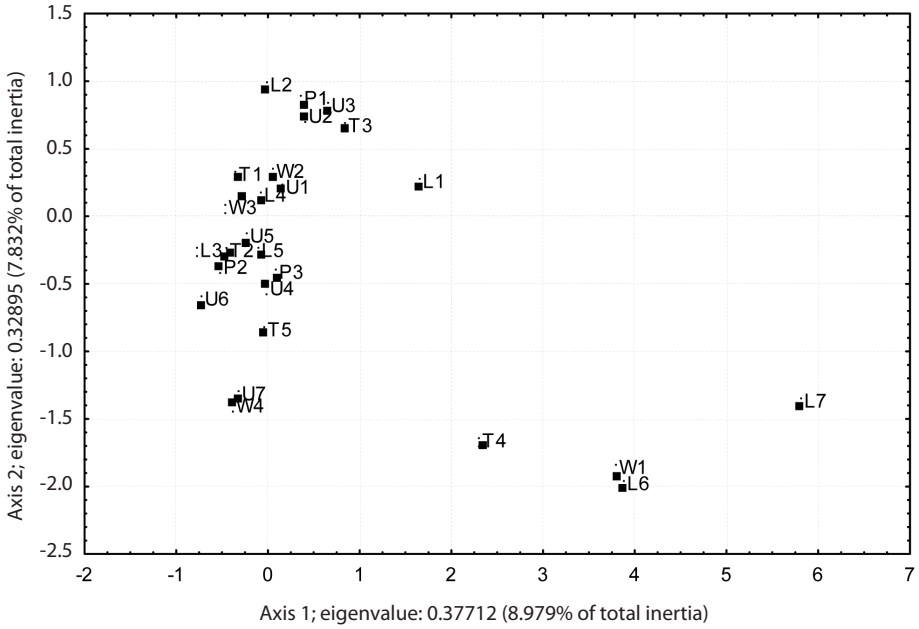
Source: own study.

these variables. Similarly, a very low attachment to this factor (K4) relates to the agricultural producers living in the Wrocławski district (P1). The results of the analyses also indicated that the declared high influence of the investigated factor (K2) was characteristic of the farmers aged 50–59 years (L5). Basing on the scatter of points, it can also be concluded that the profiles of the agricultural producers stating that the influence of the country of fertilizer production was low (K3) and none (K5) are very similar. This is indicated by the close proximity of these points in the correspondence analysis chart.

The aim of the next analysis was to indicate the simultaneous occurrences of statements about the influence of technical equipment in agricultural holdings on the purchase of mineral fertilizers and the investigated demographic and social features of agricultural producers. The χ^2 statistics values and the mean square contingency φ^2 for the variables are presented in Table 3.

The critical χ^2 values from the distribution tables, at the significance level of $\alpha = 0.01$, are lower than the calculated χ^2 statistics for all pairs of features. This means that the hypothesis on the independence of the investigated features should be rejected, and thus it can be stated that the technical equipment of an agricultural holding as a factor shaping the demand for mineral fertilizers depends on the age and education of agricultural producers, as well as on the area and location of their agricultural holdings. The value of the mean square contingency φ^2 determining the strength of these dependencies showed that whether farmers pay attention to the technical equipment of agricultural holding when purchasing mineral fertilizers depends mostly on the area of the agricultural holding and then on the age and education of farmers. The analysis also proved that the weakest dependencies concerned the location of agricultural holdings ($\varphi^2 = 0.091$).

The results of the correspondence analysis are presented in Fig. 4 in a bivariate space. The graphic presentation of simultaneous occurrences of the categories of the investigated variables reveals the technical equipment of an agricultural holding to be a very important factor (T1) when purchasing mineral fertilizers for the farmers aged 40–49 (L4) with the basic vocational education (W2) or secondary education (W3), as well as for agricultural producers that use relatively smallest agricultural holdings with an



Variable	Technical equipment of agricultural holding					Age							Education				Arable land area							District		
	very large	large	small	very small	none	<19	20–29	30–39	40–49	50–59	60–69	>70	primary	vocational	secondary	higher	5–9.99	10–14.99	15–19.99	20–29.99	30–49.99	50–99.99	100 and more	Wrocławski	Strzeliński	Kłodzki
Symbol	T1	T2	T3	T4	T5	L1	L2	L3	L4	L5	L6	L7	W1	W2	W3	W4	U1	U2	U3	U4	U5	U6	U7	P1	P2	P3

FIG. 4. **Graphic presentation of the results of analysis of correspondence between the importance of technical equipment of agricultural holding when purchasing mineral fertilizers and the investigated features of farmers**

Source: own study.

arable land area of 5 to 9.99 ha (U1). When interpreting the results of the correspondence analysis, it can be concluded that there are relationships between the statements attaching considerable importance to the technical equipment of agricultural holding (T2), the location of agricultural holdings in the Strzeliński district (P2), the agricultural holding area of 30 to 49.99 ha (U5), and the age of farmers between 30 to 39 years (L3). On the other hand, the very low importance of this factor (T3) co-occurred together with an agricultural holding area of 10 to 14.99 ha (U2) and 15 to 19.99 ha (U3). As shown by the analysis performed for the statements on a very low importance (T4) and no importance

TABLE 4. **Statistics values χ^2, critical values $\chi^2_{\alpha=001}$ (in parentheses), and mean square contingency φ^2 for the following features: brand of fertilizer, age, education, arable land area, district**

φ^2 \ χ^2	Age	Education	Arable land area	District
Brand of fertilizer	61.398 *(42.980)*	18.972 *(26.217)*	74.727 *(42.980)*	4.398 *(20.090)*

Source: own study.

(T5) of the technical equipment of agricultural holdings as a factor affecting the purchase behaviours of farmers, no relationships with the demographic and social features of agricultural producers can be indicated.

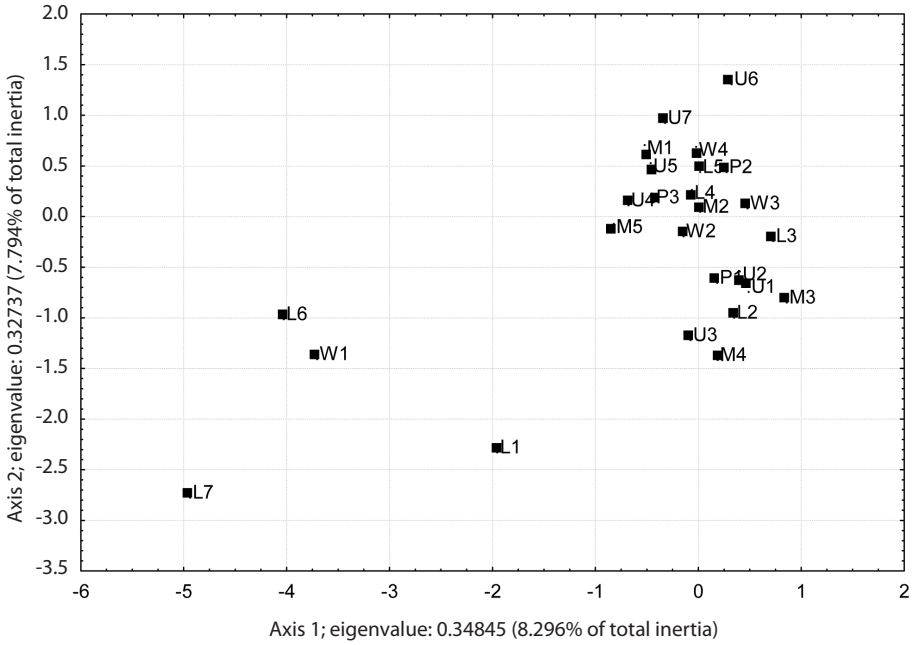
Another research problem that was solved using the correspondence analysis concerned a simultaneous occurrence of statements on the importance of the brand when purchasing mineral fertilizers and the investigated demographic and social features of agricultural producers. The χ^2 statistics values and the mean square contingency φ^2 for these variables are presented in Table 4.

Verification of the empirical values of χ^2 leads to the conclusion that the hypothesis on the independence of features should be rejected for two pairs of features: fertilizer brand – age and fertilizer brand – arable land area. Thus, it may be concluded that the brand of a fertilizer as a factor shaping farmers' behaviour in the market of fertilizers depends on the age of agricultural producers and the arable land area of their agricultural holdings. On the other hand, the mean square contingency metric φ^2 showed that the interdependence was strongest for the following pair of features: mineral fertilizer brand – arable land area.

For the optimal representation of the co-occurrence of the variables, a bivariate projection space was adopted. A graphic presentation of the correspondence between the importance of the brand when purchasing mineral fertilizers and the investigated features of farmers is shown in Fig. 5.

The results of the analysis confirmed the co-occurrence of some categories of features. The correspondence between the statements on a low (M3) and a very low (M4) importance of the brand in the selection of a fertilizer and relatively smaller agricultural holdings, (U1, U2) and (U3), respectively, was particularly characteristic. The second regularity indicates a co-existence of a very high importance of the brand (M1) when purchasing fertilizers and the agricultural holdings with an area of 30 to 49.99 ha (U5) as well as large agricultural holdings with an area of 100 ha and more (U7).

The aim of the last correspondence analysis was to indicate a simultaneous occurrence of statements on the importance of the crop cultivation technology when purchasing mineral fertilizers and the demographic and social features of farmers. The χ^2 statistics values and the mean square contingency φ^2 for the investigated variables are presented in Table 5.



Variable	Brand of fertilizer					Age							Education				Arable land area							District		
	very large	large	small	very small	none	<19	20–29	30–39	40–49	50–59	60–69	>70	primary e	vocational	secondary	higher	5–9.99	10–14.99	15–19.99	20–29.99	30–49.99	50–99.99	100 and more	Wrocławski	Strzeliński	Kłodzki
Symbol	M1	M2	M3	M4	M5	L1	L2	L3	L4	L5	L6	L7	W1	W2	W3	W4	U1	U2	U3	U4	U5	U6	U7	P1	P2	P3

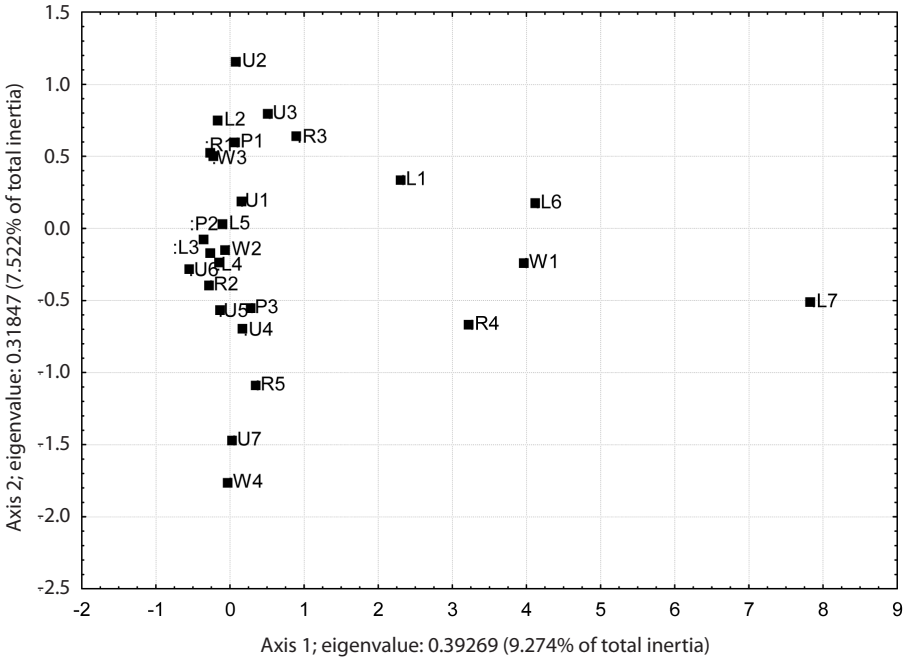
FIG. 5. **Graphic presentation of results of the analysis of the correspondence between the importance of brand when purchasing mineral fertilizers and the investigated features of farmers**

Source: own study.

TABLE 5. **Statistical values χ^2, critical values $\chi^2_{\alpha=001}$ (in parentheses), and mean square contingency φ^2 for the following features: crop cultivation technology, age, education, arable land area, district**

φ^2 \ χ^2	Age	Education	Arable land area	District
Crop cultivation technology	90.581 *(42.980)*	50.483 *(26.217)*	39.645 *(42.980)*	12.892 *(20.090)*

Source: own study.



Variable	Crop cultivation technology					Age							Education				Arable land area							District		
	very large	large	small	very small	none	<19	20–29	30–39	40–49	50–59	60–69	>70	primary	vocational	secondary	higher	5–9.99	10–14.99	15–19.99	20–29.99	30–49.99	50–99.99	100 and more	Wrocławski	Strzeliński	Kłodzki
Symbol	R1	R2	R3	R4	R5	L1	L2	L3	L4	L5	L6	L7	W1	W2	W3	W4	U1	U2	U3	U4	U5	U6	U7	P1	P2	P3

FIG. 6. **Graphic presentation of results of the analysis of correspondence between the importance of crop cultivation technology when purchasing mineral fertilizers and the investigated features of farmers**

Source: own study.

The results of the χ^2 independence test has shown that the hypothesis on the independence of features should be rejected for two pairs: crop cultivation technology and age, and crop cultivation technology and education. Whether agricultural producers pay attention to the crop cultivation technology when purchasing mineral fertilizers depends to the highest extent on their age ($\varphi^2 = 0.284$). The results of the correspondence analysis in this area are shown in Fig. 6. Analysis of the location of points in Fig. 6 leads to the conclusion that the very high importance attached to the crop cultivation technology (R1) when purchasing mineral fertilizers corresponds to the following features of agricultural producers:

- age 20–29 years (L2),
- secondary education (W3),
- agricultural holding located in the Wrocławski district (P1).

Additionally, the analysis showed that a considerable importance of the factor of crop cultivation technology (R2) is characteristic of agricultural producers conducting agricultural activity in agricultural holdings with an area of 30 to 49.99 ha (U5) and 50 to 99.99 ha (U6). The results of the studies also indicated that co-occurrence with the demographic and social features of farmers could not be determined for R4 (very low importance of the influence of a factor) and R5 (no importance) points.

Summary and conclusions

The objectives pursued in the studies were of both cognitive and utilitarian nature. The demand for knowledge about behaviours of agricultural producers in the market of mineral fertilizers keeps increasing along with the development of the mineral fertilizer market. Knowing the specificity of the needs of the agricultural producers and the factors affecting the satisfaction of these needs is useful when carrying out the segmentation of the market and building marketing strategies of production and trade companies. The behaviours of agricultural producers should be taken into account by companies operating in the market of mineral fertilizers and should provide a basis for managing them. Companies operating in the market of mineral fertilizers should identify the factors determining the specific behaviours of farmers and take them into account in order to achieve a commercial success.

The correspondence analyses allowed determining the features of an agricultural holding or its owner that have the strongest impact on the selected factors affecting the purchase of mineral fertilizers. In conclusion, it should be stated that the main determinants affecting the behaviours of agricultural producers in the market of mineral fertilizers are the age and education of a farmer and the area of agricultural holdings. As it appears from the studies, a very high or high influence of some factors on the behaviours of farmers significantly limits the implementation of modern technologies and means of production in the crop fertilization areas in Poland. Attaching a very high importance to such factors as the habit (tradition) or the country of production of a fertilizer, especially by relatively smaller agricultural holdings, can cause adverse changes in both the level and structure of fertilizer consumption. On the other hand, statements of the farmers who, prior to the purchase of fertilizers, do not take into account the technical equipment or production technology used in their agricultural holdings give rise to questions about the rationality of production behaviours of agricultural producers. The agricultural machines used in the crop fertilization operations, the precision, proper regulation and efficient performance of which exert an influence on the optimal use of nutrients contained in fertilizers, may be of particular importance in this case.

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