*Economics and Organization of Logistics*
*5 (2), 2020, 5–14*

DOI: 10.22630/EIOL.2020.5.2.9

***Michał Kruszyński***
International University of Logistics and Transport in Wrocław

# Logistics supplying farms with production inputs

## Logistyka zaopatrzenia gospodarstw rolnych w środki do produkcji

**Abstract.** The aim of the study was to illustrate the logistics of supplying selected farms with things of production in the form of synthetic fertilizers, plant protection chemicals, as well as spare parts for machines and fuel. The research was conducted in 2019 on a group of 50 agricultural producers running farms in the Radomsko district in the Łódzkie Voivodeship. The realized research shows that most of the checked farms purchase fertilizers on an annual basis, and plant protection products twice a year or more often. The decisive factor in the purchase of specific means of production is the price as a first one, but non-price factors also gain importance. In most of the farms the direct distribution is developing, where farmers purchase individual means of production from sales representatives on farms.

**Key words:** supply logistics, means of agricultural production, farm

**Synopsis.** Celem opracowania było zobrazowanie logistyki zaopatrzenia wybranych gospodarstw rolnych w środki do produkcji w postaci nawozów syntetycznych, środków ochrony roślin, a także części zamiennych do maszyn i paliwa. Badania przeprowadzono w 2019 roku na grupie 50 producentów rolnych prowadzących gospodarstwa na terenie powiatu radomszczańskiego w województwie łódzkim. Przeprowadzone badania wskazują, iż większość badanych gospodarstw rolnych nabywa nawozy raz w roku, a środki ochrony roślin dwa razy w roku bądź częściej. Czynnikiem decydującym o zakupie konkretnych środków do produkcji jest w pierwszej kolejności cena, ale znaczenia nabierają także czynniki pozacenowe. Rozwija się dystrybucja bezpośrednia, w ramach której rolnicy nabywają poszczególne środki do produkcji od przedstawicieli handlowych na terenie gospodarstw rolnych.

**Słowa kluczowe:** logistyka zaopatrzenia, środki produkcji, gospodarstwo rolne

## Introduction

The process of globalization and the related technological progress determine changes taking place in many branches of the economy, which are always supported by broadly understood logistics. Market development gives economic units the opportunity to

innovate in many areas directly or indirectly related to logistics. They take place in supply logistics, production, distribution, as well as reverse logistics, known as ecological (reverse logistics).

The functioning of the state requires an effective economy, in the area of which the development of the agricultural sector, which is the product base for the agri-food industry, is of particular importance. The task of an efficiently functioning state apparatus is to provide citizens with food security, the achievement of which is possible only through cooperation between agriculture and the processing sector. For the proper functioning of agriculture, the efficient functioning of supply logistics is of particular importance, which is responsible for equipping farms with means of agricultural production (plant protection chemicals, fertilizers, feed, seeds, lubricants, oils, fuel, as well as spare parts for machines and devices and materials). reusable), in the right place and time, taking into account the specificity of agricultural production, which depends on natural conditions.

The aim of the article is to illustrate the elements of logistics of supplying individual farms located in the Radomsko district (Łódzkie Voivodeship) with selected means of agricultural production. The above-mentioned farms conducted mixed production (plant and livestock) and were characterized by a diversified arable land area and production profile.

## Research methodology

For the research done in 2019, farms located in the Radomsko district in the Łódź Voivodeship were deliberately selected, because so far no analyzes have been carried out in this area in terms of logistics of supplying farms with means for agricultural production. 50 selected agricultural producers, representing individual farms conducting mixed production intended for the market, participated in the research. In the studied group, there were no units conducting only plant production or only animal production; always plants were grown and animals were raised in the test subjects. The structure of the researched farms was as follows: 1.01–4.99 ha (4%), 5.00–9.99 ha (12%), 10.00––19.99 ha (42%), 20.00–49.99 ha (32%) and over 50 ha (10%). The owners of the surveyed entities had secondary agricultural (42%), secondary non-agricultural (24%), higher agricultural (16%), higher non-agricultural (8%) and professional agricultural (10%) education.

The research was conducted using the guided interview method in the group of agricultural producers who are owners or users of farms using an interview questionnaire. They were mainly closed in nature with the possibility of single and multiple choice, but also open questions were asked. They concerned the process of supplying farms with means for agricultural production, taking into account such factors as the date of purchase of the desired materials, frequency and structure of purchases, method of delivery, storage period and others. When collecting the research material, the method of systemic information analysis focused on the analysis of secondary sources was used [Kędzior 2005].

The research results were presented using a descriptive, tabular and graphic technique.

## Logistics of farm supplies

Supply logistics is the process of sourcing products and services for the enterprise. It is the beginning of the internal logistic chain in the economic entity; includes projects related to ordering, storage, collection, transport, determination of recipients' needs and rational consumption of goods, as well as maintaining appropriate stocks – evaluation, protection, control [Galińska et al. 2014].

Supply logistics understood in this way forces the creation of material flows at systematic intervals. For a business unit, the proper functioning of supply logistics may lead to a reduction of the company's operating costs and an increase in its competitiveness. Therefore, it is important to optimize supply logistics on an ongoing basis in such a way that it is not only perceived as an efficient transport of materials from the plant to the business unit. It should be considered as part of integrated production, which is the customer of supply logistics. Therefore, production should pose requirements to supply logistics, which in turn should be based on line-back-planning, i.e. designing the production system that is subordinated to the constraints and needs of production [Tyslik 2011].

Costs arising in the area of supply logistics, which should be rationally optimized, are determined by the application of three principles of external material supply:

- individual supply when materials are needed – this principle eliminates the need to store materials and therefore excludes storage costs. Its disadvantage is the risk of production downtime due to delays in material deliveries, as well as ineffective use of technological lines;
- procurement with maintaining stocks – this principle boils down to maintaining a certain level of stocks in the economic unit in order to meet the internal material demand at any time when there is a need to carry out the production process;
- delivery synchronized with the production process – the supplier is obliged to deliver materials on time, determined by the production schedule. This principle allows for keeping safety stocks at a minimum level, which means that storage costs are minimal [Pfohl 2001].

The enterprise and the farm should maintain stocks at an appropriate and optimal level, which ensures the implementation of the production process.

Supply logistics, consisting of a cycle of activities related to the purchase of products or services needed by the enterprise and in accordance with its requirements [Szymańska et al. 2019], is responsible for the integration of the process of the flow of raw materials and materials in the business unit. This integration is responsible for the synchronization of supplies, which means that the raw materials and materials from which the finished products are made reach the economic entity at the right time, as well as the right amount and in the right place [Kempa 2011].

The procurement logistics is closely related to the procurement process itself, which includes all activities necessary to acquire goods and services that are in line with the purchasing entity's expectations. Regardless of the industry, there are four phases – stages of the procurement process; they include collecting information about potential suppliers, selecting suppliers and establishing terms of cooperation, as well as evaluating suppliers and improving cooperation and terminating cooperation [Urbańczyk 2006]. You should be aware of the differences between procurement and supply logistics. The main

difference is that supply logistics differs from the procurement process primarily by the integrated concept of acquiring the means of production, which is always accompanied by information flow processes [Dyczkowska 2012].

Well-organized logistics in the field of supply makes it possible to manage the supply chain of means for production in farms in an economically and technically rational way, regardless of their size and organizational structure. It is important that the supply logistics take into account the seasonality of production in agriculture, the unpredictability of individual production processes, especially in the protection of plants against pests, as well as the infrastructural possibilities of farms (presence of warehouses), their economic situation and human resources. Reliable supply logistics is of particular importance in the case of animal production, where the lack of stocks of materials (feed) leads to irreversible effects and lengthening the production cycle in a branch characterized by the inability to suspend production [Wasilewski 2010].

The logistic system of an organizational unit which is a farm may be very simple or very complex. It depends on farm size, attitude and direction as well as other factors. Logistics of farm supplies includes not only the provision of materials needed to secure the production process in plant cultivation or animal breeding, but also storage (taking into account storage susceptibility), packaging and moving these goods within individual production departments. Supply logistics on a farm must cover all material needs in order to maintain the continuity of the production process while generating minimal logistic costs, which will affect its economic situation [Kuziemska et al. 2016].

The market of suppliers supplying farms with means for agricultural production is characterized by a high degree of flexibility and adaptation to the needs of agricultural producers. In a market economy, where in the agricultural sector there are many competing concerns and dealers of agricultural production means (this mainly applies to plant protection products, fertilizers and animal feed), an agricultural producer can consciously compare commercial offers and choose the best solutions for himself. The criteria for selecting companies supplying farms include, first of all, the prices of the means of production provided, but also the waiting time for the ordered funds, the possibility of transport to the farm, which is now standard, but also the possibility of returning unused batches of material. In addition, the possibility of crediting the purchased products and services or barter exchange (the entity provides the farm with plant protection products, fodder or fertilizers, and the payment is made in grain collected from the farm). Agricultural producers also appreciate agricultural consultancy provided by suppliers of means of production and collection of used packaging, pallets or oils.

## Research results

Plant production conducted in all researched farms requires the use of various means of production, among which plant protection products (pesticides) as well as artificial fertilizers are of particular importance. The aforementioned measures affect the yield of crops, and this determines the efficiency of production. Therefore, it is important to obtain pesticides, as well as artificial fertilizers on conditions favorable to the farm (price of means, transport cost, payment date, waiting time).

The surveyed agricultural producers supply farms with fertilizers; 80% of respondents declare that they purchase nitrogen, phosphorus, potassium, calcium and multi-component fertilizers (NPK). Only 20% of the respondents obtain from the market three (out of five) types of fertilizers (multi-component fertilizers containing nitrogen, phosphorus and potassium, nitrogen and calcium), excluding the use of single-component phosphorus and potassium fertilizers. Artificial fertilizers are purchased once or twice a year (Figure 1).

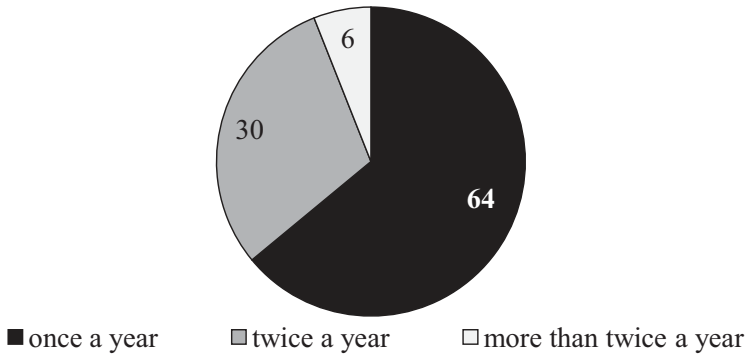


Figure 1. The frequency of purchase of artificial fertilizers by agricultural producers [%]
Rysunek 1. Częstotliwość nabywania nawozów sztucznych przez producentów rolnych [%]
Source: own study.

From among the researched farms, 64% of the farms supplied with fertilizers once a year, while 30% of the respondents made the purchase twice (before starting the spring vegetation and in autumn after sowing). Only 6% of agricultural entities purchase these funds three times. Interviews with agricultural producers and farm managers indicate that the frequency of purchase of fertilizers is determined by the economic condition of farms. Those in better economic condition purchase fertilizers once a year, while those less effective due to the lack of financial possibilities divide the purchase into two parts; spring and autumn. Among the surveyed producers, 70% indicated that the most important factor determining the frequency of purchase of synthetic fertilizers is the economic situation of farms defined at the time of their purchase, followed by the price of fertilizers (14% of responses), as well as the possibility of deferring the payment date or not (10 % of respondents) and no possibility of storage (4% of respondents); other factors were indicated by 2% of the respondents. It is important for agricultural producers to choose a supplier of synthetic fertilizers; the factors determining the selection of a specific farm operator in this respect are presented in Figure 2.

The dominant factor in choosing a supplier of artificial fertilizers is their price; such an answer was declared by 90% of respondents. 34% of the respondents indicated that an important factor in choosing a contractor is the possibility of barter exchange, which in their case consisted in replacing the grain produced on the farm with fertilizers. It is a practice that is increasingly used by agricultural producers; it requires adjusting the terms of delivering fertilizers to farmers and collecting crops from the farm; most often these processes are correlated to optimize transport costs. Supplying farms with fertilizers is always closely related to the logistic process, which is transport, the proper organiza-

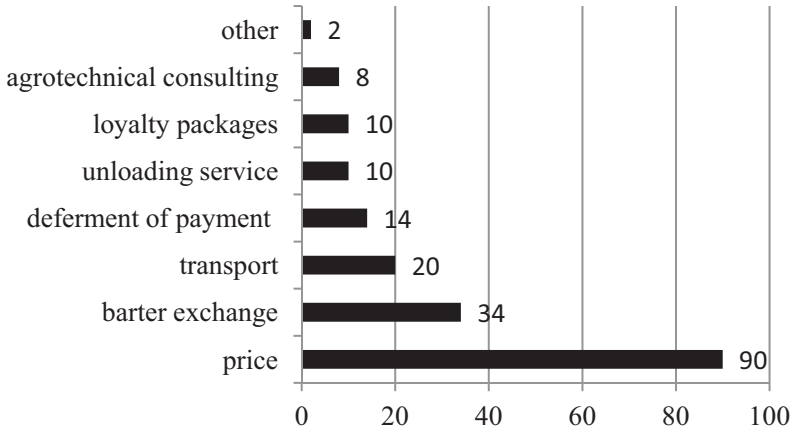


Figure 2. Determinants of selection of fertilizer suppliers for farms [%]
Rysunek 2. Determinanty wyboru dostawców nawozów do gospodarstw rolnych [%]
Source: own study.

tion of which can contribute to increasing the competitiveness of farms by optimizing the production volume and the costs of obtaining it [Wajszczuk 2016].

For 20% of the surveyed agricultural producers, an important issue is the possibility of delivering fertilizers to the farm, as they do not have their own means of transport, and 10% of farmers also expect to offer the service of unloading the delivered products, because these farms are not equipped with handling devices, and also that they do not have their own means of transport. They have manpower at their disposal to transship the purchased fertilizers. In the opinion of 14% of farmers/farm managers – the possibility of postponing the payment date for the purchased means of production is important in this area. The 10% of respondents point to loyalty packages used by the sector serving agriculture. For 8% of the respondents, agrotechnical advice provided by fertilizer suppliers is important, and other factors were indicated by 2% of respondents. The 70% of the surveyed farmers purchase fertilizers from sales representatives directly on the farm, 28% do it personally in wholesalers and other commercial entities; other sources were indicated by 2% of respondents.

The use of pesticides (plant protection products) is important for the functioning of a farm carrying out plant production. These, most often, are acquired twice a year – 70% of responses (Figure 3).

For 70% of agricultural producers declare that pesticides are purchased on farms twice a year. On the other hand, 10% of the respondents claim that they buy them once a quarter, and 4% once a year. The 16% of agricultural producers replied "more often", which means that plant protection products are purchased on the basis of field inspection based on the biological harmfulness threshold correlated with the economic profitability of treatments. Producers point out that this solution is rationale as the funds and economic resources are not frozen. Additionally there is no need to store pesticides on the farm premises (this would require specific conditions), and the situation when pesticides' expiration date during storage is no longer valid, can be avoided..

The researched farms mainly buy plant protection products from representatives of commercial enterprises who deliver pesticides directly to farms – 64% of respondents

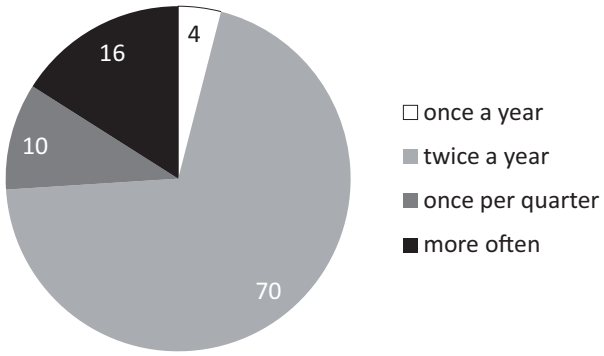


Figure 3.The frequency of purchase of plant protection products by agricultural producers [%]
Rysunek 3. Częstotliwość nabywania środków ochrony roślin przez producentów rolnych [%]
Source: own study.

choose this form of supply (Figure 4). The 22% respondents buy these products in shops and wholesalers, 8% of farmers make purchases online; others buy them directly from the producers; they buy from other farmers or indicate other sources of supply (2% of answers for each variant).

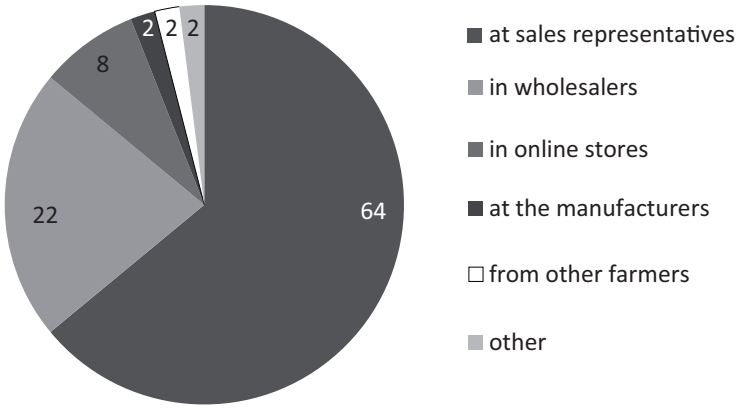


Figure. 4. Sources of supplying farms with plant protection products [%]
Rysunek 4. Źródła zaopatrzenia gospodarstw rolnych w środki ochrony roślin [%]
Source: own study.

For the functioning of farms, it is necessary to supply them not only with fertilizers and plant protection products, but also with spare parts for agricultural machinery and fuel. In the process of selecting suppliers of spare parts for agricultural machinery, the dominant criterion is the price, which was selected by 72% of the 50 surveyed agricultural producers (Figure 5). Purchase conditions (46% of indications) and the distance of the farm from the place of purchase (22%) are also an important factor in this area for farmers. The originality of the parts (12% of responses) and other factors indicated by 2% of respondents are less important.

In the group of factors determining the choice of the place of supplying the farm with fuel for agricultural machinery, the dominant factor is its price (90% of responses), as

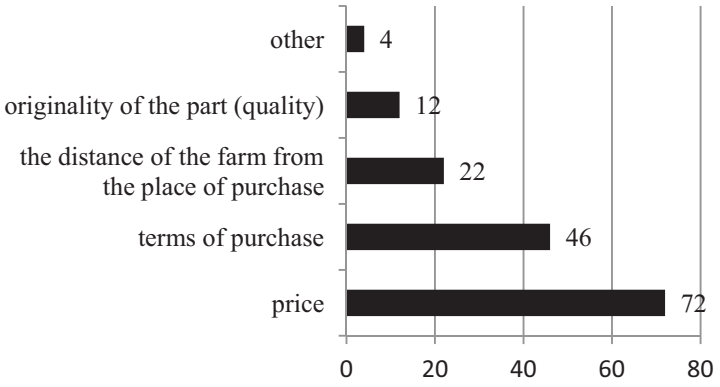


Figure 5. Determinants of selecting suppliers of spare parts for agricultural machinery on farms [%]
Rysunek 5. Determinanty wyboru dostawców części zamiennych do maszyn rolniczych w gospodarstwach [%]

Source: own study.

well as quality (84%), and then the distance from the fuel station to the farm (54%), the possibility of delivering fuel to the farm (48%) and the content of biocomponents (24%). Other factors were indicated by 2% of the respondents (Figure 6).

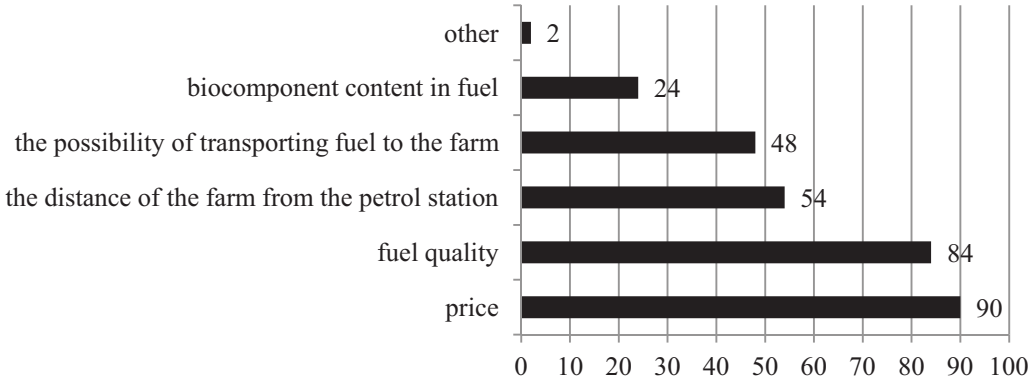


Figure 6. Determinants of the selection of fuel suppliers for tractors and agricultural machines on farms [%]
Rysunek 6. Determinanty wyboru dostawców paliwa do ciągników i maszyn rolniczych w gospodarstwach [%]

Source: own study.

The surveyed farmers declare that they order fuel from farms – 78% of the surveyed buy fuel on the farm from proven sources of supply. They have certified tanks as well as metal barrels enabling safe storage of diesel fuel for longer periods of time. The 14% of respondents purchase fuel at petrol stations, resigning from the service of delivering them to the farm, and 8% of farmers use a mixed system, in which they combine fuel supplies to the door with refilling them at filling stations. The 84% of agricultural producers purchase fuel twice a year, and 26% of the respondents declared that they do so more often.

In the opinion of the surveyed agricultural producers, the system of providing farms with means of production works correctly. Agricultural producers have no problems with the availability of fertilizers, plant protection products, energy drivers, consumables or other materials necessary for plant and animal production. Among the factors determining the choice of a supplier of means of production in agriculture, non-price factors (transport, the possibility of deferred payment terms, etc.) are playing an increasingly important role.

It should be remembered that supplying farms with means for agricultural production has a specific character, which results from the seasonality of production and its dependence on weather conditions. The frequency of deliveries is very often implemented based on the Just in Time concept (exactly on time); it mainly concerns plant protection products, the use of which is very precisely regulated by the development phases of plants and the rate of their infestation by pests (plant pests).

## Summary and conclusions

Based on the research, the following conclusions were drawn:

1. Most farms obtain fertilizers once a year, while plant protection products (pesticides) are purchased by most operators twice a year.
2. The most important criterion for the selection of means for agricultural production in the researched farms is the price, but non-price factors (the possibility of barter size of crops – cereals – for means of agricultural production – fertilizers) are also gaining importance.
3. Agricultural producers more and more often purchase means of production directly on farms from sales representatives; it eliminates transport costs and saves their time.

## References

Dyczkowska J., 2012: Logistyka zaopatrzenia i produkcji – wpływ na logistykę dystrybucji [Supply and production logistics – impact on distribution logistics], Prace Naukowe Politechniki Warszawskiej, Transport 84, 19–28 [in Polish].

Galińska B., Szulc W., 2014: Optymalizacja procesu zaopatrzenia materiałowego w wyniku wdrożenia metody MRP – planowania potrzeb materiałowych [Optimizing the material procurement proces as a result of implementing the MRP method – material needs planning], Logistyka 2, 53–56 [in Polish].

Kempa E., 2011: Problemy zaopatrzenia w systemach logistycznych przedsiębiorstw [Supply problems in logistic systems of enterprises], Zeszyty Naukowe Politechniki Częstochowskiej 4, 7–14 [in Polish].

Kuziemska B., Pieniak-Lendzion K,, Klej P., 2016: Zastosowanie nowoczesnych rozwiązań logistycznych w rolnictwie [The use of modern Logistics solutions in agriculture], Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach. Seria: Administracja i Zarządzanie 109, 173–181 [in Polish].

Pfohl H.Ch., 2001: Systemy logistyczne. Podstawy organizacji i zarządzania [Logistic systems. Basics of organization and management], Wydawnictwo Biblioteka Logistyka, Poznań [in Polish].

Szymańska E., Bórawski P., Żuchowski I., 2019: Łańcuchy dostaw na wybranych rynkach rolnych w Polsce [Supply chains in selected agricultural markets in Poland], Wydawnictwo SGGW, Warsaw [in Polish].

Tyslik M., 2011: Logistyka zaopatrzenia integratorem szczupłej i wydajnej produkcji [Supply logistics as an integrator of lean and efficient production], [in:] Nowoczesność przemysłu i usług. Koncepcje, metody i narzędzia współczesnego zarządzania [Modernity of industry and services. Concepts, methods and tools of modern management], J. Pyka (ed.), Towarzystwo Naukowe Organizacji i Kierownictwa, Katowice, 386–399 [in Polish].

Urbańczyk T., 2006: Logistyka zaopatrzenia [Supply logistics], [in:] Logistyka w biznesie [Logistics in business], M. Ciesielski (ed.), Polskie Wydawnictwo Ekonomiczne, Warsaw, 97–110 [in Polish].

Wasilewski M., 2010: Wybrane zagadnienia klasyfikacji i gospodarowania zapasami w rolnictwie [Selected issues of classification and stock management in agriculture], Wieś Jutra 1, 38–40 [in Polish].

Wajszczuk K. 2016: The Role and Importance of Logistics in Agri-Food Supply Chains: An Overview of Empirical Findings, Logistics and Transport 2(30), 47–56.

Correspondence address:

**Michał Kruszyński, PhD, Eng.**
(https://orcid.org/0000-0002-7905-1403)
International University of Logistics and Transport in Wrocław
Department of Management
Sołtysowicka St. 19b, 51-168 Wrocław, Poland
e-mails: mkruszynski@mail.mwsl.eu