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ECONOMICS TYPOLOGY OF FRUIT FARMS IN THE GRÓJEC AND WARKA AREA

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Abstract. Poland is the biggest apple producing country in the European Union. The highest apple production level in the world there are on the Grójec and Warka area. The aim of the publication is to present a typology of fruit farms in the region of Grójec and Warka. The study made use of: the survey method with using an interview, and Ward's hierarchical clustering method. The study was conducted among 229 fruit farms in Grójec and Warka area in July–August 2010. It allowed for the four types of fruit farms to be distinguished: farms with a potential for development, farms with an average potential for development, farms without a potential for development, and bankruptcy-bound farms.

Key words: typology, apples, horticulture, orchards

INTRODUCTION

In many European countries, development of fruit farming occurred gradually as a result of a constantly increasing standard of living. The fashion for back gardens as well as royal, palace and court orchards, prevalent in various parts of Europe mainly from the end of the 17th century until the turn of the 19th and 20th centuries, also played a significant role in this process. Industrialisation of Europe and internal migration within individual states contributed to the establishment of employee gardens as well as to the transformation of back gardens into fruit farms. An important determinant for the formation of orchards, both in Poland and Europe, came in the form of such elements as: knowledge and skills of farmers (gardeners and fruit farmers) engaging in orchard cultivation [Majewski 2014], the choice of a location suitable in terms of environment and climate, and selection of apple cultivars optimal in terms of market needs. Over the recent decades, the fruit consumption model has undergone a significant transformation. The

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awareness of significance of fruit in human diet has increased accompanied by consumers and consumer organisations' increased pressure on production of safe food, i.e. food free of pollutants, contaminants, and chemical agents [Engler et al. 2013]. In response to the pressure of consumer organisations, institutions of the European Union are modifying regulations pertaining both to packaging and information content to be found on packaging [Mazurkiewicz-Pizło and Pachuca-Smulska 2012]. The literature points to increasing competition on the apple market [Groot 2000]. This process influences the increase in the quality of fruit available on the market as well as the increase in the significance of integrated fruit production, i.e. a combination of ecological and conventional fruit farming [Reganold et al. 2001]. As a result of increased competition on the European fruit market, apples will have to be cheaper to produce. The fruit farmers are seeking optimal management methods able to reduce costs and increase efficiency of fruit farms [Hester and Cacho 2003] on the other they are searching for environment-friendly production methods acceptable for the consumer. It is also important to note there are high diversification of fruit producing enterprises on the European market. Entities operating on this market can have a form of cooperatives, international and domestic enterprises, as well as numerous producer groups. Producer groups constitute an alternative for the developing fruit farms of various size by fulfilling a variety of functions, e.g. increased access to know-how, increased access to market, increased competitive power, conducting joint marketing operations, and obtaining funding from the EU funds [Biernat-Jarka 2006]. As a result of high competition on the fruit market, both the quality of the offered product and the main directions in domestic sales of the domestic product as well as in their distribution have undergone a change. The aim of the publication is to present a typology of fruit farms in the region Grójec and Warka. On this base it will be created typology of orchard farms.

MATERIAL AND METHODS

The area of Grójec and Warka in Poland is characterised by the highest apple production concentration in the world. For the needs of an orchard farms analysis it were also used effects of own studies from the years 2010–2012, which were conducted in the group of orchard farmers from the Grójec and Warka area [Pizło 2001, 2011a and b]. The farms were selected based on the information pertaining to the total area and the area occupied by orchards in individual farms. The study made use of: survey method with using an interview Ward's hierarchical clustering method. The questionnaire of interview consisted of 89 questions pertaining to fruit farms proper and fruit farmers' households. Within the fruit farm area structure the following divisions were identified: up to 2 ha of orchard, from 2.01 to 4 ha, from 4.01 to 8 ha, from 8.01 to 12 ha, and more than 12 ha of orchard. The total area of orchard plantations in these farms was 1,915.65 ha (Table 1). The farms with the area ranging from 4.01 to 12 ha of orchard were dominated in the population participating in the study, and accounted for 80% of research attempt.

Table 1. Area and structure of orchards in the farms covered by the study

Specification	Less than 2 ha (very small)	From 2.01 to 4 ha (small)	From 4.01 to 8 h (medium size)	From 8.01 to 12 ha (big)	More than 12.01 ha (large)	In total
The number of fruit farms taking part in the 2010 study (–)	11	30	89	68	31	229
The structure of fruit farms covered by the 2010 study (%)	4.80	13.10	38.86	29.69	13.54	100
Total orchard area (ha)	15.8	104.55	576.65	693.99	524.66	1915.65
Orchard plantation structure (%)	0.82	5.46	30.10	36.23	27.39	100

Source: Own calculations on the basis of the research conducted in 2010.

THEORETICAL FRAMEWORK

Economic decisions made by fruit farmers pertain to, similarly as in the case of other enterprises, the allocation of financial and material resources as well as one's own time and time of farm labourers (including family members) in such a manner as to maximise profits while making sensible investments in the farm. Fruit farmers' decisions pertain to production issues related, among others, to the choice of: apple rootstock type [Robinson et al. 2004, Gjamovski and Kiprijanovski 2011, Sosna and Gudarowska 2013] which determines the tree's growth, its resistance to frost, and its crop yield; and particular apple cultivar which is connecting both to its florescence [Sosna and Gudarowska 2013] and harvest period. Such decisions should also depend on the target group preferences – i.e. consumer preferences. Next to the above-indicated decisions, the fruit farmers have to decide on the intensity of cultivation, investment issues related to the size of area of new plantings, and construction of a new fruit storage facility. Another type of decisions for the fruit farmer are marketing activity: where, to whom, and for how much to sell apples. It is these decisions that the optimum utilisation of the farm resources and profitability of the venture depend on [Perry et al. 2001]. Next to the above-indicated criteria of an economic character, there are also decisions related to responsibility for the consumer's health and the natural environment [Fan et al. 2012]. Comparative studies of apple cultivars indicate that the factors reducing the environmental impact of fruit farming and which at the same time are significance for the farm's economic standing include [Mouron et al. 2006]: control of energy-consumption, toxicity for natural environment, and eutrophication. Reduction of energy consumption in apple production is to a greater degree correlated to fuel cost reduction (reduced operation of machinery) in particular through optimisation of organisation in the farm (e.g. during apple harvest time) [Mouron et al. 2006]. In turn, the plant protection level depends on the cultivar cultivated as well as homeostasis of the environment. Assessment of plant protection effectiveness is difficult to measure due to the influence of atmospheric factors [Mouron and Scholza 2006], in particular wind, rain and sunshine. For many years, especially following the accession to the EU, specialist fruit farms in Poland have been changing the fruit tree cultivation system departing from traditional cultivation (among others, big trees and wide spacing

between rows) towards dwarf and ridge-top orchards with several thousand trees per 1 ha [Szewczuk et al. 2011]. The income generated from apple cultivation, however, strongly depend on the market and consumer preferences on the one hand while on the other on the agritechnical factors as well as the fruit farmer's know-how and economic capacity. The change in the cultivation method has contributed to the intensification of production and increased efficiency of a substantial part of fruit farms.

CHARACTERISTICS OF THE GRÓJEC AND WARKA AREA – AN AREA OF CONCENTRATED ORCHARD PRODUCTION

The present territory of the Grójec-Warka region almost overlaps with the Grójec poviat area. The Grójec area is dominated by intensive orchard cultivation covering for more than 40% of national apple production. Orchard intensity in individual communes of the Grójec poviat reaches almost 70%. The Commune of Grójec is located 45 km away from Warsaw. In turn, the communes of Warka and Grójec form a homogeneous fruit farming region. The Grójec and Warka area is characterised by concentrated orchard production and it is one of the biggest fruit farming areas in Europe.

WARD'S HIERARCHICAL CLUSTERING METHOD

In the study of the fruit farms in the Grójec and Warka region, groups were isolated with the use of Ward's hierarchical clustering method. Upon a preliminary analysis of the survey data from the set of 229 fruit farms, 30 farms were removed when missing data was detected. Finally, 199 farms constituting the classification object set (Ω) remained to be used in the further studies. Ward's method is frequently employed in economic research [Siedlecka 1998, Dudek and Orłowski 2006, Karpio et al. 2006]; it gives a possibility to group objects in clearly defined clusters with approximate size. The cluster analysis most frequently focuses on a finite set of objects $\Omega = \{o_1, o_2, ..., o_n\}$. Each of the objects in set (Ω) is characterised by m-characteristics represented by variables X_i ($i = 1, 2, ..., m$) and it may be considered to be a point in a certain m-dimensional space, the so-called classification space. Subsequently, a certain measure of distance (d) is introduced inside the set (Ω) thus obtaining a metric space (Ω, d). The methods for classification of objects used presently are divided into several groups and one of those groups is a group of so-called hierarchical clustering methods. These methods commence the classification process from the formation of n one-element clusters (n – number of objects), which in subsequent $n - 1$ steps are combined in increasingly larger groups (clusters) until one cluster containing all the objects is obtained. The algorithm for grouping of objects within the hierarchical clustering methods is as follows:

- having a given set of objects $\Omega = \{o_1, o_2, ..., o_n\}$ and metric d, n of one-element clusters $\{o_1\}$, $\{o_2\}$, ..., $\{o_n\}$ is generated and the matrix of the distance between them is determined $D = [d_{ij}]$;

- based on the matrix of the distance between the clusters $D = [d_{ij}]$, two clusters X and Y located the closest in relation to each other, i.e. compliant with the requirement expressed as $d_{XY} = \min\{d_{ij}\}$, are identified;
- clusters X and Y are joined into one by reducing their number by 1 and conducting a new measurement of the distance between the clusters, a new distance matrix (D) is determined;
- the steps are repeated several times until one cluster containing all the objects is obtained.

The best-known clustering methods are: the nearest-neighbour method, the furthest neighbour method, the median method, the centre of gravity method, the group average method, and the Ward's method. Differences between the particular methods pertain to the differing ways for determination of distances between clusters. In the case of Ward's method, the manner of calculating the distances between clusters is complicated and it is recorded with the use of the following formula [International Symposium...]:

$$d_{hk} = \frac{n_i + n_h}{n_i + n_j + n_h} d_{hi} + \frac{n_j + n_h}{n_i + n_j + n_h} d_{hj} - \frac{n_h}{n_i + n_j + n_h} d_{ij}$$

where: h, i, j, k – designate clusters;
k – new cluster formed by joining clusters i and j;
d_{hi}, d_{hj}, d_{ij} – distances between clusters;
n_i, n_j, n_h – size of clusters.

Results of clustering of objects by means of agglomerative methods are frequently presented as graphs or hierarchical trees (dendrograms).

From the pool of characteristics, 21 variables were initially selected, describing various aspects of fruit farming-related operations: the cultivation area, volume of production, costs, information on new plantings, and others as well as household characteristic variables. The set of characteristics, however, had to be narrowed down due to the strong correlation of certain variables or a low level of their variability – among others such variables, as: *volume of other crop production*, *other crop cultivation area*, *total costs*, and *total volume of production*, were omitted. The following variables *pear production*, *pear cultivation area*, and *ordinary cold storage* were also omitted due to the high zero value incidence. In the course of the analyses, a decision was made to omit certain household characteristics. Finally, the set of the characteristics contained 12 following variables: X_1 – orchard area; X_2 – new plantings area; X_3 – apple cultivation area; X_4 – apple production volume; X_5 – value of 1 ha of new plantings; X_6 – total economic costs; X_7 – direct costs; X_8 – ordinary storage area; X_9 – number of hours worked; X_{10} – family survival time in absence of income; X_{11} – a number of persons in a household; X_{12} – monthly family income (six income classes). The values of variables X_2, X_3, X_4, X_6, X_7, X_8 and X_9 were calculated per 1 ha of the cultivation area. Variables X_1, X_5, X_{10}, X_{11}, X_{12} were not calculated. Table 2 provides the values of correlation coefficients between the variables. In the majority of cases, absolute values of correlation coefficients are close to zero and point to a very low correlation of characteristics.

Table 2. Matrix of the linear correlation coefficient between the variables

×	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
X_1	1.00	–	–	–	–	–	–	–	–	–	–	–
X_2	0.08	1.00	–	–	–	–	–	–	–	–	–	–
X_3	0.16	0.05	1.00	–	–	–	–	–	–	–	–	–
X_4	0.03	–0.04	0.10	1.00	–	–	–	–	–	–	–	–
X_5	0.22	0.09	0.16	0.10	1.00	–	–	–	–	–	–	–
X_6	–0.24	0.00	0.18	0.13	0.07	1.00	–	–	–	–	–	–
X_7	0.04	0.11	0.17	0.07	0.03	0.35	1.00	–	–	–	–	–
X_8	–0.11	0.04	–0.05	–0.03	–0.02	–0.05	0.03	1.00	–	–	–	–
X_9	–0.46	–0.01	–0.05	0.16	0.05	0.43	0.17	0.06	1.00	–	–	–
X_{10}	0.20	–0.03	0.06	0.04	0.07	0.10	0.07	–0.11	–0.12	1.00	–	–
X_{11}	0.24	0.11	–0.01	0.10	0.10	0.02	0.02	–0.09	0.05	0.08	1.00	–
X_{12}	0.20	0.01	0.10	0.11	–0.25	0.01	0.03	–0.12	–0.17	0.24	0.12	1.00

Source: Own study on the basis of research.

Variability coefficient values V_i of characteristics X_i (i = 1, 2, ..., 12) were calculated as a quotient of a standard deviation to the median value of a given characteristic. With the exception of variables X_1, X_3, X_{11}, and X_{12}, the values determined point to the high or extremely high level of variability of the variables at issue (Table 3).

Table 3. Variability coefficients Vi of the variables at issue

×	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
V_i	56%	85%	23%	188%	111%	68%	80%	256%	80%	117%	37%	42%

Source: Own study on the basis of research.

In the multivariate analysis, it is important to make the level or range of characteristics variability uniform. The variables taking on high values have a significantly larger impact on the distance between objects than the smaller value variables. In certain cases, characteristics of relatively small values may have no impact on the classification of objects whatsoever. The transformation of variables has this effect that all the characteristics become *important* to the same degree. The present study makes use of standardisation of characteristics which has this result that the median value of each of the characteristics equals zero while the standard deviation equals one. The conversion formula is as follows

$$\tilde{x}_i = \frac{x_i - \overline{X}_i}{S_i}$$

where: x_i, $\tilde{x}_i$ – values of i-th variable before and after standardisation;

$\overline{X}_i$, S_i – median value and the value of the standard deviation of variable X_i respectively. The distances between the objects were calculated with the use of the Euclidean metric. In further three steps, the number of four clusters was adopted.

TYPOLOGY OF ORCHARD FARMS CLUSTERS IN THE GRÓJEC AND WARKA AREA

The clusters were designated with symbols A, B, C, and D and were presented as a dendrogram (Fig. 1).

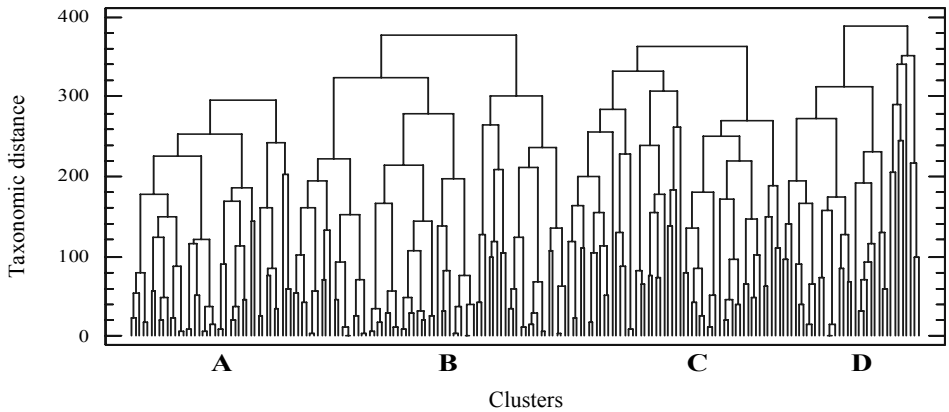

Fig. 1. Classification of fruit farms by Ward's method (the case of four clusters)
Source: Own study on the basis of research.

Tables 4 and 5 respectively provide information on the size of clusters and coordinates of specific cluster centroids. Most fruit farms qualified for cluster B. The smallest number of them appeared in cluster D.

Table 4. The case of four clusters: size and percentage of the total number of orchard farms

Cluster	Number of orchard farms in a cluster (–)	Share in all clusters (%)
A	41	20.6
B	69	34.7
C	54	27.1
D	35	17.6

Source: Own study on the basis of research.

Coordinates of the centroids (verses of Table 5) signifying centres of the clusters provide good accuracy information on the average level of all 12 characteristics (in relation to each cluster separately). They make determination of the location of the cluster's centre in space possible and point to differences between the clusters. They also show, obviously in a certain approximation, whether a given characteristic diversifies the clusters to a small or large degree.

It is fitting to indicate that, for example, variable X_2 (size of new plantings per 1 ha) does not show any differences between clusters A, B, and C since the values of the second coordinate of the centroids are identical. The situation is similar in the case of variable

Table 5. The case of four clusters: centroid coordinates

Cluster	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
A	11.9	0.18	0.89	21.2	301.9	5 876.8	4 234.7	11.5	790.3	0.51	4.2	2.6
B	7.2	0.18	0.71	15.0	44.6	3 579.2	3 473.4	20.0	797.3	0.29	4.0	3.0
C	10.1	0.18	0.89	33.7	81.3	7 195.2	6 282.0	11.7	800.2	1.14	4.1	4.3
D	4.6	0.11	0.88	47.8	127.2	8 998.9	5 398.6	53.4	1 934.8	0.46	3.5	2.1

Source: Own study on the basis of research.

X_3 (share of apple cultivation area in the total cultivation area): in this respect there are no differences between clusters A, C, and D. Whereas substantial differences occur, for example, in the case of variables: X_4 (apple production volume), X_5 (value of 1 ha of new plantings), X_6 (general economic costs), X_7 (direct costs).

Farms with the median orchard area of 11.9 ha were classified within cluster A. These farms had the largest area among all the identified clusters. This group consists of farms with the area from 5.8 to 21 ha, nevertheless, the farms within 7 to 15 ha interval are dominant. At the same time, fruit farms qualified within this group are characteristic for a very high value of 1 ha of new plantings (X_5, on average PLN 301.9 thousand) and the lowest number of hours worked (X_9, on average 790.3 h per ha). In this group we observe a low apple yield per 1 ha (X_4: 21.2 t per ha) and low general economic and direct costs (X_6: PLN 5,876.8 per ha) and (X_7: PLN 4,234.7 per ha). Households in this group are characterised by the highest average number of people in the family (X_{11}: 4.2 person) and a low average monthly income level (X_{12}). The average monthly income of the family is PLN 1,641 while an average monthly income per person is PLN 438.5. At the same time these are families with the level of savings sufficient to sustain a family for ca. 0.51 year (X_{10}) and is lower only than the analogous indicator for cluster C.

Among the farms qualified within group B, 69 farms were studied, which amounted to 34.7% of all surveyed farms. The farms within this group were characterised by the average size orchard area of 7.2 ha. This group includes farms with the area from 1 to 17 ha, but is dominated by those in range of 3–12 ha interval. The characteristic distinguishing this cluster against the entire population was distinctly the lowest level of many indicators, i.e.:

- the lowest share of apple cultivation area in the total cultivation area (X_3: 0.71);
- the lowest size of apple cultivation area (X_4: 15 t per ha);
- the lowest value of 1 ha of new plantings (X_5: PLN 44.6);
- the lowest general economic and direct costs (X_6: PLN 3,579.2 per ha; X_7: PLN 3,473.4 per ha);
- the shortest family survival time in absence of income (X_{10}: 0.29 year).

This group records also a small number of hours worked (X_9: 797.3 h per ha), slightly higher than in group A. The average number of people in the family (X_{11}) is 4.0, with the average monthly family income of PLN 2,142, and the average monthly income per person is PLN 567. The average income of this household group is distinctly higher than in the case of clusters A and C, they are only lower than the average income for cluster D households.

The number of fruit farms qualified to cluster C was 54 and it was the second biggest group constituting 27.1% of the total number of farms (Table 4). This group included

farms with the most diversified orchard area: from 1.6 to 28 ha whereby the average area is 10.1 ha. This group includes the highest number of fruit farms with large orchard area and standing out in terms of high income indicators. This group is characterised by the highest level of average income: $X_{12} = 4.3$ (monthly family income – six income classes) which gives the average family income at the level of PLN 3,825 and the average monthly income per capita of PLN 1,154.9. In this respect, cluster C households clearly dominate over the three remaining groups. The level of accumulated savings is also the highest while the average period of household sustenance on previously accumulated resources in absence of any family income was as much as 1.14 year (X_{10}). This group of farms is characterised by high general economic costs (X_6: PLN 7,195.2 per ha) and the highest direct costs (X_7: PLN 6,282.0 per ha). Apple production in cluster C is distinctly higher than in the case of clusters A and B farms: 33.7 t per ha (X_4), at a slightly higher number of hours worked (X_9: 800.2 h per ha).

The fourth group of orchard farms is cluster D, comprising 35 farms with the lowest orchard area of 4.6 ha. These are farms with the area from 0.5 to 9 ha with the prevalence of the farms in the interval from 2 to 7 ha. The volume of apple production per 1 ha is the highest in this group and it is 47.8 t per ha (X_4). At the same time, it is fitting to point to the new plantings level per 1 ha of cultivation area which is the lowest among all the groups (X_2: 0.11) while the very value of 1 ha of new plantings reaches an average level and is PLN 127.2 (X_5). At PLN 8,998.9 per ha (X_6), the level of general economic costs is the highest in this group while at PLN 5398.6 per ha (X_7) the high level of direct costs is lower only in comparison to cluster C farms. Cluster D farms are characterised by an extremely high value of the hours worked (X_9: 1,934.8 h per ha) which is almost 2.4 times higher than in the three remaining groups. Cluster D households generate the lowest income: the average monthly income per household is PLN 1254, while the average income per capita is PLN 436.7. The lowest persons per household indicator (X_{11}: 3.5) has this result that despite a low household income, the income per capita is approximate to the average income in cluster A (Table 6).

Table 6. Indicated average monthly gross farm income per capita for each indicated cluster

Cluster	Average number of persons in an fruit farm	Average income class	Average income of an analysed fruit farm	Average income per capita
A	4.2	2.6	1 641	438.5
B	4.0	3.0	2 142	567.0
C	4.1	4.3	3 825	1 154.9
D	3.5	2.1	1 254	436.7

Source: Own study on the basis of research.

The interval series specified in the survey was used to calculate the average income of farms. The analysed income is an average monthly farm income (farm income) obtained in 2010. The last income interval was defined as right-open, hence the maximum income value was adopted at PLN 8,000. To determine the average farm income, the income determined median interval was adopted. For each group, the total of incomes of farms divided by the number of the farms in a given cluster was determined.

SUMMARY

A significant part of fruit farms in the analysed Grójec and Warka area are family farms (ventures) with the increasing group of intensive cultivation farms. On the basis conducted research, there are follow four orchard farm types:

- farms with a high potential for development characterised by a high production potential (orchard area, infrastructure, especially storage facilities) are operated by fruit farmers who have a successor or who took over the farm, or those with social capital in the form of a supportive family. Most often, these are group A farms with the orchard area ranging from 7 to 15 ha and, at the same time, the largest average number of people in family as well as a part of group C farms characterised by a high income indicator;
- farms with an average potential for development – minority of farms classified within farm clusters A and C. In particular, clusters C farms are characterised by the largest orchard area which predestines this group as a group with a potential for development. These farms maintain multidirectional structure of orchard production;
- fruit farms without a potential for development. They are predominantly farms in cluster B, characterised by the lowest degree of specialisation or the lowest value of new plantings (traditional orchards are dominant). Frequently, these farms must struggle to survive. In majority, they are run by older farmers without successors prepared to take over;
- bankruptcy-bound fruit farms constitute a small group of farms. They are usually farms which due to random causes such as, for example, spouse's demise are in a difficult situation or farms which due to the lack of a successor suffered from years of underinvestment. It is possible to include within this group cluster D fruit farms which despite a high value of hours worked in orchards generate the lowest income.

Summing up the development of horticulture in the area Grójec and Warka we can say that there is a big development potential. Nevertheless the main barrier of development is a lack of diversification of apple's market. The research point out that the biggest develop chance have a fruit farms with the high degree of development potential. These are the one, which have a good professional and families relations and the owner of farm have the vision of growth. In turn the barrier of fruits farm development is many lines of production. It concerns especially farms with average potential of growth. The last two groups of farms probably will have to resign from production or will have to diametrically change the farm organization.

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EKONOMICZNA TYPOLOGIA GOSPODARSTW SADOWNICZYCH W REGIONIE GRÓJCA I WARKI

Streszczenie. Polska jest największym producentem jabłek w Unii Europejskiej. Obszar Grójca i Warki charakteryzuje się najwyższym poziomem produkcji tych owoców na świecie. Celem publikacji jest przedstawienie ekonomicznej typologii gospodarstw sadowniczych w regionie Grójca i Warki. W pracy wykorzystano następujące metody badawcze: metodę sondażową z wykorzystaniem kwestionariusza wywiadu oraz metodę grupowania hierarchicznego Warda. Badanie przeprowadzono wśród 229 gospodarstw sadowniczych na terenie gmin Grójca i Warki w okresie czerwiec-sierpień 2010 roku. Pozwoliło to na wyodrębnienie czterech typów gospodarstw sadowniczych: gospodarstwa o dużym potencjale rozwojowym, gospodarstwa o średnim potencjale rozwoju, gospodarstwa bez potencjału rozwoju oraz gospodarstwa upadające, pozbawione możliwości dalszego rozwoju.

Słowa kluczowe: typologia, jabłka, ogrodnictwo, sadownictwo

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