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SPECIALIZATION IN AGRICULTURAL PRODUCTION AND ITS INFLUENCE ON EFFECTS OF SCALE. CASE STUDY OF A FARM FROM THE COMMUNE OF STRZELNO

Summary: The aim of the article was to determine the influence of agricultural farm specialization on effects of scale as obtained by such farm. A farm from Strzelno commune will serve as an example with data quoted from the years 2010-2016, when the farm conducted its business activities concentrating on the production of fattening cattle. The article will examine increase of production scale and its influence on earned income from one piece of cattle and the influence on direct and unit costs as well as the relation between incurred costs and earned profits. The trend will be analysed, which will allow me to determine yearly changes in cost indices and productivity in the analysed farm.

Key words: specialization, production scale, effects of scale, income, productivity, changes, agriculture, Poland.

1. INTRODUCTION

The problems related to cost accountancy belong to very important issues of agricultural economics. Edward Nowak in his publication claims that the aim of contemporary cost accountancy is to provide users with economic information that is necessary to evaluate one's business and, consequently, take reasonable and rational economic decisions [Nowak 2010, p. 13-18]. As can be seen, the specialist literature offers many, various approaches of defining cost accountancy, but every single publication clearly indicates the important role it plays in running a business, including running of a farm.

This work is aimed at presenting how profitability and productivity of a farm located in the commune of Strzelno changed in the years 2010-2016. The farm has been running specialized business of breeding fattening cattle in a closed cycle since 2010. It, additionally, carries out plant based production, however, to make the analysis clearer, only income and costs data concerning directly animal

production have been taken into consideration. The main aim of the work is to present the influence of farm specialization on achieving effects of scale and improving the farm's economic situation. The research concentrates on determining a direct influence of production profile on effectiveness of using one's own resources. The analysis is carried out on the example of the farm that has changed its production structure over the past 10 years with the use of a case study as a research method.

2. PRODUCTION SPECIALIZATION AND ITS INFLUENCE ON BENEFITS OF SCALE

Production scale is defined as a size of uniform production in a farm. By analysing production scale one may consider its effects, i.e. benefits (growing effects) and disadvantages (diminishing effects). We deal with benefits of scale when long-run average costs (LAC) drop with simultaneous growth of the production. Growing effects of scale are – according to many sources – a result of a more dynamic production growth than consumption of the related production factors (means), which consequently leads to reduction of unit costs [Encyklopedia Agrobiznesu – *Agricultural Encyclopaedia*, 1998, p. 240-241]. It is connected with the fact that overhead costs are distributed over larger production, which results in lowering of average cost of producing a single unit of a product. However, advantages of scale appear only to some production extent and its exceeding leads to so called anti-effect of scale – increase of unit costs. It is the case when increased using of production means does not lead to corresponding production increase, i.e. when lon-run average costs increase alongside the production increase [Begg, Fisher, Dorbusch 2003, p. 196-204]. The issue of costs optimasation becomes here of primary importance. As regards production intensity, taking proper decisions by a farmer is a difficult task. One has to take into account many factors, including the size and type of expenses, production technology or economic and natural conditions. The above factors have to do to some extent with choosing proper production scale, but the biggest challenge is finding its edequate level. As the diagram below suggests, large poduction scale is not always the best solution possible and therefore its optimisation is necessary as maximum is not always an optimal value in the production context. Minimum unit costs, often tantamount to optimal production effectiveness, are usually achieved by maximum area of the production activity, i.e. in the case of animal breeding by the maximum amount of animals in a herd.

There are many factors influencing increasing effects of scale, and the one that is of the biggest importance for this elaboration is production specialization. Specialization of farms and connected increase of production scale is one of the most significant factors in the development of agricultural sector. It is of special importance in Poland as one of the main problems facing Polish agriculture is its fragmentated structure and low economic effectiveness of individual farms

[Smędzik 2012, p. 5-9], which gives rise to the question of income and profitability of this sector. The issue of profitability is the most important problem of the Polish agriculture that it tries to solve in various ways or at least minimize. One of possible factors of increasing profitability of Polish farms is improving their efficiency due to production specialization.

The production specialization is understood as limiting variety of agricultural production or increasing production of some selected products with simultaneous maintaining production of other goods at so far level. Some sources define specialized farm as such that produce one or two goods (to sell or for a farmer's own needs), with this one two goods constituting such a huge share of the production that they determine economic activity of the whole farm. The notion of specialization is made up not only of production scale growth but also its concentration. What should be emphasized here is the fact that these are not equivalent terms. When defining concentration, geographical proximity should be taken into account, that is not mentioned in the notion of production scale. Besides that, also concentration as compared to production scale is a process and not a state. Juszczyk claims that specialization of agricultural production is considered to be a positive phenomenon due to its concentration of forces and means as well as increasing production scale, which in turn creates huge opportunities to reduce unit costs. Thanks to it, added value from the production activities increases and we deal with benefits of scale. Considering specialization as a global phenomenon, some comparative advantages are revealed and production effciency increases with enhanced competitiveness [Stępień 2007, p. 210].

From the perspective of implementing the conception of sustainable growth and retreating from the idea of industrialized agriculture in the Europena Union, more and more often negative effects of specialized production are emphasized as compared to its benefits. The process of agricultural intensification, for example, by excessive use of fertilizers, which may disturb ecosystem, constitute widely critisized element in the model of industrialized agriculture. Unfortunately, it is connected with production specialization, mostly achieved through capital intensive process of production intensification. It consists in increasing objectified labour and one may differentiate here two tendencies:

- intensive application of production means, e.g. industrial fodders, mineral fertilizers or qualified seeds as their use increase crops and productivity,
- automation, changing of production technology, increasing of assets' wear and tear, which is connected with minimizing of labour force use.

Production specialization as well as its intensification is shaped by the same mechanisms and the same factors, i.e. increasing demand for agricultural products, which results from demographic growth, mechanical and technical or biological and technical progress, farm's distance from its supply and customer market as well as economic legal status of a person running a farm [Jerzak 1975, p. 7-15]. In the time when in the EU sustainable growth in agriculture is of significant importance, special attention is paid to negative

aspects of specialization related to all connections and dependence between production specialization and its intensification. First of all, these negative features of the above processes are perceived in their influence on social and environmental balance in rural areas. Zegar claims that industrial agriculture, which is closely related with intensive, specialized production brings benefits to a group of rural families whose profits decrease and get more and more distant from countryside community. Firstly, it influences unfavourably the natural environment and rural landscape and secondly on has impact on alternative social and rural activities as well as separates farm vitality from the vitality of a village – both as regards their economical and social dimension [Zegar 2005, p. 10-17]. In view of that, one of the most important task facing agricultural economics is searching for such model that would guarantee high economic effciency of an individual farm combined with simultaneous implementation of sustainable growth conception. Determining such model poses a great challenge for Poland that as the EU member is regulated by the same mechanisms and conditions of agricultural development as other EU countries, but exhibits many features specific only for it. This includes such issues as, for example, the highest labour intensive level of production among all EU countries, high land resource, highly fragmented agricultural structure or lower level of agricultural production intensity and profitability as compared to other EU members. Some of these features testify to high potential that is still hidden in the Polish agriculture and which may develop in current circumstances, such as high land resources or low production intensity. On the other hand, the most significant problem to solve is the need to increase production profitability in the Polish agriculture, which is possible through improving farms' economic effectiveness. The need to increase income earned by Polish farms after joining by Poland of the EU structures seems undisputable, but in spite of that income earned by indvidual farms is still considerably lower than those of the EU-15 countries. In 2004 an increase of farms' income by 15% was recorded, which was the result of not only EU funds (especialy direct payments) but also changing prices [Wilkin 2006, p. 14-15]. However, even in spite of the above, profits of Polish farmers in 2004 accounted only for c. 70% of what is earned by EU farmers in net values [Józwiak 2005, p. 12]. The above data indicate the need to take actions aimed at improving economic results in the Polish agriculture, especially taking into account the Polish circumstances. Otherwise, as a result of having no means for reproduction, the Polish agriculture may lose its competitiveness.

Structural changes of the agricultural sector may result not only in improving agricultural structure of farms, but most of all, will enable them to use more efficient techniques of production. This consequently should bring improvement of production effciency and lead to increasing profits for farmers as well as increase puchasing power of customers thus leading to higher level of social wellbeing. It is the implementation of the idea of prices both profitable for producers and accessible for consumers [Rembisz 2007, p. 39].

3. BENEFITS OF SCALE IN THE CASE OF THE FARM IN QUESTION IN THE PERSPECTIVE OF ITS FINANCIAL RESULTS

Production specialization is a process that is chosen by ever increasing number of farmers. It results from many benefits that it offers, among which one may mention the following:

- possibility of maximum using of one's production potential (land, labour and capital),
- reducing of production costs per unit,
- improving efficiency in trading agricultural products.

As it was discussed above, farm specialization should lead as a result to an increase in production scale and consequently to the benefits of scale. In agriculture, growing effects of scale occur by reducing costs per unit and achieving a higher profit with just slightly higher labour input. Following this, when changing to specialized production, one may mention the following ways of reducing costs per unit:

- making better use of equipment and machines,
- more effective use of arable land,
- improving labour effciency and distribution of overhead costs.

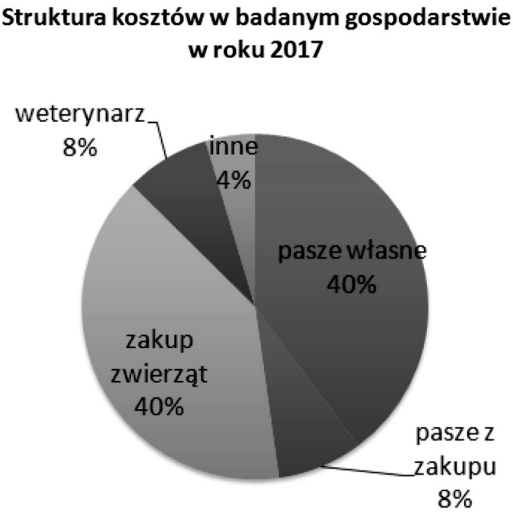
As may be seen, one may claim that the positive effect of specialization is the reduction of general costs (overheads) and income increase that is connected with benefits of scale.

The farm in question is located in south-west part of *kujawsko-pomorskie* province, in *mogileńki* district, commune of Strzelno in the village of Rzadkwin. It is located in the area that suits agriculture because of its fertile soils, which translates into high productivity of plant production. The area is poor in water resources – rivers, hydrographically and surface waters, while the area'a structural landscape contributes to evaporation processes and huge loss of water. The farm has transformed into a specialized one over the last decade and since 2010 has been producing exclusively fattening cattle and bulls up to 2 years of age. The production is carried out in an open cycle, i.e. is based on purchased calves and male cattle are the only bred animals in the farm. At the beginning, the farm had 15 milking cows and 7 sows. As the first step, they resigned from breeding pigs due to, among others, occurrence of ASF in Poland's territory. Although, the area where the farm is located was not endangered, but the farmer was considering giving up that production anyway so this acted as an additional stimulus. As the farm's milk production was gradually decreasing so in 2010 the last cow was sold. Since that time, the only bred animals had been male cattle. In order for the livestock not to lose its value, every piece was sold before it turned 2 years of age. The farm was gradually modernized and adapted to conduct breeding in an intensive way and every year the number of animals increased. This will allow to analyse costs incurred in the course of the production scale increase. Although, the farm runs also plant production but it will not be taken into account in that

analysis, except for its corn production. The corn crop is entirely sent for forage and it should be emphasized that the land area on which it was cultivated grew with the increase of bred animals.

The table 1 below presents production results of beef livestock in that farm over the period of recent years. By undergoing the process of production specialization, the farm increased gradually the number of bred animals, which was closely related with increasing the production scale. The number of animals was presented by breaking them into calves up to 1 year of age and bulls aged 1-2. Such differentiation was applied due to the fact that analysis is done on a yearly basis and the whole bull's breeding cycle takes about 2 years. A farmer buys calves at the age of a few weeks to feed them for the following months in order to esnusre that their weight increase would be as high as possible. Selling takes place when such animals reach an age that is close and not exceeds two years – so that their weight would be the highest with simultaneous keeping of the meat's best quality. Meat of cattle aged over 2 years dramatically loses its value. The animals are bred in corrals (homestead) with 10-14 pieces in each. The same animals are kept together throughout the whole breeding period due to which the farmer avoids creating unnecessary stress among animals that is connected with changing herd by them. The animals are bred in an intensive way – they actually stay all the breeding time in their corrals as the farmer does not allow them to graze on meadows. The only time when they leave their homestead is when manure is disposed – they are then moved as a whole herd to a special "substitute" corral. At that time, the farmer removes manure form the main corrals and lays fresh straw on the ground. In the course of the animals' growth, they are moved to other corrals that are adapted to their age and size. At the beginning, whole

Picture 1. Structure of direct costs in the farm in year 2017

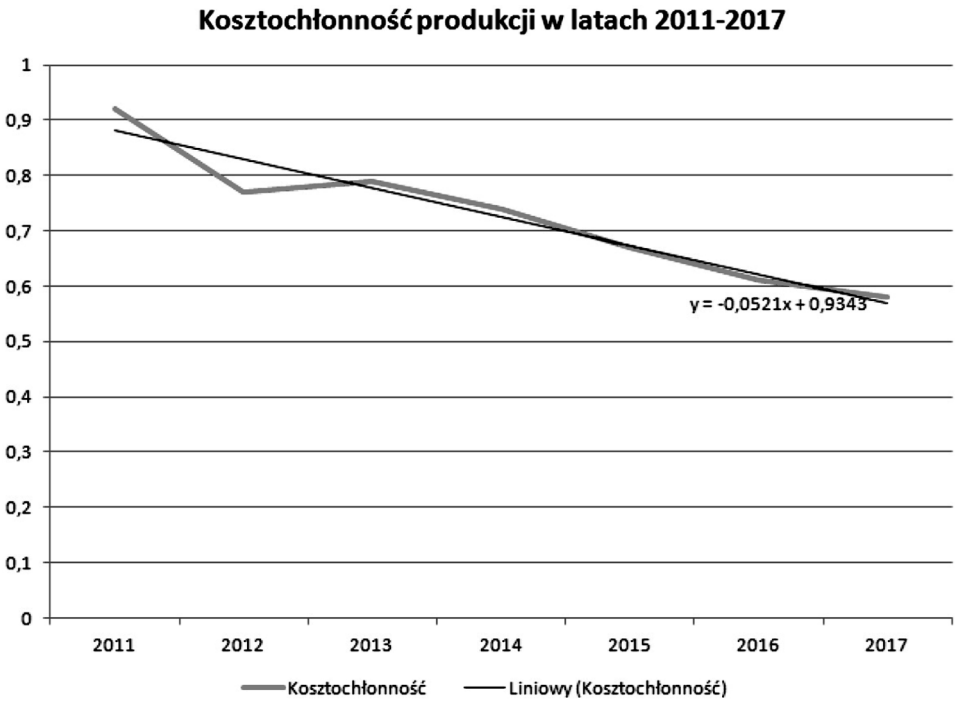


Source: one's own elaboration according to data obtained from the farm, Rzadkwin 2018.

work was carried out manually, but when the farm got equipped with a loading device, the corrals were adapted in such a way as to enable the whole process of handling to be performed with minimum labour input. In connection with the above, the corrals were equipped with fodder tables that provide all the time volume fodder that bulls as ruminants may use according to their nature. Also, the farmer's knowledge in this respect improved, as having no other activities, he could concentrate on maximising profits from cattle breeding. However the price for livestock in that period fluctuated and it was that factor that farmers had no influence on. It depends on current situation on the agricultural market. It follows that income which is determined here as a product resulting from multipling animal's weight by the price for a kilogram of such meat increases as well. As dynamic of a single animal's average weight was larger than the dynamic of price changes, income increase on every animal is visible in the period in question. As far as the costs are concerned, direct production costs increase and it is closely correlated with increasing production scale and cannot be avoided.

The main sources of costs in the case of that farm is purchasing animals – every year the farmer buys on average 60 pieces of calves at an average price of PLN 1,200 each. As far as one's own fodder is concerned, its costs are high due to individual production of corn and silaging it for volume fodder. The area cultivated with corn over the recent years has amounted to 18 ha, and average

Picture 2. Production costs in the years 2011-2017



Source: one's own elaboration according to data obtained from the farm, Rzadkwin 2018.

cost of producing silage from 1 ha of corn ranges from PLN 4,400 to 5,000. The farmer buys also beet pulp that due to sugar beet cultivation can be purchased at discount prices. Moreover, the farmer produces himself mineral fodder such as barley grit. Veterinary services such as calf vaccinations are especially intensive in the first stage of animal development and animals are more vulnerable to all kinds of diseases or infections during their first 6 months of life, which makes such veterinary care very important. Among the fodder bought, one may find various kinds of proper fodder and complementary mixtures but not too much as most fodder is produced on one's own. In view of the above, one may trace unit costs, which in the beginning stage of the production increased but ver the three recent years have remained stable.

Table 1. Compilation of data concening animal production in the years 2011-2017

Year	2011	2012	2013	2014	2015	2016	2017
Number of calves [pieces]	12	23	30	38	35	37	40
Number of 1-2 years old bulls [pieces]	50	59	62	74	76	75	72
Toral number of bred animals [pieces]	62	81	92	112	111	113	112
Average weight of a cattle piece [kg]	603,26	651,20	670,22	706,12	723,22	790,14	789,18
Average price for a kg of livestock [PLN]	5,58	6,40	6,20	5,96	6,02	5,91	6,35
Income on one piece [PLN]	3366,19	4167,68	4155,36	4208,48	4353,78	4669,73	5011,29
Direct costs [PLN]	96124,02	128142,71	150144,22	158115,047	160220,15	162238,13	162832,79
Unit/piece costs [PLN]	3100,77	3203,56	3264,00	3100,29	2913,09	2846,28	2907,72
Profit [PL/ piece]	265,41	964,11	891,35	1108,18	1440,68	1823,44	2103,56
Cost to income ratio	0,92	0,77	0,79	0,74	0,67	0,61	0,58

Source: one's own elaboration according to data obtained from the farm, Rzadkwin 2018.

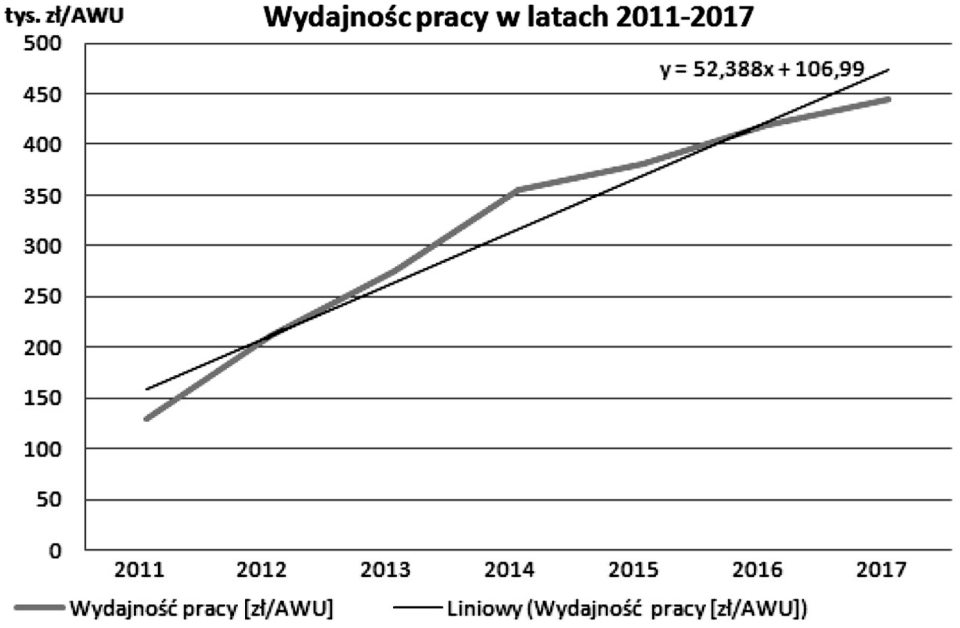
The diagram of costs indicated in pict. 2 presents how over the period in question the production costs have looked like, i.e. the relation between costs and earned income. The index informs of the share of operating activity's costs in income from sales, thus showing what share from sales is to cover the costs of the operating activity. At the beginning this result reached 92%, which means that as much as 92% income was necessary to cover the costs and the profit amounted to less than 10% of the earned income. As may be seen, the tendency is decreasing, although at one point a growth may be observed, but it results from factors beyond the farmer's control. In 2013 the price for one kg of livestock drooped, which was reflected in lower income. A cost intensive index was determined that looks as follows:

$$y = -0{,}0521x + 0{,}9343$$

According to it, one may claim that costs decreased on a year to year basis by 0.05 units, i.e. every year 5% less income from that year was necessary to cover the relevant cost. It is highly positive situation and testifies to a good and profitable running of a farm with decreasing costs of operating activities.

The diagram below presents how labour efficiency changed in the years 2011-2017. Labour was determined in AWU (annual work unit) that correspond to 2,200 worked hours over a year or a one person employed on a full-time basis. Labour efficiency was described as a ratio between final production value to performed workload (labour).

Diagram 4. Labour efficiency in the years 2011-2017



Source: one's own elaboration according to data obtained from the farm, Rzadkwin 2018.

As you can see from the diagram, the labour effciency was increasing on a year to year basis, which means that the final production increased with decreasing labour input at the same time. At the beginning, the labour input was at the level of PLN 140 thousand for AWU, which means that one full-employed person in the farm could produce goods worth PLN 140 thousand over a year. As a result of the transformation processes that have taken place in the farm, this value increased year by year according to the trend line and below equation:

$$y = 52{,}388x + 106{,}99$$

The trend equation shows that every year the production worth as produced by one full-employed person increased by PLN 52,000. Such situation is related with the improvement of the farm's mechanisation, getting rid of additional animal production branches and concetration on the production of fattening cattle as well as adapting the farm's infrastructure in such a way as to make everyday routine time spent on animal handling as short as possible. When analysing the above aspects, one may clearly state that the farm's benefits of scale are achieved and the process of specialization has positively influenced its development.

4. SUMMARY

The aim of the article was to determine whether the examined farm from the commune of Strzelno achieves benefits of scale and how specialization has influenced that process. At first, a theoretical analysis of the process of specialization and the notion of a scale in agricultural farms was carried out. At the beginning, basic data from the farm were compiled, which allowed to notice that the production was increasing from year to year to stabilize in the last three years. Such data made it possible to determine income and cost for one piece of cattle. With the ratio for these above two indices, it was possible to compare production costs and its tendency of change in relation to the increase of the production scale. A trend equation was determined that made it possible to assess how the situation was changing from one year to the following. The analysis of lineal regression was also applied when labour effciency was analysed. When summing up the work, one may put forward the following conclusions:

The problem with diversification of production in Poland results from many factors, such as, for example, traditional attitude, not being willing to change and being afraid of new solutions. The process of production specialization is connected with many advantages that can be measured mostly with the use of income increase, lower labour input, production scale or the effects of scale. The last item results from diminishing unit/piece costs and being able to produce larger amount of goods with the same input.

In the context of achieving benefits of scale, it is the most important to raise the problem of costs optimisation. In order to choose proper intensity, one has

to take into account many factors, such as, for example, size and type of input, technological progress, natural or economic circumstances. In an agricultural environment of effects of scale, the biggest challenge is posed by achieving a proper level of production scale. Not always its increase brings expected results, therefore its optimisation seems to be of primary importance. In the conetxt of a production scale, maximum values are not always optimal ones.

In the examined farm, cost structure is rather simple. There are only 5 types of costs, with 80% of them being purchasing animals, which results from the specific character of the farm with open breeding cycle, as well as the costs of producing one's own fodder. This also means some savings as when one would like to buy quality fodder for catlle, high costs woould be involved, especially with such production scale.

The above research shows that optimisation and reasonable increasing of production scale results in improving of the most important indicators from the point of view of effects of scale – unit (piece) costs and overall costs that in the examined case decrease as well as labour efficiency that dynamically grows. The farm in question proves that consistent meeting of aims and well organized process of transformation into specialized production brings many benefits, of which the most important is achieving benefits of scale.

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SPECJALIZACJA PRODUKCJI ROLNEJ I JEJ WPŁYW NA EFEKTY SKALI. STUDIUM PRZYPADKU GOSPODARSTWA Z GMINY STRZELNO

Streszczenie: Celem niniejszego artykułu jest określenie wpływu specjalizacji gospodarstw rolnych na uzyskiwane przez dane gospodarstwo efekty skali. Poniżej przywołany będzie przykład podmiotu z gminy Strzelno, przytoczone dane będą dotyczyć lat 2010-2016 kiedy to gospodarstwo prowadziło działalność skupiającą się na produkcji bydła opasowego. Zbadane zostaną przyrosty skali produkcji i ich wpływ na osiągany przychód ze sztuki bydła, na koszty bezpośrednie i koszty jednostkowe oraz zostanie określona relacja osiągniętych przychodów do poniesionych kosztów. Przeprowadzona zostanie analiza trendu, która pozwoli określić jak z roku na rok zmieniała się kosztochłonność i wydajność pracy w badanym gospodarstwie.

Słowa kluczowe: specjalizacja, skala produkcji, efekty skali, dochód, produktywność, zmiany, rolnictwo, Polska.

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