

TADEUSZ FILIPIAK

Warsaw University of Life Sciences – SGGW, Poland

EFFICIENCY OF PRODUCTION FACTORS IN HORTICULTURAL HOLDINGS VERSUS HOLDINGS OF OTHER AGRICULTURAL TYPES

Key words: production efficiency, horticultural farms, FADN

ABSTRACT. The purpose of the research was to assess the efficiency of production factors in horticultural holdings in Poland versus other agricultural types in years 2004-2017. General characteristics of holdings of other agricultural types in Poland were presented, the productivity of labour, soil, and capital was determined. In the years 2004-2017, a nominal increase in soil productivity was recorded in holdings of all agricultural types, except for horticultural holdings and those specialising in granivores. In the studied period, horticultural holdings still had the highest land productivity, followed by holdings with permanent crops and specialising in granivores. In the years analysed, an increase in labour productivity was noted in almost all types of holdings, except for herbivorous holdings. Holdings specialising in granivores had the highest labour productivity, followed by field cultivation, horticultural and dairy holdings. On the other hand, capital productivity in the analysed period decreased in almost all types of holdings, except for horticultural holdings (nominally, while in real terms it decreased in all types). Horticultural holdings had the highest labour productivity, followed by field cultivation, and holdings specialised in granivores.

INTRODUCTION

Holdings of an agricultural type and all agriculture are influenced by external and internal factors that force or initiate change. External factors include: economic development of the country, growth in non-agricultural sectors, the situation on the labour market, domestic and foreign food demand, price relations, state policy, etc. [Wicki 2019]. Internal factors include: production resources in holdings, production technology used, production profitability, income per agricultural holding, know-how, information held, etc.

The competitive ability of the economy and its individual sectors shapes production capacity, its effective use, and is subject to modifications under the influence of endo- and exogenous factors [Rzeszutko 2014]. Along with the development of agriculture, the role of land decreases as a result of effective land substitution by modern means of production and broadly understood human capital (labour) [Kawagoe, Hayami 1985]. The main production factors in agriculture include land, labour, and capital, which are used in various proportions to produce goods and services. In turn, the volume of production

depends on the amount, structure, and type of production factors used, and the efficiency of production processes. Changes in production resources and their efficiency may provide the basis for assessing holdings and enable the forecasting of the development of agriculture [Gołębiewska 2008]. The available studies show that holdings engaged in the same production may be characterised by much varying efficiency of production factors. The differences in land or labour efficiency were many-fold [Skarżyńska 2018].

Agnieszka Gałęcka's research [2017] shows that the economic efficiency of holdings also depended on agricultural type, which differentiated production/economic results. Improving productivity in the whole agriculture can be achieved by changing the employment structure, based on increasing the share of holdings from more efficient production types [Czyżewski, Staniszewski 2017], which, however, does not seem to be feasible to implement. In terms of productivity of production factors in agriculture, as shown by research by Justyna Góral and Włodzimierz Rembisza, Poland, in recent years, has been showing stagnation of agricultural productivity. The slight increase did not result from improved technical means provided to labour force, land concentration or capital [Góral, Rembisz 2017]. A similar relationship was observed in relation to the soil factor [Bezat-Jarzębowska, Rembisz 2016]. Usually, however, as other authors note, with sufficient land availability, an increase in labour productivity was achieved as a result of rapid technical growth of the labour infrastructure [Kasztelan 2009], and the efficiency of production factors was strongly correlated with the size of holdings [Komorowska 2019]. It should be noted that for many EU countries, the long-term characteristic observed is an increase in labour productivity together with a stagnation in land and capital efficiency measured by gross value added [Kołodziejczak 2014]. The efficiency of production factors measured by the real value of production increased at a much higher price than measured by gross value added [Wicki 2016], which shows the high influence of price relations in shaping productivity in agriculture. The differences in the profitability of production of individual agricultural products and the varying efficiency of production technologies may act as the basis for diversifying the efficiency of production factors in holdings with various production types.

Horticulture plays an important role in agricultural production in Poland. Horticultural crops, although representing ca. 3.2% of farming land, constitute over 31.3% of the total plant production value. They also contribute to improving the foreign trade balance by representing an important share in exports. The share of export of products in fresh or processed form constituted about 60% of fruit production, 40% of vegetable production and 20% of ornamental plant production [Zmarlicki 2015].

RESEARCH METHODS

The purpose of the research was to compare the efficiency of production factors in horticultural holdings in Poland with other agricultural types in Poland in the years 2004-2017. The research covered holdings participating in the Polish FADN system, in the following agricultural types: agricultural crops (1), horticultural crops (2), permanent plantations (4), dairy production (5), herbivores (6), granivores (7) and mixed (8). It is also worth mentioning about the limitations in the interpretation of results obtained by using medium sizes for relatively strongly diversified activity groups. In fact, the variable

search results are higher than those shown by individual action data. Separate outliers for collective type cells cannot be observed either.

The study identifies the general characteristics of holdings from individual agricultural types and the efficiency of production factors (land, labour and capital). Productivity of production factors was measured using gross value added at current prices and fixed prices from 2017. As the deflator of gross value added, the index of agricultural final production prices was used, while the value of total assets was adjusted using the CPI in agriculture for investment purposes. Land and labour expenditure were adopted in natural units.

Descriptive statistics methods were used in the study, including absolute and relative dynamics of changes calculated using linear and exponential regression analysis. The tabulation and descriptive method was also used. The main research material were Polish FADN data, Central Statistical Office data and literature on the discussed issues.

CHARACTERISTICS OF THE HORTICULTURAL HOLDINGS STUDIED

Table 1 presents the resources of basic production factors in Polish holdings with various production types in 2004–2017. The largest land resources were in field crops (average area 30.80 ha of farming land), while the smallest area was for horticultural holdings (an average 4.80 ha of farming land) and orchard holdings (an average 8.85 ha of farming land). In the period analysed, an increase was recorded in the total area among almost all types of farming, except for those breeding granivores (average annual decrease by 1.13%). The largest increase was recorded in horticultural holdings (annual average increase by 4.71%), followed by holdings specialising in dairy production (annual average increase by 3.15%) and those specialising in breeding herbivorous animals (annual average increase by 2.62%).

In the analysed period, the largest labour resources were found in horticultural holdings (an average of 2.49 AWU per farm), followed by permanent holdings (on average 2.08 AWU). In turn, the lowest total labour resources were found in herbivorous holdings (on average 1.60 AWU) and mixed holdings (1.62 AWU). In the years 2004–2017, a decrease in labour resources was recorded in holdings of almost all farming types, except for dairy holdings and granivores types.

The largest capital resources were observed in the granivores type (on average PLN 698.61 thous.), followed by field type crops (on average PLN 547.64 thous.), and dairy cow type holdings (PLN 542.42 thous.). In turn, the lowest total capital resources were observed in mixed holdings (on average PLN 380.74 thous.) and herbivorous holdings (PLN 436.18 thous.), horticultural holdings (PLN 436.99 thous.) and holdings of permanent plantation type (PLN 501.83 thous.).

In the analysed period, the total value of capital increased across all types of agricultural holdings. The highest increase in total capital was recorded in dairy holdings (a nominal average annual increase by 11.50%, in real terms by 8.37%), followed by field crop holdings (a nominal average annual increase by 10.07%, in real terms by 6.94%) and in holdings of granivore type (a nominal average annual increase by 9.95%, in real terms by 6.82%). On horticultural holdings, a slight decrease in the value of capital was recorded (an average of 0.2% per year).

Table 1. Resources of farms with different types of farming in Poland in 2004-2017

Production factor	Production type	Average 2004-2017	Average annual growth* [%]	2004 =100	Annual resource change	Coefficient of variation [%]
Land [ha]	1	30.80	1.58	110.02	0.46	35.04
	2	4.80	4.71	163.80	0.21	20.79
	4	8.85	1.56	119.56	0.14	8.57
	5	19.03	3.15	144.97	0.58	13.74
	6	18.52	-1.13	93.68	-0.21	8.51
	7	19.19	2.62	137.20	0.50	12.34
	8	16.75	0.93	110.42	0.16	5.51
	AWU [number]	1	1.72	-1.34	88.07	-0.02
2		2.49	-0.36	87.73	-0.01	6.06
4		2.08	-1.28	78.97	-0.03	9.16
5		1.77	0.48	107.10	0.01	2.66
6		1.60	-2.02	80.57	-0.03	9.43
7		1.81	1.34	122.22	0.03	8.86
8		1.62	-0.30	95.15	0.00	3.28
Total capital [thous. PLN]		1	547.64	10.07	288.17	51.21
	2	436.99	2.93	106.65	13.44	21.95
	4	501.83	4.93	155.78	26.02	25.53
	5	542.42	11.50	382.08	62.02	50.89
	6	436.18	5.66	215.92	27.26	34.09
	7	698.61	9.95	280.10	73.70	50.20
	8	380.74	8.70	265.48	34.83	42.17

1 – field crops, 2 – horticultural crops, 4 – permanent plantations, 5 – dairy cows, 6 – herbivores, 7 – granivores, 8 – mixed

* average annual growth calculated on the basis of the exponential function

Source: own study based on FADN data

EFFICIENCY OF PRODUCTION FACTORS IN HORTICULTURAL HOLDINGS VERSUS HOLDINGS OF OTHER AGRICULTURAL TYPES

The study measured the performance of individual factors using gross value added. In the FADN accounting methodology, it is an income category calculated according to the formula in which the total value of production is reduced by the direct cost, general production cost and general economic cost. No depreciation cost or external factor cost (hired labour, interest and leases) are deducted.

In the years 2004-2017, the highest productivity per area unit was recorded in horticultural holdings (an average of ca. PLN 20.08 thous. per 1 ha), followed by permanent crop holdings (an average of ca. PLN 8.39 thous. per 1 ha) and granivore holdings (an average of ca. PLN 5.65 thous. per 1 ha). In turn, the lowest land productivity was observed in holdings specialising in herbivorous and mixed farming (about PLN 2.48 thous. per 1 ha).

In nominal terms, an increase in land productivity was observed on almost all types of farms, except for horticultural holdings and holdings specialising in the production of granivores (Figure 1). The largest increase in land productivity was observed in holdings specialising in the production of herbivorous animals (an annual average of ca. 4.45%), in dairy holdings (an annual average of ca. 4.18%), as well as in holdings specialising in field cultivation (an annual average of ca. 2.17%) and in mixed holdings (an annual average of ca. 1.94%). A slight increase was observed in holdings specialising in permanent crops (0.44% on average). A decrease in land productivity was observed in granivore holdings (by 1.73% on average per year) and horticultural holdings (by 0.82% on average per year).

In real terms, an increase in land productivity was only recorded in holdings specialising in granivores (real annual average of 0.94%) and dairy holdings (real annual average of ca. of 0.67%). In absolute terms, the largest nominal increase in gross value added per 1 ha was recorded in holdings specialising in the production of granivores (annual average by PLN 264.43 per 1 ha) and in dairy holdings (annual average by PLN 151.87 per 1 ha). The decrease in land productivity in horticultural holdings resulted from a greater increase in farming land (an annual average of ca. 4.71%) than gross value added (an annual average of ca. 3.88%). Generally, in the researched farm types, a greater increase in gross value added than in the farming land was observed, except for horticultural holdings and holdings specialising in the cultivation of herbivorous animals. For the latter, a greater decrease in gross value added (an annual average of ca. 2.86%) than the farming land area (an annual average of ca. 1.13%) was recorded.

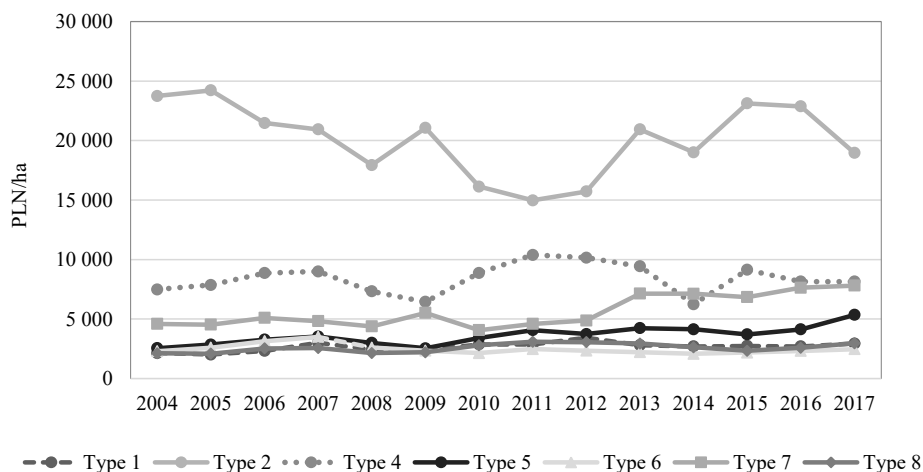


Figure 1. Land productivity on farms of various agricultural types in Poland in 2004-2017 (in current prices)

Source: own study based on Polish FADN data

In the years 2004-2017, the highest labour productivity was recorded in holdings specialising in the production of granivores (an average of PLN 59.95 thous. per 1 AWU), followed by those specialising in field cultivation (an average of PLN 48.36 thous. per 1 AWU) in horticultural holdings and those specialising in dairy production (on average, PLN 38.31 thous. and PLN 36.09 thous. per 1 AWU, respectively) (Figure 2). In the analysed period, the lowest labour productivity was recorded for mixed holdings (an average of PLN 26.64 thous. per 1 AWU) and in holdings specialising in the production of herbivorous animals (an average of PLN 28.69 thous. per 1 AWU).

In the analysed period, an increase in labour productivity was recorded for almost all types of holdings, except for holdings specialising in the production of herbivorous animals (a nominal average annual decline by 0.84%, in real terms by 4.35%). The decrease in labour productivity in these holdings was driven by a greater decrease in gross value added (an annual average of ca. 2.86%) than a decrease in labour (an annual average of ca. 2.02%). The largest increase in labour productivity was recorded in holdings specialising in dairy production (a nominal average annual increase by ca. 6.86%, in real terms 3.35%), followed by holdings specialising in field crops (a nominal average annual increase by ca. 5.09%, by 2.41% in real terms) in holdings specialising in the production of granivores (a nominal average annual increase by ca. 5.73%, 2.22% in real terms). In horticultural holdings, an increase in labour productivity was also observed (a nominal average annual increase by ca. 4.24%, 0.74% in real terms). A slightly smaller increase in labour productivity was observed in mixed holdings (a nominal average annual increase by ca. 3.16%, however, in real terms an average annual decrease of 0.35%) and in holdings specialising in permanent crops (a nominal average annual increase by ca. 3.28%, in real terms an average annual decrease by 0.23%). In absolute terms, the largest increase in labour productivity was observed in holdings specialising in the production of granivores (an average annual increase by ca. PLN 3.48 thous. per 1 AWU), followed

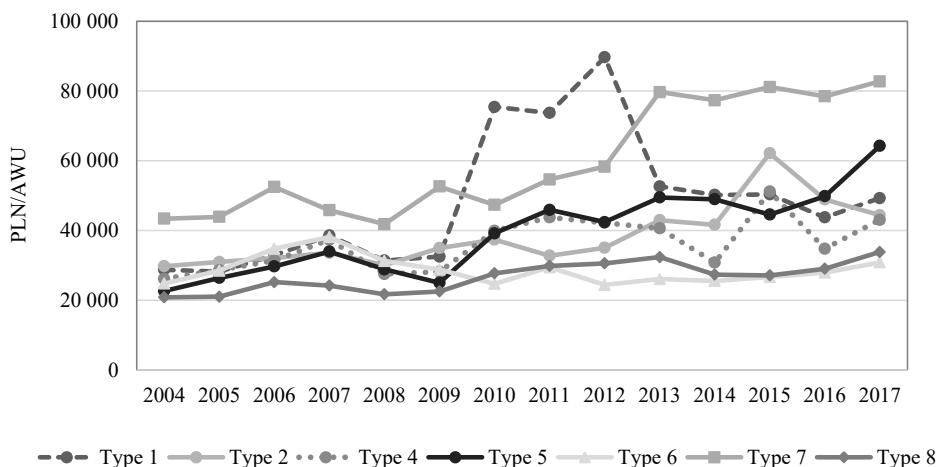


Figure 2. Labor productivity on farms of various agricultural types in Poland in 2004-2017 (in current prices)

Source: own study based on Polish FADN data

by dairy holdings (an average annual increase by PLN 2.64 thous. per 1 AWU) and in holdings specialising in field crops (an average annual increase by PLN 2.09 thous. per 1 AWU). In general, the increase in labour productivity resulted from an increase in gross value added, combined with a decrease in labour.

In the years analysed, the highest capital productivity was recorded for horticultural holdings (an average of ca. PLN 0.22 per 1 PLN of capital), followed by holdings specialising in field crops and in production of granivores PLN 0.17 PLN per PLN 1 of capital) (Figure 3). The lowest capital efficiency was observed for holdings specialising in the production of herbivores (ca. PLN 0.12 from PLN 1 of capital) and mixed holdings (PLN 0.13 from PLN 1 of capital).

In the analysed period, a decrease in capital efficiency in holdings of almost all agricultural types was observed, except for horticultural holdings. In horticultural holdings, a nominal increase in capital efficiency was observed (by 0.96% on average per year, while in real terms there was a decrease by 2.55%). In other types of holdings, a decrease in capital efficiency was recorded, the largest one in holdings specialising in the production of herbivores (a nominal average annual increase by 8.53%, in real terms by 12.03%), followed by holdings specialising in field crops (a nominal average annual increase by 6.32%, in real terms by 9.00%) and in mixed holdings (a nominal average annual increase by 5.83 per year, 9.34% in real terms). For overall capital efficiency, a greater increase was recorded in the value of capital than in gross value added in the period analysed. Only for horticultural holdings, there was a greater increase in value added (an average annual increase by ca. 3.88%) than total capital (an average annual increase by ca. 2.93%). For holdings specialising in the production of herbivores, the decrease in capital efficiency was the largest and resulted not only from a decrease in gross value added, but also from an increase in the value of total assets.

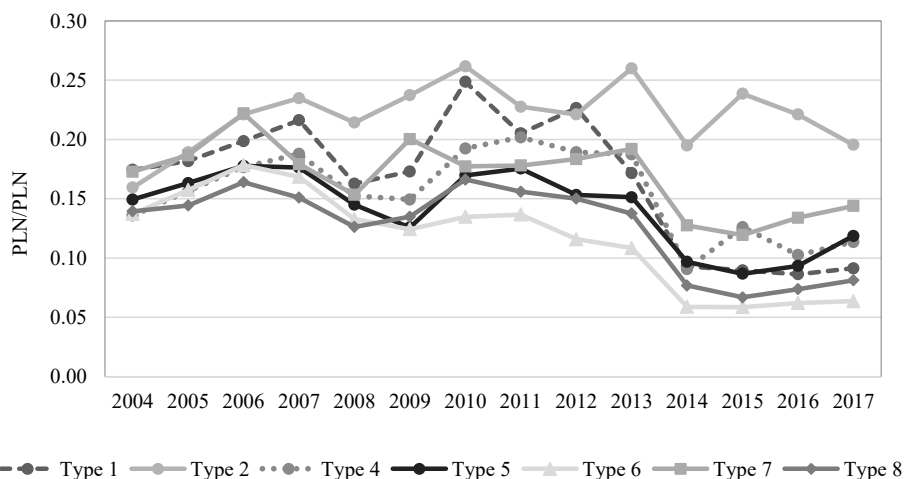


Figure 3. Capital efficiency on farms of various agricultural types in Poland in 2004-2017 (in current prices)

Source: own study based on Polish FADN data.

SUMMARY AND CONCLUSIONS

Horticulture plays an important role in Polish agricultural production. Despite occupying a small area, farming land accounts for a much larger share in the value of generated global and commodity production. Due to limited consumption in the country, gardening also plays a significant role in exports.

In the period analysed, an increase in area was observed for all types of holdings, with the exception of herbivore holdings, with the largest increase in land resources in horticultural and dairy holdings. At the same time, for almost all types, a decrease in labour resources was noted, except for granivore and dairy holdings. In the period analysed, the value of total assets increased nominally for all types of holdings, with a slight decrease in real terms for horticultural holdings.

In the years 2004-2017, there was an increase in land productivity in holdings of all agricultural types, with the exception of horticultural holdings and the granivore type. In the period analysed, the highest land productivity was recorded for horticultural holdings, followed by holdings with permanent crops and those specialising in granivores.

In the analysed period, an increase in labour productivity was also noted for almost all types of holdings, with the exception of herbivore holdings. Holdings specialising in granivores had the highest labour productivity, followed by field cultivation, and horticultural and dairy holdings.

In turn, the capital efficiency in the analysed period decreased for almost all types of holdings, except for horticultural holdings. Horticultural holdings had the highest labour productivity, followed by field cultivation, and holdings specialising in granivores.

Horticultural holdings maintain a good competitive position in comparison with other types of holdings. They were characterised by what was definitely the highest efficiency of land and capital. However, there was a slight decrease in land productivity for horticultural holdings during the period analysed, associated with a greater increase in area than production value. On horticultural holdings, the area of land is not always of importance, but capital, especially in holdings growing vegetables indoors, replaces the soil factor, and production processes gain a quasi-industrial character [Filipiak 2014]. Due to the relatively large labour input in horticultural holdings, labour productivity was lower than in granivore type holdings, dairy holdings and holdings specialising in field cultivation. In the analysed period, there was an increase in labour productivity in horticultural holdings, yet it was smaller than in dairy holdings, holdings of the granivore type and those specialising in field crops. The level and increase of labour productivity in horticultural holdings will determine the likelihood of obtaining income that is the basis for supporting a farmer's family.

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WYDAJNOŚĆ CZYNNIKÓW PRODUKCJI W GOSPODARSTWACH OGRODNICZYCH NA TLE GOSPODARSTW O INNYCH TYPACH ROLNICZYCH

Słowa kluczowe: wydajność czynników produkcji, gospodarstwa ogrodnicze FADN

ABSTRAKT

Celem badań była ocena wydajności czynników produkcji w gospodarstwach ogrodniczych w Polsce na tle innych typów rolniczych w latach 2004-2017. Przedstawiono ogólną charakterystykę gospodarstw o różnych typach rolniczych w Polsce, określono wydajność pracy, ziemi oraz kapitału. W latach 2004-2017 odnotowano nominalny wzrost wydajności ziemi w gospodarstwach we wszystkich typach rolniczych, z wyjątkiem gospodarstw ogrodniczych oraz specjalizujących się w zwierzętach ziarnożernych. W badanym okresie nadal największą wydajnością ziemi charakteryzowały się gospodarstwa ogrodnicze, następnie gospodarstwa z uprawami trwałymi oraz specjalizujące się w zwierzętach ziarnożernych. W analizowanych latach odnotowano wzrost wydajności pracy prawie we wszystkich typach gospodarstw, z wyjątkiem gospodarstw ze zwierzętami trawożernymi. Największą wydajnością pracy charakteryzowały się gospodarstwa specjalizujące się w zwierzętach ziarnożernych, w uprawie polowej, a także gospodarstwa ogrodnicze i mleczne. Z kolei wydajność kapitału w badanym okresie zmniejszała się prawie we wszystkich typach gospodarstw, z wyjątkiem gospodarstw ogrodniczych (nominalnie, realnie we wszystkich typach). Największą wydajnością kapitału charakteryzowały się gospodarstwa ogrodnicze, następnie specjalizujące się w uprawie polowej oraz w zwierzętach ziarnożernych. Gospodarstwa ogrodnicze charakteryzowały się największą wydajnością ziemi i kapitału. W badanym okresie w gospodarstwach ogrodniczych odnotowano niewielki spadek wydajności ziemi, natomiast wzrost wydajności pracy oraz kapitału.

AUTHOR

TADEUSZ FILIPIAK, PHD

ORCID: 0000-0002-9397-7595

Warsaw University of Life Sciences – SGGW

Department of Economics and Organization of Enterprises

Nowoursynowska St. 166, 02-787 Warsaw, Poland