

INTENSITY OF PRODUCTION ORGANIZATION AND TECHNICAL EQUIPMENT OF POLISH AGRICULTURE

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ABSTRACT

The work presents the relationship between the intensity of production organization and technical equipment of Polish agriculture. The intensity of production organization was determined using B. Kopeć's indicator method. Updates have been introduced to this method in order to reflect the changes that have occurred in Polish agriculture in the last thirty years. The state of farm mechanization and its changes were determined on the basis of the data collected by the Central Statistical Office (GUS) of Poland. The relationship between agriculture organization intensity and the basic indicators characterizing farm mechanization was analyzed.

INTRODUCTION

Since intensity is a qualitative phenomenon, it is unmeasurable. The intensity of agriculture organization can be evaluated using a point scale. Such a scale takes into consideration the share of high-input crops in the crop structure, and the number of livestock units per unit of area. One of the methods used for determining agricultural organization intensity is the indicator method developed by B. Kopeć in the 1950s. The first publication presenting this method appeared in 1958 (Kopeć 1958) and the last in 1987 (Kopeć 1987). Kopeć's method is used by numerous Polish authors (Figurski, Lorencowicz 2010; Jankowski, Bieńkowski, Holka 2010; Kluba, Rudnicki, Wiśniewski 2016; Kocira 2009; Kołtun 2014; Kopiński 2009; Lorencowicz 2009; Malaga-Toboła, Kocira 2013; Parafiniuk 2013; Polna 2009; Sawa 2009; Szelaż-Sikora 2008; Szelaż-Sikora, Cupiał, Niemiec 2015; Szuk 2009; Żak 2013), which proves its usefulness.

The objective of the research is to determine the relationship between the intensity of production organization and the technical equipment of Polish agriculture.

METHODS

Over the past twenty years, significant changes, both economic and technological, have occurred in Polish agriculture. There has been a significant increase of cultivated plant yields, an increase of productivity in animal production, as well as changes concerning fertilization and farm mechanization (Tab. 1).

Tab. 1. Selected parameters characterizing the changes in Polish agriculture over 1995-2015

Specification	Unit	1995	2015	Change 1995-2015
Yield of five basic cereals	dt/ha	30.6	37.9	24%
Sugar beet yield	dt/ha	344	520	51%
Potato yield	dt/ha	164	210	28%
Annual milk yield per one cow	thousands of liters	3136	5164	65%
Average annual number of eggs per one hen	pcs	163	231	42%
NPK mineral fertilizers	kg/ha	76.6	123.2	61%
Utilized agricultural area (UAA) per one tractor	ha	13.6	10.2*	-25%
Installed power of tractors	kW/100ha	229.4	416.7*	82%

*2013 data.

Source: Central Statistical Office of Poland, GUS (1995-2016).

Therefore, it was necessary to update Kopec's method (Lorenkowicz, Mazurek, Kocira 2017). Taking into consideration selected factors which characterize agriculture, changes were proposed to point ranges determining the degree of intensity (degrees of development). An application has been developed in the spreadsheet for calculating the intensity and its level for particular provinces of Poland in 1995-2015 (Fig.1). The results obtained show the intensity level according to the original Kopec's method (hereinafter referred to as "K'1987") and after its update ("K'2017").

	A	B	C	D	E	F	G	H	I
1									
2	SELECT:	province		year					
3		Wielkopolskie		2010					
4									
5		Type of indicator	K'1987	K'2017					
6		Degree of development							
7	Percentage of farms over 10ha	V	III'		5	3			
8	Percentage of farms under 2ha	V	IV'		5	4			
9	Power of tractors, kW/100ha UAA	V	II'		5	2			
10	Hectares of UAA per one tractor	V	IV'		5	4			
11	Mineral fertilization NPK, kg/ha UAA	I	III'		1	3			
12	Cereal yield, dt/ha	V	II'		5	2			
13	Sugar beet yield, dt/ha	V	II'		5	2			
14	Potato yield, dt/ha	IV	III'		4	3			
15	Annual milk yield per one cow, thousands of liters	V	III'		5	3			
16	Number of eggs per one layer (annually), pcs	V	IV'		5	4			
17									
18	Degree of development for a province	V	III		5	3			
19									
20									
21	lr	149.24	124.14						
22	lz	254.40	206.29						
23	lr+lz	403.64	330.43						
24									
25									
26			B2						
27	Level of intensity organization	C2 high greater	medium greater						
28									
29									
30									
31									

Fig. 1. Application determining intensity level of agriculture organization for provinces in 1987-2017

Farm mechanization changes were determined using the following indicators:

- installed power of tractors [kW/100 ha]
- utilized agricultural area (UAA) per one tractor [ha/tractor]
- number of combine harvesters per 100 ha [combines/100 ha]

The data used in the analyses were obtained from the database of the Central Statistical Office of Poland (GUS 1995-2016). For most of the parameters analyzed, the data availability covered the entire period under investigation, yet in some cases data from selected years were unavailable, which made interpretation of the results difficult.

RESULTS

In the period under review, there were significant changes in the intensity of the agriculture organization. In 2006-2015 (Fig. 2) the intensity of the agriculture organization in Poland increased by 13.8% as measured by the original method (K'1987)

or by 16% as measured by the updated method (K'2017). In both cases, there is a noticeable increase in intensity; however, the point ranges are different, which essentially illustrates the changes in the method.

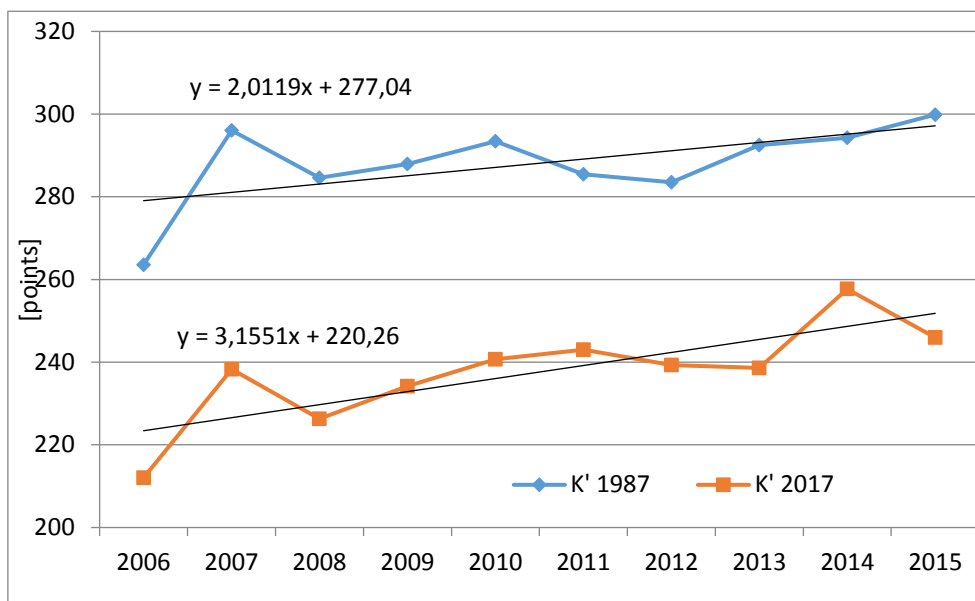


Fig. 2 Intensity of production organization in Poland in 2006-2015

Detailed results of studies in the intensity of agriculture organization for particular provinces are presented in Tab. 2. As it is in the graph, intensity fluctuations are noticeable, but the general trend is increasing.

Tab. 2. Summary of the results of the intensity agriculture organization assessment according to the original (K'1987) and updated (K'2017) method for particular provinces in 2006-2015

Province	2006		2015		Change 2006-2015	
	K'1987	K'2017	K'1987	K'2017	K'1987	K'2017
Dolnośląskie	204.3	168.9	206.7	171.2	1%	1%
Kujawsko-pomorskie	372.0	254.7	343.2	256.6	-8%	1%
Lubelskie	187.5	172.5	232.5	192.6	24%	12%
Lubuskie	124.0	149.9	207.4	155.1	67%	3%
Łódzkie	211.9	211.9	319.0	263.4	51%	24%
Małopolskie	169.1	169.1	221.6	180.8	31%	7%
Mazowieckie	292.6	200.5	310.7	231.0	6%	15%
Opolskie	279.9	208.7	271.2	271.2	-3%	30%
Podkarpackie	139.3	127.7	186.2	139.1	34%	9%
Podlaskie	316.8	234.9	356.6	265.3	13%	13%
Pomorskie	258.8	191.8	253.0	208.3	-2%	9%
Śląskie	224.8	166.6	255.8	210.7	14%	26%
Świętokrzyskie	180.3	180.3	260.7	178.9	45%	-1%
Warmińsko-mazurskie	249.6	206.3	240.0	198.6	-4%	-4%
Wielkopolskie	310.2	286.5	420.4	386.3	36%	35%
Zachodniopomorskie	165.2	123.6	186.4	153.5	13%	24%
Mean value	263.6	212.0	299.9	246.0	14%	16%

The increase of UAA per 1 tractor (Fig. 3) can be attributed both to the increase in the farm acreage and to the purchase of more powerful tractors than those used previously.

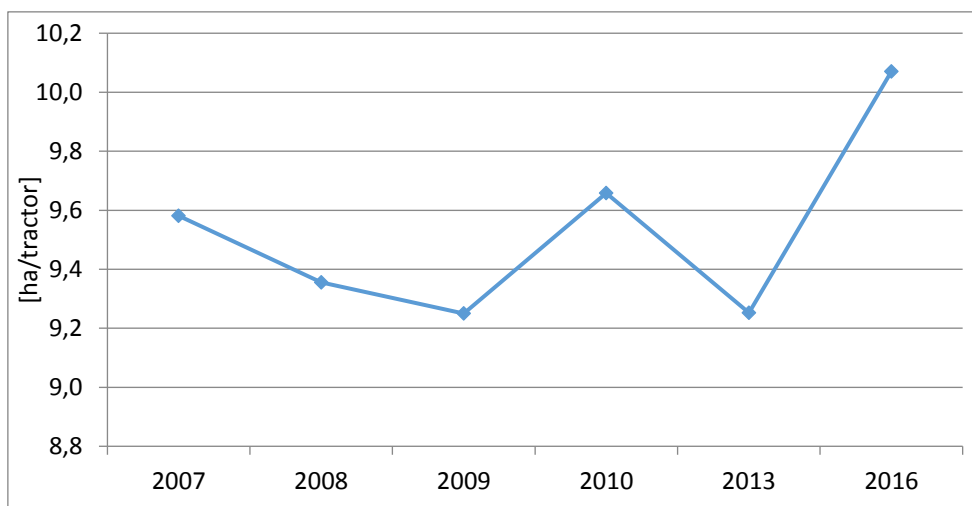


Fig. 3. Utilized agricultural area per one tractor in Poland in 2007-2016

In most of the cases observed, the number of combine harvesters per 100ha (Fig.4) increases. This may indicate a constant demand for these machines in the Polish farms as well as an increasing profitability of smaller farms for which owning a combine harvester had not been possible before for economic reasons. On average, there are 2 combine harvesters per 100 ha UAA in Poland.

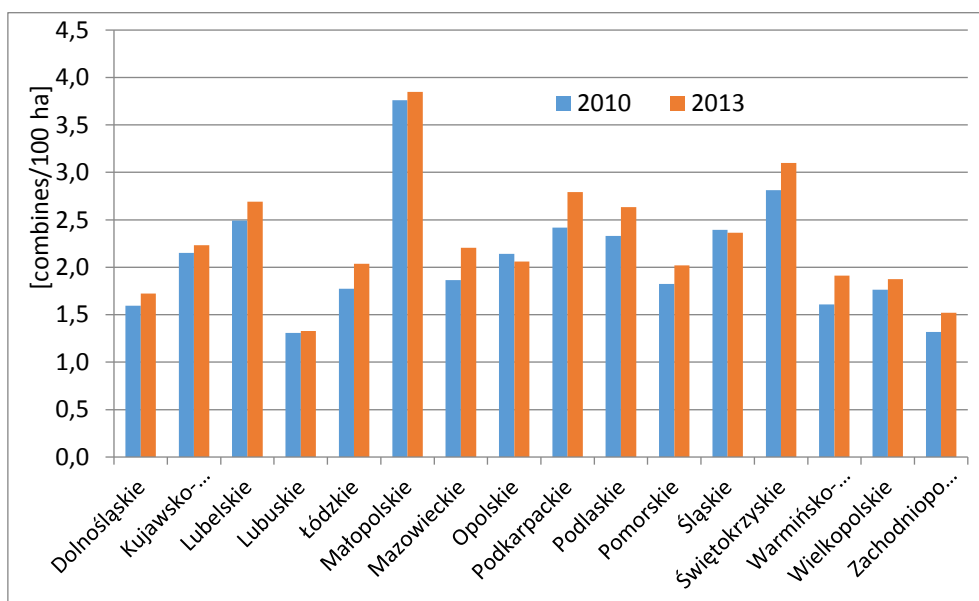


Fig. 4. Number of combine harvesters per 100 ha of cereals in particular provinces of Poland in 2010 and 2013

The installed power of tractors increased from 2.1% up to even 22.5% depending on the province. The change dynamics of this indicator is varied and it is in no direct relation to the production organization intensity in agriculture.

The graphs and tables presented show the general increase in the value of installed power indicators. By comparing the values of the indices directly with the values of production intensity, it is not possible to determine unequivocally the relationships between the traits under examination.

Tab. 3. Installed power of tractors in kW/100ha and intensity of production organization in particular provinces of Poland in 2007-2013

Province	2007	2007	2010	2010	2013	2013	Change 2007-2013 in %	
	kW/100ha	points	kW/100ha	points	kW/100ha	points	kW/100ha	points
Dolnośląskie	258.4	168.3	226.5	162.0	264.0	164.7	2.1%	-2.1%
Kujawsko-pomorskie	337.3	298.1	308.2	324.6	360.2	280.3	6.8%	-6.9%
Lubelskie	473.8	178.5	458.5	177.2	531.3	217.7	12.1%	22.0%
Lubuskie	165.1	138.0	168.6	130.3	202.4	155.2	22.5%	12.5%
Łódzkie	485.4	251.2	475.9	244.7	559.2	283.7	15.2%	12.9%
Małopolskie	710.7	248.2	659.6	151.2	833.3	159.7	17.3%	-35.7%
Mazowieckie	418.9	235.9	395.8	241.4	477.5	248.7	14.0%	5.4%
Opolskie	308.5	233.1	280.6	267.0	293.1	242.3	-5.0%	3.9%
Podkarpackie	641.9	141.4	596.8	113.2	696.7	125.0	8.5%	-11.6%
Podlaskie	358.6	262.1	358.1	289.7	412.6	238.3	15.1%	-9.9%
Pomorskie	248.8	195.5	218.6	198.7	269.0	235.1	8.1%	20.2%
Śląskie	485.4	180.1	427.3	168.7	518.3	172.9	6.8%	-4.0%
Świętokrzyskie	568.6	193.8	569.7	169.7	696.7	189.2	22.5%	-2.4%
Warmińsko-mazurskie	201.0	186.3	183.4	197.0	217.9	177.5	8.4%	-4.8%
Wielkopolskie	349.1	337.3	321.4	330.4	376.1	327.6	7.7%	-2.9%
Zachodniopomorskie	134.5	138.7	124.9	139.6	145.5	131.3	8.2%	-5.3%

The graphs show the increase in both the intensity and the indicators expressing farm mechanization. It can be stated that the increase in production intensity affects the quantity of fixed assets, or that changes in farm mechanization affect the increase of intensity.

CONCLUSIONS

On the basis of the data analyzed, the impact of the intensity of production organization on farm mechanization in Poland cannot be clearly determined. Some relationships may be noticed, such as a general increase in the number of tractors and, what it involves, an increase in the level of tractive force, and a decrease in surface area per one tractor with the simultaneous increase in intensity. These relationships are not immediately noticeable for particular provinces.

Only a more detailed analysis based on research studies on a group of selected farms will allow to determine precisely the relationships between the examined features.

REFERENCES

- Figurski J., Lorencowicz E. (2010). Ocena zmian wielkości ekonomicznej i intensywności organizacji produkcji w wybranych gospodarstwach rodzinnych. *Roczniki Naukowe SERiA*, XII(3), 72-75, <http://rn.seria.com.pl/rn/category/45-12-3.html?download=2217,12-3-figurski>
- GUS (1995-2016). Roczniki Statystyczne Rolnictwa. www.stat.gov.pl
- Jankowiak J., Bieńkowski J., Holka M. (2010). Wpływ intensywności produkcji rolnej na emisje azotu do środowiska. *Roczniki Naukowe SERiA*, XII (1), 65-69, <http://rn.seria.com.pl/rn/category/43-12-1.html>
- Kluba M., Rudnicki R., Wiśniewski Ł. (2016). Intensywność organizacji produkcji a poziom mechanizacji rolnictwa w Polsce w świetle powszechnego spisu rolnego 2010. *Studia Komitetu Przestrzennego Zagospodarowania Kraju PAN*, 167, 214-230, <http://journals.pan.pl/Content/97834/mainfile.pdf>
- Kocira S. (2009). Intensywność organizacji produkcji a wielkość ekonomiczna i typ rolniczy gospodarstw. *Journal of Agribusiness and Rural Development*, 3(13), 99-104, http://www.jard.edu.pl/pub/13_3_2009.pdf

- Kołtun M. (2014). Intensity of production organization compared to the work factor in family farms. *Agricultural Engineering* 4(152), 143-150, DOI: <http://dx.medra.org/10.14654/ir.2014.152.089>
- Kopec B. (1958). System gospodarczy jako wyznacznik struktury ekonomicznej w rejonie. *Zagadnienia Ekonomiki Rolnej*3(1), 29-61.
- Kopec B. (1987). Intensywność organizacji w rolnictwie polskim w latach 1960-1980. *Roczniki Nauk Rolniczych* 84(1), 7-27.
- Kopiński J. (2009). Zmiany intensywności organizacji produkcji rolniczej w Polsce. *Journal of Agribusiness and Rural Development*,2(12), 85-92, http://www.jard.edu.pl/pub/11_2_2009.pdf
- Lorencowicz E. (2009). Intensywność organizacji produkcji a poziom mechanizacji prac w wybranych gospodarstwach rolnych Lubelszczyzny. *Journal of Agribusiness and Rural Development*,2(12), 111-117, http://www.jard.edu.pl/pub/14_2_2009.pdf
- Lorencowicz E., Mazurek K., Kocira S. (2017). Próba aktualizacji metody określania intensywności organizacji rolnictwa. *Roczniki Naukowe SERiA*, XIX(1), 92-98, DOI: 10.5604/01.3001.0009.8346
- Malaga-Toboła U., Kocira S. (2013). Intensywność organizacji produkcji w ekologicznych i konwencjonalnych gospodarstwach mlecznych. *Journal of Agribusiness and Rural Development*,1(27), 153-165, http://www.jard.edu.pl/pub/14_1_2013_pl.pdf
- Parafiniuk S. (2013). Dochodowość gospodarstw rodzinnych o różnej intensywności organizacji produkcji. *Roczniki Naukowe SERiA*,XV(4), 316-320, rn.seria.com.pl/rn/category/25-5-html?download=1208,15-4-parafiniu4
- Polna M. (2009). Intensywność organizacji rolnictwa w Polsce w latach 1996-2002. *Journal of Agribusiness and Rural Development*,2(12), 157-165, http://www.jard.edu.pl/pub/19_2_2009.pdf
- Sawa J. (2009). Intensywność organizacji jako miernik ekologicznego zrównoważenia produkcji rolniczej. *Journal of Agribusiness and Rural Development*,2(12), 175-182, http://www.jard.edu.pl/pub/21_2_2009.pdf
- Szeląg-Sikora A. (2008). Zasoby użytków rolnych oraz wyposażenie w sprzęt rolniczy gospodarstw a poziom intensywności prowadzonej produkcji rolniczej. *Inżynieria Rolnicza*,9(107), 283-290, https://yadda.icm.edu.pl/yadda/.../httpir_ptir_orgartykulypl107ir1072328pl.pdf
- Szeląg-Sikora A., Cupiał M., Niemiec M. (2015). Intensity and labour consumption of integrated production in horticultural farms. *Agriculture and Agricultural Science Procedia*, 7, 249-254, DOI:<https://doi.org/10.1016/j.aaspro.2015.12.040>
- Szuk T. (2009). Wpływ mechanizacji na intensywność organizacji wybranych gospodarstw Dolnego Śląska. *Journal of Agribusiness and Rural Development*2(12), 233-240, http://www.jard.edu.pl/pub/27_2_2009.pdf
- Żak A. (2013). Zmiany obszarowe a intensywność gospodarowania w gospodarstwach indywidualnych. *Roczniki Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich*,100(2), 97-107, http://www.wne.sggw.pl/czasopisma/pdf/RNR_2013_T100_z2.pdf