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POWER SOURCES AND MEANS OF TRANSPORT IN AGRICULTURE OF THE WARMIA AND MAZURY REGION IN POLAND

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Key words: tractor, truck, trailer, harvester thresher, equipment, Warmia and Mazury region, Poland.

Abstract

In 2002, on the farms of the Warmia and Mazury region there were 45.9 thousand tractors, by 2.0% less than in 1996. An increase by 2.2% was recorded on individual farms, whilst on other private farms and in the public sector their number decreased by 68.8% and 34.2% respectively. Similar trends of changes in the number of other power sources and means of transport were noted in the region. They resulted in the increase in the share of individual farms in agricultural land use.

The number of machines per 100 farms and the percentage of farms with machines in relation to the total number of farms rise proportionally to the increase in the AUA of farms. The number of machines per 100 ha of AUA decreases as the size of farms grows. That is why the Warmia and Mazury region, with its size of farms 2.5-fold higher than the average for Poland, has a lower number of tractors, trucks, trailers and self-propelled harvester threshers per 100 ha of AUA and a higher number of the above machines per 100 farms.

ŚRODKI ENERGETYCZNE I TRANSPORTOWE W ROLNICTWIE WARMIŃSKO-MAZURSKIEGO REGIONU POLSKI

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Słowa kluczowe: ciągnik, samochód ciężarowy, przyczepa, kombajn zbożowy, wyposażenie, region warmińsko-mazurski, Polska, tendencja rozwoju.

Streszczenie

W 2002 r. w gospodarstwach regionu warmińsko-mazurskiego znajdowało się 45,9 tys. ciągników, o 2,0% mniej niż w 1996 roku. W gospodarstwach indywidualnych odnotowano wzrost o 2,2%, podczas gdy w innych gospodarstwach prywatnych oraz w sektorze publicznym zaobserwowano spadki, odpowiednio o 68,8 i 34,2%. Podobne były trendy zmian liczby innych środków energetycznych i transportowych w regionie. Były one wynikiem wzrostu udziału gospodarstw indywidualnych w użytkowaniu ziemi rolniczej.

Liczba maszyn w przeliczeniu na 100 gospodarstw i udział procentowy gospodarstw z maszynami w stosunku do ogółu gospodarstw zwiększa się ze wzrostem powierzchni UR gospodarstw, natomiast liczba maszyn na 100 ha UR maleje w miarę wzrostu obszaru gospodarstw. Region warmińsko-mazurski, przy jego 2,5-krotnie większym od średniego dla Polski obszarze gospodarstw, ma mniejszą liczbę ciągników, samochodów ciężarowych, przyczep i samojezdnych kombajnów zbożowych na 100 ha UR i większą liczbę wymienionych maszyn w przeliczeniu na 100 gospodarstw.

Introduction

In spite of a low level of purchases of new tractors and agricultural implements, the number of farm machines on Polish farms increases. The results of the Agricultural Census 2002 show that the number of tractors was by 4.7% higher than in 1996. There were also increases in the number of other power sources and means of transport: trucks – by 72.7%, trailers – by 13.2% and harvester threshers – by 27.6%. However, due to regional diversification of farm size and property structure, as well as other factors, the process of changes in particular provinces (voivodships) was different.

The purpose of this study was to analyze the agricultural equipment of the Warmia and Mazury region as regards power sources and units of transport. The analysis included tractors, trucks, trailers and self-propelled harvester threshers within the period 1996-2002.

Material and Methods

The national and regional statistical data – results of Agricultural Censuses 1996 and 2002 (GUS 1997, GUS 1997a, GUS 2003, GUS 2003a and WUS 2003) provided a basis for the study. During the period between the two censuses changes were observed not only in farm equipment, i.e. power sources and means of transport, but also in resources of agriculturally used area (AUA), the number and size structure of farms. Therefore, the indices of numbers of tractors, trucks, trailers and self-propelled harvester threshers in relation to land area and the number of different categories and size groups of farms have been calculated.

In some cases there were no detailed 1996 data for the present territory of the Warmia and Mazury Province. In such cases the data regarding

the former Provinces (Voivodships) of Olsztyn and Elbląg have been used as a basis for building structural models applied as tools for estimations.

Results and Discussion

In 2002 there were 80.6 thousand farms in the Warmia and Mazury region and, compared with the agricultural census 1996, the number of entities decreased by 7.7 thousand, i.e. by 8.7%. The decrease in the number of farms in the region was higher than the average for Poland, which amounted to 4.3%. The number of farms exceeding 1 ha of AUA also decreased as compared to 1996 by 1.9 thousand farms (by 3.5% – the decrease by 1.9 per cent point lower than the national average). In 2002 there were 52.1 thousand such farms, of which 99.5% were individual ones. In 2002, the average agriculturally used area (AUA) per farm in the region amounted to 14.00 ha, compared with 5.76 ha AUA for Poland. The average size of farms with AUA of more than 1 ha reached 21.5 ha AUA and was bigger than the national average (8.4 ha). 74.4% of the total AUA is in individual use. Other private farms own 11.9% and the public sector – 13.7% of the total AUA in the Warmia and Mazury region. The size of farms affects the situation in the field of agricultural mechanization.

In 2002, on the farms of the Warmia and Mazury region there were 45.9 thousand tractors, i.e. by 2.0% less than in 1996 (Table 1). An increase by 2.2% was recorded on individual farms (Figure 1). In the public sector the number of tractors was systematically decreasing (by 68.8% as compared to the situation of 1996), which was connected with changes in the

Table 1

Number of tractors and other power sources on farms in 1996 and 2002

Years	Tractors	Trucks	Trailers	Harvester threshers
1996	46 877	2 596	31 418	5 005
2002	45 948	3 563	30 734	5 513
1996=100	98.0	137.2	97.8	110.1

Source: WUS 2003 and author's calculations

ownership structure in agriculture. As compared with 1996, the number of tractors decreased also on other private farms (by 34.2%). The largest numbers of tractors and trailers for trucks were noted in the farm size group of 10 to 20 ha of AUA, whereas the highest numbers of trucks, trailers for tractors and harvester threshers were recorded in the farm size group of 20 to 50 ha (Table 2).

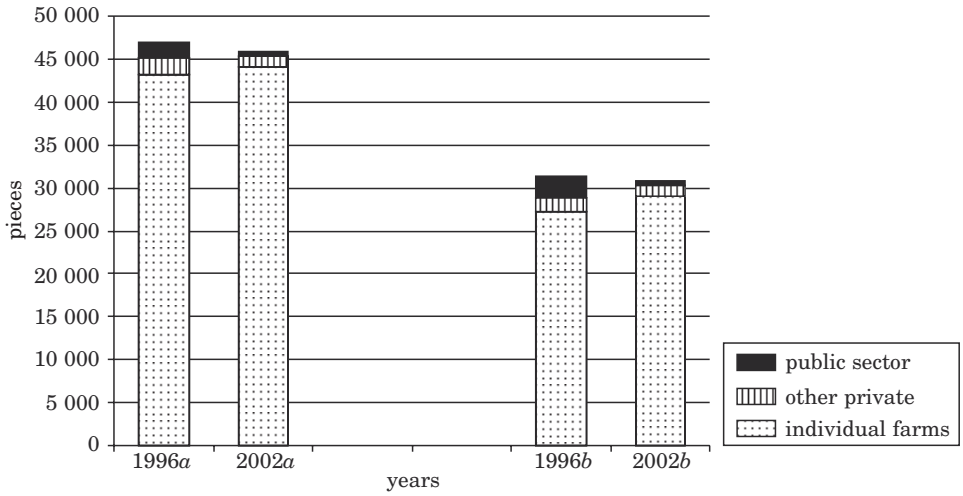

Fig. 1. Number of tractors (*a*) and trailers (*b*) in particular sectors of regional agriculture, 1996 and 2002

Table 2

Farms with tractors and other power sources in 2002 according to size groups

Size of farms (ha)	Number of farms with					
	tractors	trucks		trailers		harvester threshers
		< 2 tons	> 2 tons	for tractors	for trucks	
< 1	1 852	11	6	26	2	0
1 to 5	3 266	308	157	1 028	143	178
5 to 10	4 199	197	95	1 788	100	
10 to 20	11 128	376	193	6 349	234	831
20 to 50	8 675	468	285	6 564	132	2 347
> 50	2 258	312	281	1 997	37	1 507
Total	31 378	1 672	1 017	17 752	648	4 863

Source: WUS 2003 and author's calculations

The number of farms with tractors and other power sources and units of transport, in relation to the total number of farms, was increasing proportionally to the growth in the AUA of farms (Table 3). The biggest differences were observed in the case of harvester threshers. The percentage of farms with tractors ranged from 6.5% in the group of farms below 1 ha of AUA to 93.3% in the group of farms with 50 ha and more (Figure 2).

In 2002, there were about 4 tractors, 0.3 trucks, 2.7 trailers and 0.5 harvester threshers per 100 ha of AUA in the Warmia and Mazury region

Table 3

Farms with tractors and other power sources as a percentage of total farms in 2002

Size of farms (ha)	Percentage of farms with					
	tractors	trucks		trailers		harvester threshers
		< 2 tons	> 2 tons	for tractors	For Trucks	
< 1	6.5	0.0	0.0	0.1	0.0	
1 to 5	17.5	1.6	0.8	5.5	0.8	0.7
5 to 10	53.3	2.5	1.2	22.7	1.3	
10 to 20	80.7	2.7	1.4	46.1	1.7	6.0
20 to 50	93.1	5.0	3.1	70.4	1.4	25.2
> 50	93.3	12.9	11.6	82.6	1.5	62.3
Average	38.9	2.1	1.3	22.0	0.8	6.0

Source: WUS 2003 and author's calculations

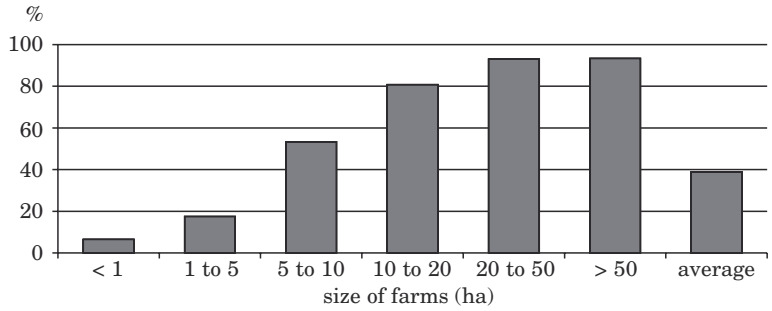

Fig. 2. Farms with tractors in relation to the total number of farms

(Table 4). For tractors, the value of the above index in the region reached approximately 50% of the average value for Poland. Previous analyses show that the number of tractors, in relation to the unit of AUA, was decreasing as the size of farms was growing (Pawlak 2003). Also in the Warmia and Mazury region the number of tractors decreases as the size of farms grows (from 20.2 in the group of households with less than 1 ha of AUA to 1.4 on farms with 50 ha and more). The number of tractors per 100 farms increases proportionally to the growth in size of farms. In 2002 there were only 7.2 of them per 100 households with less than 1 ha, and 325 per 100 farms with 50 ha and more (Figure 3). The average size of a farm in the Warmia and Mazury region is about 2.5-fold higher as compared with the national average. This is the main reason for such a big difference in the value of the indices under discussion, both for tractors and other power sources and means of transport.

Table 4

Tractors and other power sources per 100 ha of AUA in 2002

Years	Tractors	Trucks	Trailers	Harvester threshers
1996	3.78	0.21	2.53	0.40
2002	4.07	0.32	2.72	0.49
1996=100	107.7	150.8	107.5	121.0

Source: WUS 2003 and author's calculations

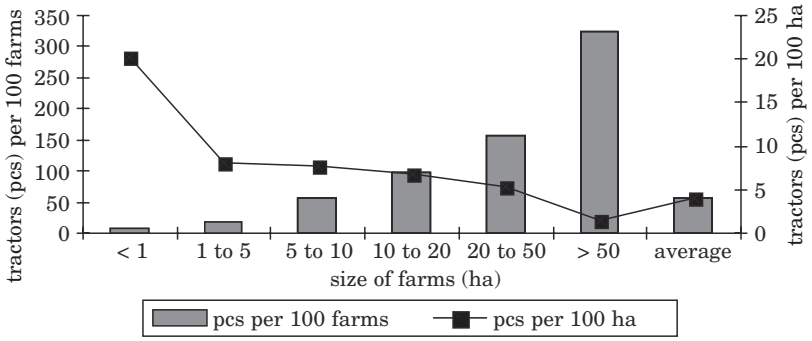

Fig. 3. Number of tractors per 100 farms and per 100 ha of AUA

In the structure of tractors, the vehicles with a power 40-60 kW are most numerous (Figure 4). In general, the number of tractors with a higher power of engines is higher, compared with the average for Poland. In the Warmia and Mazury region, the proportion of tractors with engines of 60 kW and more amounts to 19%, compared with the national average of 9% versus the total number of tractors. The percentage of higher power range tractors was rising proportionally to the increase in the AUA of farms. This is the main reason for the above differences.

In 2002, as compared with 1996, the number of farms owning tractors decreased by 5% and was equal to 31.4 thousand, which made up 38.9% of the total number of farms. The average number of farms with tractors in Poland is a little lower and amounts to 36.7%.

In 2002, 2.7 thousand farms owned 3.6 thousand trucks; on 1.7 thousand farms there were 1.9 thousand trucks with a tonnage up to 2 tons. On average there were 132.5 trucks per 100 farms (average for Poland is 126.3). The number of farms with trucks per 100 farms was increasing with the increase in AUA. In the group of farms with an area to 10 ha the farms with trucks constituted from 0 to 3.7%, and in the group of farms bigger than 50 ha they accounted for more than 24% of the total number of farms.

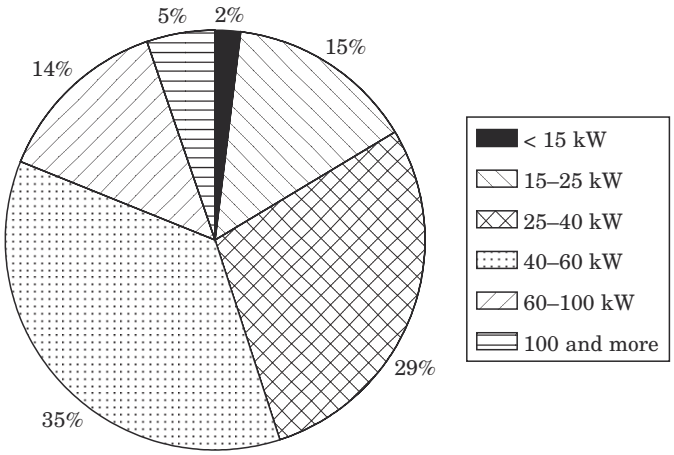

Fig. 4. Structure of tractors by engine power

The number of trailers in 2002 was 30.7 thousand, including 29 thousand on individual farms exceeding 1 ha of AUA. Compared with the situation in 1996, this number was by 2.2% lower as regards the total number of farms, and by 2.2% higher on individual farms exceeding 1 ha of AUA. On average, there were 36.1 trailers per 100 farms in the region, and 2.6 trailers per 100 ha of AUA.

The number of harvester threshers in 2002 was 5.5 thousand. Compared with the situation in 1996, this number was by 10.1% higher. On average, there were 6.8 harvester threshers per 100 farms in the region, and 1.1 machines per 100 ha of cereals and rape. The average values of these indices for Poland were: 4.2 harvester threshers per 100 farms and 1.5 machines per 100 ha of cereals and rape.

Conclusion

Compared to 1996, the number of tractors in the Warmia and Mazury region was by 2% lower in 2002. A decrease by 68.8% was recorded in the public sector, and by 34.2% on private farms other than individual ones. At the same time, an increase by 2.2% was observed on individual farms. Similar trends of changes in the number of other power sources and means of transport were noted in the region. They resulted in the increase in the share of individual farms in agricultural land use.

The analysis performed in the study has confirmed interdependencies between the size of farms and the values of indices describing the number of machines per unit of AUA and per 100 farms. The number of machines

per 100 farms and the percentage of farms with machines in relation to the total number of farms rise proportionally to the increase in the AUA of farms. The number of machines per 100 ha of AUA decreases as the size of farms grows. That is why the Warmia and Mazury region, with its size of farms significantly higher than the average for Poland, has a lower number of tractors, trucks, trailers and self-propelled harvester threshers per 100 ha of AUA and a higher number of the above machines per 100 farms, compared with the national averages.

References

Ciągniki, maszyny rolnicze i inne środki transportowe. 1997. GUS. Seria wydawnicza Narodowy Spis Powszechny. Powszechny Spis Rolny 1996, Warszawa.

Ciągniki, maszyny rolnicze i inne środki transportu w gospodarstwach rolnych. 2003. GUS. Narodowy Spis Powszechny Ludności i Mieszkań. Powszechny Spis Rolny 2002, Warszawa.

PAWLAK J. 2003. *Środki mechanizacji w rolnictwie polskim.* Przegląd Techniki Rolniczej i Leśnej, 10: 3–5

Raport z wyników spisów powszechnych województwa warmińsko-mazurskiego. 2003. WUS. Powszechny Spis Rolny 2002. Olsztyn.

Użytkowanie gruntów i ich jakość. 2003. GUS. Narodowy Spis Powszechny Ludności i Mieszkań. Powszechny Spis Rolny 2002, Warszawa.

Użytkowanie gruntów i powierzchnia zasiewów. 1997a. GUS. Seria wydawnicza Narodowy Spis Powszechny. Powszechny Spis Rolny 1996, Warszawa.

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