

## FLEET OF TRACTORS ON FARMS OF LATVIA AND TRENDS OF DEVELOPMENT

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**Abstract.** The article deals with the renewal rates of the fleet of tractors on the farms of Latvia, the changes in the quantity of tractors, and their energy intensity. It shows the rate of the growth of the number of tractors in the fleet of tractors which were produced during the last six years, as well as its diversity. It presents a study of the interrelation between the formation of the structure of the fleet of tractors and the total area under crop on the farm. It exposes the distribution structure of energy provision by the engine capacity of the tractor depending on the total area under crop of the farm, priority acquisition of new tractors having a small share among those tractors which are being purchased nowadays. Perspectives are revealed for further formation of the fleet of tractors by reducing the quantity of tractors and increasing the number of energy intensive machines on the farms.

**Keywords:** fleet of tractors, energy provision, farms, power capacity, area of farms.

### Introduction

In order to ensure economic efficiency of the fleet of tractors, great attention should be paid to correct formation of its structure, quantity and energy intensity. The topicality of this issue results also from the fact that the tractors make the main energetic basis on the farmers' homesteads, particularly, during the last few years when their prices and energy intensity have significantly grown. Therefore, comprehensive economic and technical estimate of the fleet of tractors allows to find out efficient ways of its development [5]. High-energy provision is required to raise labour efficiency, which can be attained by increasing the number of tractors, or their capacity. The most efficient is the second way.

### Objects and methods

The object of the present research is the Latvian fleet of tractors. The applied methods are analysis and interpretation of the statistical data and prognoses for the renewal of the fleet of tractors, its structure and number. There are used the materials of the Central Statistics Office and National Inspection of Technical Supervision [1, 2].

### Results and discussion

During the time period from 2000 to 2007, there were no essential changes in the quantitative composition of the fleet of tractors. Thus, if in the year 2000 it constituted 54820 tractors, then in 2007 it had increased by 8.6 %. In many respects it accounts for the purchase of new tractors, increased number of disabled tractors on the farms. The number of technically nondefective tractors, which could operate adequately, does not reach 50 %, only 38 % undergo technical checkups. It is also characteristic that undergoing a technical checkup of tractors has a tendency to decrease, and this indicates ageing of the tractor park. Figure 1 shows distribution of the number of tractors on the farms with different areas under crop and the percentage of the tractors on these farms produced during the last 6 years (excluding tractors on the farms which have no areas under crop).

It is evident from Figure 1 that on the farms having more than 50 ha of areas under crop the number of tractors has increased 3.3 times in the year 2007 if compared to the year 2000. In many respects, this accounts for economic conditions of large farms during the last years.

The average annual rate of increase in the number of tractors in the fleet produced during the discussed period of time from 2000 to 2007 constituted 6.3 %. The absolute increase in the number of tractors in the fleet of tractors produced during the last 6 years was 1678 tractors if compared to the year 2000.

Figure 2 presents the dynamics of the number of tractors in the fleet of tractors produced during the last 6 years from 2000 to 2007. On the basis of analytical alignment of the time series of the number of tractors in the fleet produced during the last 6 years a trend model is obtained  $Y=17.923X^3 -198X^2+664.2X+2249.4$  which is adequate to the basic tendency for the number the

tractors produced during the previous 6 years to change in the fleet. This confirms the value of the determination coefficient  $R^2 = 0.8632$ . In the trend model the changes of the number of tractors produced during the last 6 years in the fleet of tractors are regarded as the function  $Y=f(x)$ , where  $Y$  is a theoretical value of the number of tractors produced in the previous 6 years,  $X$  is the period of time (years),  $X = 1... 8$  (the years 2000 and 2007).

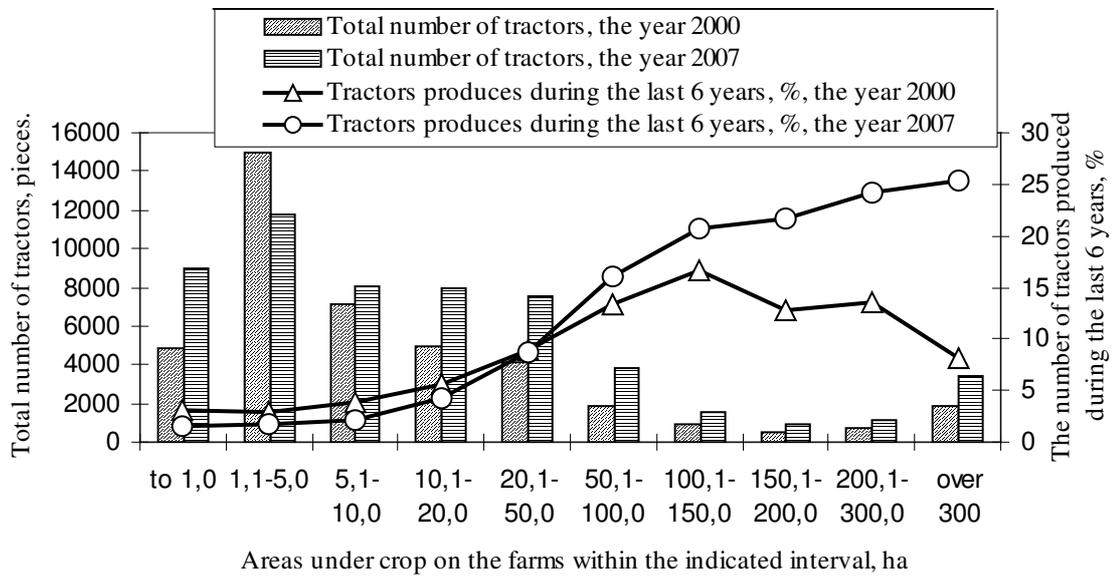


Fig. 1. Total number of tractors and their percentage produced during the last 6 years on farms with different areas under crop (the years 2000 and 2007)

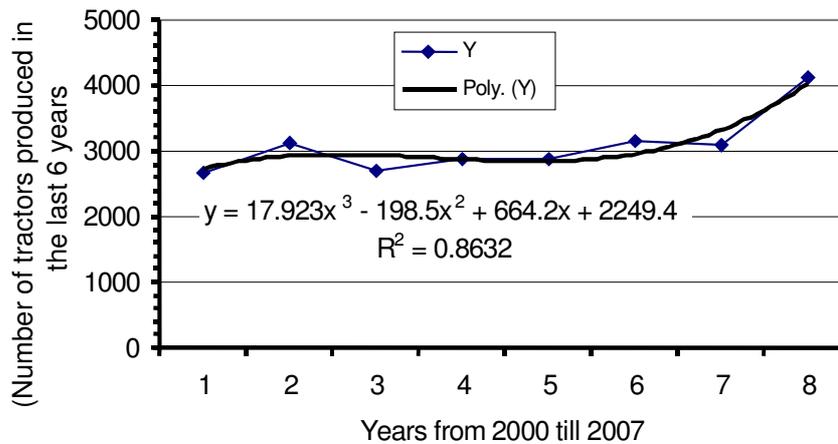


Fig. 2. Dynamics of the number of tractors in the fleet of tractors produced during the last 6 years from 2000 to 2007

It is evident from Figure 2 that the dynamics of the number of tractors in the fleet produced during the last 6 years has certain heterogeneity caused by economic conditions of the farm and other factors.

The equation obtained as a result of analytical alignment of the time series, as well as the changes of the number of tractors in the fleet produced during the last 6 years show that its development takes place with a variable increase. The coefficient ( $a_3 = 17.923$ ) characterises the acceleration level of the particular process and shows that it grows since  $a_3 > 0$ .

Significant changes are going on in the qualitative composition of tractors, their capacity is growing. Thus, in 2007, if compared to the year 2000, the total capacity of the fleet of tractors had increased by 15 %. Figure 3 presents a change of the mean capacity of the tractor on farms with different areas under crop in comparison of the year 2000 to 2007.

It is apparent from Figure 3 that the mean capacity of the tractor on a farm with an area under crop up to 50 ha is 48 kW, but on farms with areas under crop more than 50 ha it was 66 kW in the

year 2000, and in the year 2007 it was 51 and 73 kW, respectively. The data show that on small farms the mean capacity of the tractor increased by 7 %, and on larger farms it went up by 12 % in the year 2007 if compared with the year 2000. The specific energy provision per hectare of the area under crop has changed as well. Figure 4 presents the distribution of energy provision on the farms engaged in the grain production with various areas under crop.

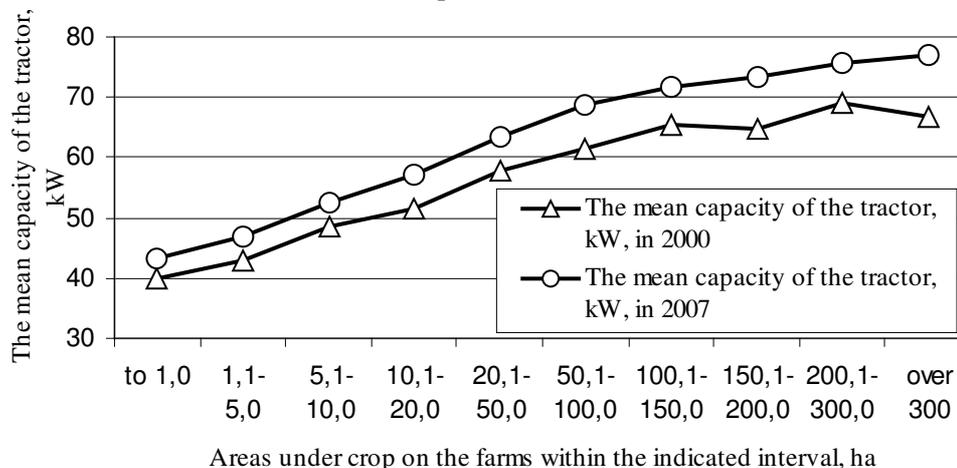


Fig. 3. The mean capacity of the tractor on farms with different areas under crop (in the years 2000 and 2007)

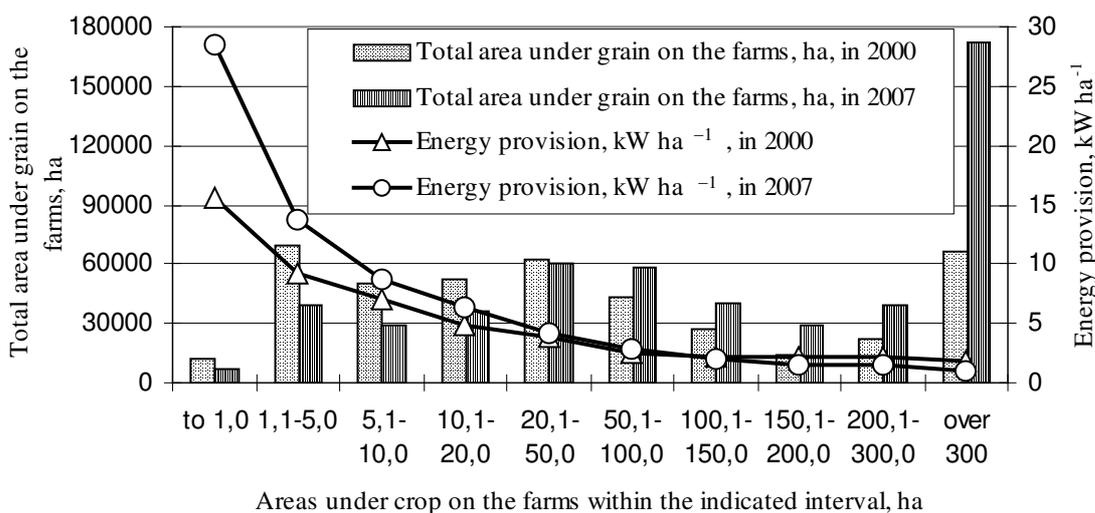


Fig. 4. Energy provision and the total area under grain on the farms (the years 2000 and 2007)

Figure 4 shows that the mean energy provision on the farms with the areas under crop less than 50 ha is  $8.1 \text{ kW ha}^{-1}$  but on the farms which are larger than 50 ha it was  $2.19 \text{ kW ha}^{-1}$  in the year 2000, and in 2007 –  $12.3$  and  $1.77 \text{ kW ha}^{-1}$ , respectively. The data analysis indicates that on the small farms the specific energy provision per hectare increased over 52 % in 2007 in contrast to the year 2000. The cause of this is the fact that the area under crop has decreased on these farms, there are a lot of tractors (see Fig. 1), and the mean capacity of the tractor has increased by 7 %. On the average, the area per one tractor is 6 ha. On the large farms the specific energy provision per hectare has decreased by 19 %. On the average, the area per one tractor is 47 ha. If comparison is made of the number of farms having more than 50 ha of the area under crop, in 2000 there was 1 % of such farms, their areas under crop constituted 41 % of the total area under crop, but in 2007 – 3 %, and their area under crop covered 66 %. There is a tendency for the farms to increase their areas.

Data show that the energy provision on the farms is ensured not at the expense of the number of tractors but by increasing their capacity. Evidence to this is the fact that high-power tractors are mainly used on the large farms, which allows having high efficiency of the tractor aggregates and promotes reduction in the fuel consumed per hectare. Changes in the energy provision are also

connected with the application of new technologies. Besides, the use of combined aggregates performing several technological operations raises simultaneously the indices which characterise the growth of efficiency and point to a change in the soil tillage methods [3].

For comparison, in the industrial countries, like Canada, the USA, Australia, the energy provision constitutes  $0.35 \text{ kW ha}^{-1}$ , in the countries of Central and Eastern Europe –  $1.06 \text{ kW ha}^{-1}$ , on small farms of Western Europe and Japan –  $9.18 \text{ kW ha}^{-1}$  [4]. Data show that highly efficient energy intense machinery is used in the industrial countries. Energy provision is solved at the expense of increased capacity of tractors, not their number.

When a tractor was chosen, the highest priority was given to 5 brands from the year 2000 to 2007. Purchase of the tractors in this period is presented in Figure 5.

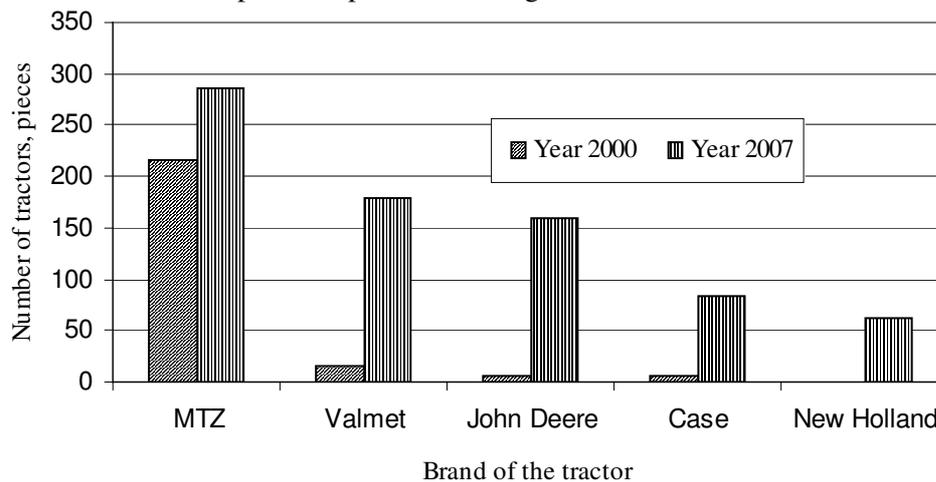


Fig. 5. Purchase of new tractors of the highest priority by the farms in the years 2000 and 2007

It is evident from Figure 5 that the tractors of the brand MTZ have the greatest share in the considered group of tractors. However, the number of the acquired tractors MTZ is decreasing from year to year as compared with the total number of tractors purchased during a year. Thus, in 2000, their share constituted 72 %, but in 2007 already 26 %. Data show that among the purchased tractors ever increasing preference is given to the brands: Valmet (Valtra), John Deere, Case. This indicates that the decisive factors in the renewal process of tractors are not only the prices but also reliability, energy intensity, the possibilities of effective application, fuel economy, comfort and other indices.

## Conclusions

1. Data analysis indicates that the structure of the fleet of tractors on the farms of Latvia is changing at the expense of the increasing share of energy intensive tractors.
2. During the period from the year 2001 to 2007, the total power of the tractor fleet has increased by 15 %, or 390475 kW.
3. The structure of the fleet of tractors on the farms depends on the total area under crop and the volume of production of the farm.
4. On the farms with the total area under crop of 200-300 ha, the tractors of 80-100 kW capacity constitute 85 %.
5. The tendency of the farms to become larger, the increasing number of energy intensive machines, the renewal rates of the fleet of tractors and the number of technically nondefective tractors allow a prognosis that in the future the number of tractors may reach 24 – 28 thousands.

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