

Trends of the transformation of Estonia's Wheeled Tractor Park

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Abstract. This paper analyses the current situation of the Estonian Tractor Park and the trends of its transformation. The examination focuses on the brands and age of the tractors in use currently and in the recent past. It tries to predict the composition and the main tendencies of tractor procurement in the near future. It became evident that 90% of the tractors currently used in Estonian agriculture are of Russian origin, although during the last 10 years the purchase of Russian tractors has decreased substantially. At the same time the purchase of convenient, well-designed, highly efficient, but expensive Western tractors has increased rapidly, indicating the growing prosperity of Estonian farmers.

Key words: tractor, predictions, tractor park, Russian - western tractors

INTRODUCTION

According to data from a structural study from 2003, there were approximately 36.8 thousand farms in Estonia and about 795.6 thousand ha of agricultural land at that time. About 70% of these farms had less than 10 ha of agricultural land, or about 12% of the total amount of agricultural land. Most of the agricultural land (66%) was owned by farms of more than 50 ha. An average farm had approximately 244 ha of agricultural land (Põllumajandusloendus..., 2002).

The enlargement of the European Union brought changes to Estonian farmers. While the growth in financial assistance is an important issue, other factors such as increased competition should also be considered. As a result, the successful farmer is one who produces more effectively, whose merchandise is of higher quality and whose manufacturing costs are lower than competitors. Lower production costs presume that the costs can be controlled. Therefore it is important to maintain agricultural machinery with utmost thoroughness to assure its reliability and provide a sound basis for future planning.

The objectives of the Common Agricultural Policy (CAP) which were recorded in the Rome treaty (in effect since January 1st 1958) were kept unchanged and formulated once again in the Amsterdam treaty in 1997 (Eesti maaelu arengukava ..., 2004). These objectives are the following:

- 1) To raise agricultural productivity by enhancing the technological progress and by guaranteeing the rational development of agriculture and most importantly – optimal use of the workforce;
- 2) To ensure high living standards through increased personal incomes for those in the agricultural sector

- 3) To stabilize markets;
- 4) To guarantee the supply of food products;
- 5) To guarantee reasonable consumer prices.

From time immemorial, agriculture in all its dimensions has been a primary means of occupation and income for the rural Estonian population. Changes in economics in the 1990's made country living unattractive for many, and led to the migration of young and educated people to the cities. Thus, the size and growth potential of the rural work force decreased, as did the quality of skilled labour. Rural Estonia can currently be described as having low population density, high average age and low purchasing power, rather closed local society even approaching asocialization from society, in some cases. As a result of the reforms and a changed market situation, the relative importance of agriculture has lessened in terms of the economy, employment and land use. The agricultural landscape has altered significantly; and lands no longer in use are becoming overgrown (Eesti maaelu arengukava..., 2004; Eesti riiklik arengukava..., 2004; Ülevaade Põllumajanduse..., 2004).

The level of development of the countryside is important for improving the quality of life of the entire population. With the increased opportunities for peoples' well-being, there is also a growing need for re-connecting with nature and the traditional cultural environment. Thus, some people are now returning to the countryside. The rural area is strategically important, as well, both as a food source for the cities and as a shelter in a state of emergency (Eesti riiklik arengukava euroopa..., 2004).

Every tractor, despite its reliability, needs attention to its technological condition, including periodic maintenance, repairs and an assessment of its projected life. Therefore, there is a great need for a tractor maintenance infrastructure with its own personnel, material-technical base, organization and leadership, acting as a single, united system - a „human - machine”.

Since the destruction of collective farming, more farmers are using tractors manufactured in the EU. Most manufacturers provide maintenance service contracts, in which maintenance work is scheduled and performed by authorized mechanics, but the price for this kind of service is quite high.

The tractor population in Estonian agriculture has not been analyzed sufficiently in recent years. Data provided in this research should be useful not only to tractor suppliers but also to their users and maintenance service providers (assessors of tractors' technological condition, repair workers, various providers of spare parts, materials, fuels and lubricants).

This research deals with the changes in the composition of the tractor park (brand of tractor, year of production, country of manufacture) during the last 15 years. By then, agricultural production had reached a certain degree of stability and a system for addressing the needs of existing agricultural equipment and technologies had been created. Basic trends in the technological development in agriculture had also been fixed.

The primary purpose of this research was to determine the current condition of the agriculture-related tractor park or “population” and its future in Estonia. Accordingly, the authors set out to do the following:

- 1) Examine the distribution of tractors according to their numbers, composition and age;
- 2) Analyze the cause of developments in agriculture (since the destruction of collective farming);
- 3) Analyze national aid-programs for agriculture.

MATERIALS AND METHODS

The original data for this research comes from the databases of the Estonian Motor Vehicle Registration Centre (MVRC) and can be considered trustworthy, as the work of the MVRC is fully computerized and all databases from nearby MVRC branch offices have been centralized in Tallinn. Therefore, duplication and confusion is highly unlikely. As MVRC is the only institution that issues documentation of ownership, their representatives examine all the data provided about the tractor on site. There is no official way to sell or buy a tractor without the MVRC documents. MVRC has no motivation or need to falsify or change the data. Also, as MVRC has complete data on any tractor, one can say that all tractors in active use have been accounted for. Therefore, we can conclude that the results of this work are representative and apply to all Estonian agricultural production.

One possible miscalculation is if the tractor was still in the MVRC database, but in fact no longer existed, had totally lost its working capacity or was essentially scrap metal. In 2002, when the tractors' technical passports were renewed, MVRC employees tried to exclude all such machines from their lists. For this reason, an decree was issued, stating that owners of tractors manufactured before 1992 had a limited time in which to renew the technical passports. If, during that period of time, the technical passport was not renewed, the tractor was assumed not to exist and was erased from the register. In addition, we can also assume that there are a considerable number of local unlicensed, unregistered tractors in use. Tractors of Western origin, must be registered and documented through border control; it is impossible not to do so. Customs and other taxes enable us to efficiently track the movement of these tractors.

A separate question is how many tractors are actually employed directly in agriculture. Considering the main object and direction of our work, we are mainly interested in the tractors that are actually working in the agricultural sector. Unfortunately, MVRC has no separate record for the factual usage of the tractor. Therefore, the tractors registered in Tallinn and Tartu are viewed separately and viewed in the context of how this affects the general composition of the tractor population.

In this research it was presumed that the tractors registered in Estonia's two largest cities work on municipal projects (canalisation, plumbing and other public utility objects, firms' internal transportation, construction companies, etc). A slight miscalculation in the analysis of the tractor census may also occur from the fact that the new tractors are often bought with lease-agreements. These leasing companies – the actual owners of the tractors – have recorded Tallinn as the location of the company and therefore, based on the research methods, these particular tractors are considered to be in non-agricultural use. If both the buyer and the actual user of the tractor are farmers, the tractor should be considered to be in actual agricultural use.

RESULTS AND DISCUSSION

The distribution of tractors according to brands and manufacturing dates is shown in Table 1 and the percentage of distribution in Table 2. A comparison has been made between information provided by MVRC and the 2001 Agricultural Census (Table 3).

A comparison of data indicates that the numerical difference between databases concerning tractors manufactured in 1991 or later is only 2.7%. The tractors that are registered in the MVRC and work in the city infrastructure have been excluded from the Agricultural Census. Based on the comparison, it can be stated that the data concerning newer tractors is reliable.

In the case of tractors manufactured before 1991, the experts unanimously concluded that the number actually used in agriculture was in reality 40% larger than shown in the 2001 Agricultural Census. Consequently, some 46 441 tractors were being used in agriculture in 2001. The reasons for these conclusions are as follows:

- 1) The data from the MVRC is more accurate, as everything is documented;
- 2) The Agricultural Census was based on oral examination and therefore many farmers covered up their unregistered, but working tractors, due to the cost of insurance, annual inspection and vehicle registration.
- 3) Distribution of tractors into agricultural and non-agricultural categories is rather conditional, because making decisions about the machine's purpose according to the charter of their owner company can be equivocal. According to the MVRC, 2964 tractors, or 8.6% of the total number, were registered in companies in Tallinn and Tartu. In fact, 25.5% of all Western tractors and 6.8% of Russian tractors have been registered in Tallinn and Tartu, The domination of Western companies is probably due to the proximity of leasing firms. Therefore approximately 8,6% of the tractors are outside the agricultural sector (Table 2). According to expert opinions, only 3-4% of all the tractors are being used in non-agricultural areas; therefore it can be assumed that the majority of the tractors are occupied in agriculture.

There is no tractor manufacturing plant in Estonia; tractors have to be purchased either from Russia, at low cost, or at greater expense from Western countries. Although both new and used tractors are imported into Estonia, the recent tendency is towards buying new tractors. Bigger companies have their own branch offices in Estonia and sales (leasing) go through them. Quantities of newly registered tractors in Estonia during the last five years are shown in Fig. 1, and indicate an annual increase in new tractor purchases. However, their importance and numbers are insignificant, compared to the total number of tractors. Only 0.6–1.7% of all active tractors registered in MVRC during the last five years are new. After twelve years or 12 000 work hours, the usefulness of a tractor is considered exhausted and its further exploitation is unreasonable. The tractor is then removed from active use.

Table 1. Distribution of tractors by the years of manufacturing and the brands in Estonia by years 1990–2004.

Tractor brand	Before 1990	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Amount	among them Tallinn	among them Tartu
MTZ	8899	555	614	667	269	369	137	100	239	459	200	150	174	408	82	160	13482	966	240
T-25	3521	26	487	407	335	505	251	3	1	0	0	0	0	0	0	0	5536	144	127
T-30	0	0	1	2	3	46	9	0	5	0	9	0	1	4	0	3	83	32	5
VTZ	0	0	0	0	0	0	0	0	0	1	11	8	21	32	0	12	85	27	4
T-40	3520	347	471	138	28	2	0	0	4	1	0	0	0	0	0	0	4511	141	133
LTZ	0	3	3	10	29	3	3	0	0	7	31	12	26	18	0	0	145	32	7
T-150K	1684	169	116	5	0	3	0	0	1	0	0	0	0	1	0	0	1979	47	30
T-16	2654	120	134	41	9	5	0	0	1	0	0	0	0	0	0	0	2965	37	54
JUMZ	1168	70	41	9	10	0	0	0	0	0	0	0	0	1	0	0	1299	21	33
K-700/701	495	53	495	53	17	0	0	0	0	0	0	0	0	0	0	0	1113	20	23
Russian tractors amount	21941	1343	2362	1332	700	933	400	103	251	468	251	170	222	465	82	175	31198	1467	656
JOHN DEERE	34	0	1	2	1	0	1	1	2	4	3	1	27	33	37	66	213	159	1
VALMET(VALTRA)	56	2	2	8	14	3	15	23	16	18	21	17	25	33	106	100	459	167	8
MF	57	9	2	0	1	2	1	11	11	5	0	4	2	3	10	8	126	36	4
NEW-HOLLAND	0	0	0	0	0	2	1	5	10	8	2	7	17	20	7	19	98	74	4
DEUTZ-FAHR	13	0	0	0	0	0	0	2	0	1	0	0	1	18	23	14	72	40	0
CASE	22	3	0	0	2	2	2	14	10	13	2	1	5	1	0	0	77	16	3
ZETOR	15	2	1	2	0	0	0	5	8	11	1	0	0	0	0	0	45	11	3
FORD	33	0	0	3	2	1	2	0	3	0	0	0	0	0	0	0	44	1	5
CNH-INTERNATSIONAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	22	46	36	0
SAME	1	0	1	0	0	0	0	2	1	0	0	4	5	5	0	0	19	10	0
LAMBORGHINI	0	0	0	0	0	0	0	0	4	8	4	2	0	1	0	0	19	9	3
Other Western tractor brands	1794	30	54	33	19	11	19	15	22	6	13	6	6	10	14	33	2085	194	57
Western tractors amount	2025	46	61	48	39	21	41	78	87	74	46	42	88	124	221	262	3303	753	88
Total amount	23966	1389	2423	1380	739	954	441	181	338	542	297	212	310	589	303	437	34501	2220	744

Table 2. Percentage distribution of tractors by the year of manufacturing and the brand in Estonia by years 1990–2004.

Tractor brand	Before 1990	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Amount	among them Tallinn	among them Tartu
MTZ	37.1	40.0	25.3	48.3	36.4	38.7	31.1	55.2	70.7	84.7	67.3	70.8	56.1	69.3	27.1	36.6	39.1	2.8	0.7
T-25	14.7	1.9	20.1	29.5	45.3	52.9	56.9	1.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.4	0.4
T-30	0.0	0.0	0.0	0.1	0.4	4.8	2.0	0.0	1.5	0.0	3.0	0.0	0.3	0.7	0.0	0.7	0.2	0.1	0.0
VTZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	3.7	3.8	6.8	5.4	0.0	2.7	0.2	0.1	0.0
T-40	14.7	25.0	19.4	10.0	3.8	0.2	0.0	0.0	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	13.1	0.4	0.3
LTZ	0.0	0.2	0.1	0.7	3.9	0.3	0.7	0.0	0.0	1.3	10.4	5.7	8.4	3.1	0.0	0.0	0.4	0.1	0.0
T-150K	7.0	12.2	4.8	0.4	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	5.7	0.1	0.1
T-16	11.1	8.6	5.5	3.0	1.2	0.5	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	0.1	0.2
JUMZ	4.9	5.0	1.7	0.7	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	3.8	0.1	0.1
K-700/701	2.1	3.8	20.4	3.8	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.1	0.1
Russian tractors amount	91.6	96.7	97.5	96.5	94.7	97.8	90.7	56.9	74.3	86.3	84.5	80.2	71.6	78.9	27.1	40.0	90.4	4.3	1.9
JOHN DEERE	0.1	0.0	0.0	0.1	0.1	0.0	0.2	0.6	0.6	0.7	1.0	0.5	8.7	5.6	12.2	15.1	0.6	0.5	0.0
VALMET(VALTRA)	0.2	0.1	0.1	0.6	1.9	0.3	3.4	12.7	4.7	3.3	7.1	8.0	8.1	5.6	35.0	22.9	1.3	0.5	0.0
MF	0.2	0.6	0.1	0.0	0.1	0.2	0.2	6.1	3.3	0.9	0.0	1.9	0.6	0.5	3.3	1.8	0.4	0.1	0.0
NEW-HOLLAND	0.0	0.0	0.0	0.0	0.0	0.2	0.2	2.8	3.0	1.5	0.7	3.3	5.5	3.4	2.3	4.3	0.3	0.2	0.0
DEUTZ-FAHR	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.2	0.0	0.0	0.3	3.1	7.6	3.2	0.2	0.1	0.0
CASE	0.1	0.2	0.0	0.0	0.3	0.2	0.5	7.7	3.0	2.4	0.7	0.5	1.6	0.2	0.0	0.0	0.2	0.0	0.0
ZETOR	0.1	0.2	0.1	0.1	0.0	0.0	0.0	2.8	2.4	2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
FORD	0.1	0.0	0.0	0.2	0.3	0.1	0.5	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
CNH-INTERNATSIONAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	5.0	0.1	0.1	0.0
SAME	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.1	0.3	0.0	0.0	1.9	1.6	0.8	0.0	0.0	0.1	0.0	0.0
LAMBORGHINI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.5	1.3	0.9	0.0	0.2	0.0	0.0	0.1	0.4	0.0
Other	7.5	2.2	2.2	2.4	2.6	1.2	4.3	8.3	6.5	1.1	4.4	2.8	1.9	1.7	4.6	7.6	6.0	0.6	0.2
Western tractors amount	8.4	3.3	2.5	3.5	5.3	2.2	9.3	43.1	25.7	13.7	15.5	19.8	28.4	21.0	72.9	60.0	9.6	2.2	0.3
Total amount	69.5	4.0	7.0	4.0	2.1	2.8	1.3	0.5	1.0	1.6	0.9	0.6	0.9	1.7	0.9	1.3	100.0	6.4	2.2

Table 3. Comparison of data from the databases of MVRC (Motor Vehicle Registration Centre) and 2001 Agricultural Census.

Indicator	Origin of the data		Differences in data between different databases	
	From Motor Vehicle Registration Centre databases, pieces	From a collection of statistics, 2001. Agricultural Count. 1. General Data. Horticulture. Animal raising., pieces	pieces	%
2001 Tractors amount	33172	37178	4006	10.8
Production date 1991 or later	7200 / 21.7	7044 / 18.9	156	2.2

Our data shows the composition of wheeled tractors by brands and manufacturing dates beginning from 1990 till 2005. The study represented in Tables 1 and 2 do not reflect earlier years, when collective farming was not yet wholly abolished and tractors were still in their registers. The data here provides a reasonable basis for making presumptions about the past, present and future of the Estonian tractor park.

One can distinguish three periods in the dynamics of tractor purchasing during the cited 15 years.

1. 1990–1994 could be characterized by an annual sharp decrease in tractor import from Russia, from 2000 to 700. Previously, many brands were bought, including large tractors like the K-701 and T-150.
2. 1995–1997 reflected a deep crisis caused by the economic crises in Russia. The number of tractors purchased decreases even further, reaching its all time low in 1996. At that time only 181 tractors of Russian origin were bought in Estonia (Table 1). It also appears that the import of Western tractors began in 1996 (Table 2.), when the sales figures of Western tractors rose from 41 to 78. Since then these numbers have been increasing every year.
3. 1998–2004 are the years of stability. New tractors were bought annually; the import of Western tractors increased further. Western tractors exceeded the sales figures of Russian origin tractors (Fig. 1) for the first time beginning in 2003.

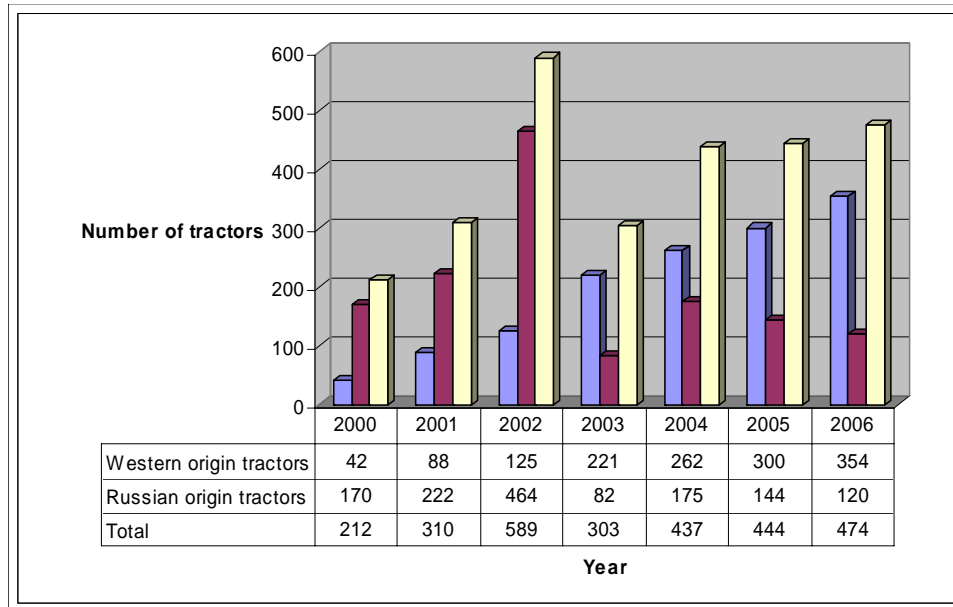


Fig. 1. Number of the first registered new tractors.

The main reason for low tractor sales is the poverty of the farmers. The ranking of investments is also a factor. Units larger than 40 ha are better able to adjust their production according to the needs of the market, as a bigger cash flow enables flexibility in planning investments and improving profit margins. Agricultural units that are smaller than 40 ha are often not capable of reacting quickly enough to market changes. The producers who grow crops mainly for themselves are in the most difficult situation.

Preservation of smaller enterprises is important to maintaining the countryside's economic viability, providing jobs to its inhabitants, and helping to preserve population levels and the local cultural environment. In order to remain viable, these farms should begin to explore alternative entrepreneurship or specialization (Verlaine et al., 2003).

Labour efficiency also depends upon the type of farming undertaken. For example, more work is required in varied activities or with products related to milk than in plant cultivation. The labour efficiency in plant cultivation is 1.5 times larger than that of animal breeding.

Agricultural machines' demand

Due to the large number of new agricultural machines, both tractors and other machinery, it is no longer possible to examine all of them on site. Therefore, based on data from foreign tests and experience, it is important to analyze the economic benefits of each machine. For the most efficient use of machinery, used in combination with tractors, they have been classified according to their power readings. The division was created using different kinds of indicators (Table 4).

Table 4. Power readings of Russian tractors.

No	Indicator	Technical readings								
		Tractors brand	T-16	T-25	T-40	JUM Z-6L	MTZ -82	DT-75M	T-150 K	K-701
1.	Traction force* class KN	6	6	9	14	14	30	30	50	60
2.	Engine	D-21	D-21A	D-37	D-65	D-240	A-41	SM D-62	JAM S-240	D-160
3.	Nominal power kW	14	18	36	44	58	66	121	220	117

* traction force is a force which is applicable on crop fields with normal humidity and density. The engine works on a regulatory sector on the control panel. Tractors have been distributed into such groups since the Soviet period. However, these groups are flexible; it is always possible to supplement them. Using the structural development of the Estonian tractor park as a basis, the tractors could be classified as follows: up to 70 hp (51 kW); 71...90 hp (52...66 kW); 91...110 hp (67...81 kW); 111...130 hp (82...95 kW); 131...150 hp (96...110 kW); 151...170 hp (111...125 kW); 171...200 hp (126...147 kW); over 200 hp (over 147 kW) (Karjane, 2003).

MVRC has a somewhat different classification of power readings than that presented in this paper. Depending on the speed of field ploughing, each operation has its own productivity and power requirement. It is presumed that all the machinery and equipment is being used in good and comparable working conditions. Every machine or tool has its own tractor, suitable for its power requirements. A precondition for making choices is the power usage of machine types. By knowing the cost of a certain tractor's engine power, it is possible to determine the cost for each operation. A tools cost per unit can be calculated by totalling the equipment and tractors' figures (Karjane, 2005).

Distribution of present-day tractors by age

One of the indicators of a tractor's capability is its age. Tractor distribution according to age is presented in Fig. 2. The following conclusions can be drawn from the data in Tables 1 and 2:

1. The tractors being used in Estonian farms and fields are very old (Fig. 2). The average manufacturing date is 1986; average age, 19 years old.
2. Only 13.61% of the tractors are less than 10 years old. The optimum age of usage for a tractor is 12 years.
3. 11 532 tractors, or 34% of the total number, are over 20 years old. Without proper maintenance, there is a constant threat that the tractor may break down and farm work will have to be suspended.
4. Most, 73.6% of Western tractors are more than 15 years old.

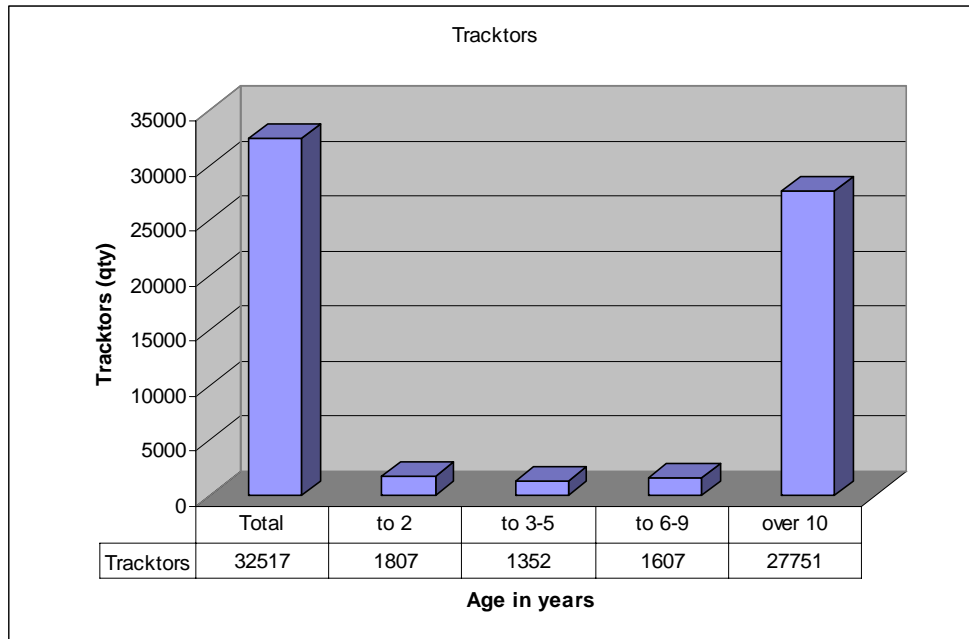


Fig. 2. Classification of tractors by the age (all tractors) 31.12.2006.

Old Western tractors have also been imported into Estonia. Since there is no reliable information about their technical condition, capabilities, and how they have held up on Estonian fields, separate research is required.

Composition of tractor park by brands

Tables 1 and 2 show the distribution of tractors according to their brands and manufacturing dates. The data supports the following conclusions:

1. The most popular and widespread brand is the MTZ, produced in the Minsk Tractor Works, Byelorussia. It manufactures about 39% of all the tractors – 13 482. According to the MVRC, in 2002 the MTZ's sold almost 3 times as many as all Western brands combined. Most are purchased brand new.
2. MTZ tractors produced today are well-designed, well-built, and their price and quality relationship is balanced. It is possible to buy them with the best Western equipment included – Danfoss' hydrostatic wheel mechanism, Bosch hydraulics system (2 cylinders), Grammer's cabin seats, engine-warming mechanism 220 V (block heating) etc.
3. Next in popularity is a small village tractor T-25, which is produced by the Vladimir Tractor Works in Russia. A total of 5536 of these tractors were bought in the years studied. Next is another light-class tractor T-40 (4511), manufactured in the Lipetsk Tractor Works in Russia. Note: The T-30 brand was replaced by a tractor produced in the same plant – VTZ; and the LTZ was renamed T-40.
4. VALTRA is leading the sales of Western tractors with 459, followed by John Deere and MF, who sold 213 and 126 tractors, respectively. The sales figures of all other Western brands do not exceed 100.

5. It is also important to note the constant and irreversible increase in the sales of Western tractors. In 2003 for the first time, more Western origin tractors were sold than Russian (correspondingly 221 and 82).
6. As of January 1, 2005, there were 34 563 tractors registered in Estonia. Of that number, 31 259 (90.4%) were of Russian origin and 3304 tractors (9.6%) were of Western origin (Figure 4).
7. The tractor K700/K701 has not been purchased for a long time and is slowly disappearing. This is also true for another large-class tractor- the T-150 K, although there were still a considerable number of them working in the Estonian fields from 1990.

In the case of a tractor, similarly to any other technical asset, intensive exploitation is presumed. Otherwise the work hour and hectare, ton or any other unit would cost so much that labour and production would become economically meaningless. Intensive exploitation, on the other hand, presumes a large farm or a common use of machinery. Every case requires separate evaluation according to the specific conditions. When purchasing a tractor, the primary consideration its intended use, the necessary technology, the coupling devices, prospective workload, etc. “Over-purchasing” – buying a more powerful machine than the tasks require - can lead to higher costs for fuel, maintenance and repairs. The possibility of a gradual increase in costs of after-sales service is no less important a consideration.

The use of the Western agricultural machinery and technology affects decision-making about the power of the tractor to be purchased. The following observations and recommendations have been made:

- 1) the most commonly purchased tractors are in the 140–165hp power class
- 2) for use with more productive coupling devices, 160–170 hp tractors are advised.
- 3) for field work 160 hp is preferred; for transport, 137; for, loading work, 92 hp, and in using power take-off (field work, transport, load work) 112 hp tractors are preferred.

The preference for using large tractors in field work might be induced by the following factors:

- 1) The innovations and improvements are designed primarily for the more powerful tractors, and customers are highly satisfied with these technologically advanced machines
- 2) The need for continuous improvement of field work technology (e.g. implementation of machinery for soil preparation, fertilization, sowing and/or grass cutting-conditioning) can be satisfied only by powerful tractors that are appropriate for the intensive working process;
- 3) There is a trend towards more extensive work productivity (Karjane, 2005).

The dynamics of the Estonian tractor population during the last 15 years (Table 1) indicates a small but continuously increasing annual growth in the number of tractors. The process has been stable and without sudden changes. Research shows that most of the tractors registered are in working order and have been in continuous use since they were registered in the Estonian Motor Vehicle Registration Centre. No tractor has been

removed („written off”) from the EMVRC during these years. There has also been a small but continuously increasing number of Western tractors registered.

When dividing the tractor population according to brands, the origin of the tractors in Estonia must not be forgotten. Before the collapse of collective farming, there were at least 360 state or collective farms in the SSRE¹. Each of them had a compact set of tractors, which could be used to handle all the necessary work at any time of the year. During the agricultural reform they fell into the possession of individuals unsystematically, at best. Therefore it is almost impossible to find an optimal tractor assembly for any farm from the list of current tractors.

Summary

The Estonian tractor park/population can best be understood as a holdover from the Soviet era, with both benefits and deficiencies. Most of the tractors (27.7%) are 16 or more years old; 41.9%, or 14453, are more than 20 years old, many are leftovers from the collective farming of the Soviet era. The low cost and simplicity account for their continued widespread use. According to the data from the MVRC, there are over 34000 wheeled tractors in Estonia. According to expert opinions an additional 13600 unregistered tractors should be added to this number, for a total of 48101. Most (90,4%) are of Russian origin. While complete maintenance, diagnostics and repair work on Western tractors are scheduled and conducted by the manufacturing companies, maintenance on Russian tractors is rather random.

All in all, although there is some market pressure from Western tractors, their number doesn't significantly affect the composition of the tractor park. For example, Western brands accounted for only 7.6% of newly registered tractors in 2004. For maintenance service providers, the reality is that the majority of the Russian tractors (31198) will remain the most common agriculture vehicle for the foreseeable future, i.e. ten years. However, the increased use of Western agricultural equipment and technology is inevitable. With increased wealth, farmers will be able to take better advantage of maintenance service providers who offer competent service at reasonable prices. Therefore, it is an urgent priority for county vocational schools in Estonia to train maintenance specialists qualified in machinery diagnostics and repair.

It is also important to bear in mind that changes in agriculture happen slowly. As tractors usually work in combination with other agricultural machinery, when buying a new tractor the farmer also has to consider buying a complete new set of such tools. This explains the relative success of MTZ tractors, as most of the existing tools can be attached to them.

CONCLUSIONS

The technical condition of the current tractor park in Estonia is worrisome. A substantial number of the tractors (41,9%) are over 20 years old and, in reality, should

¹ Soviet Socialist Republic of Estonia

be considered as scrap iron. It is necessary to analyse the whole process of production, calculating fuel consumption, and the wear on tractors to determine total expenses for tractor owners' related to the use of agricultural machinery. Currently the state-financed research projects do not include technical branches so there is no research about the maintenance, diagnostics and repairs of the tractors.

It is not reasonable to keep working with the amortized tractor park, especially with growing concerns about pollution, for example, and increasing European regulations in this field. To get an accurate, sufficient and representative overview of the actual capabilities of Western tractors working throughout Estonia, more research is necessary. Such studies would also assist farmers in making decisions about the purchase of tractors.

Additionally, as diesel fuel price has taken a sudden rise (summer, autumn 2005), fuel consumption is another important factor which directly affects the real cost of a product. Therefore it is important to implement a national plan for the development and long-term implementation of more economical fuel usage. As the price of a product increases, the consumers are the ones who have to pay for it.

A problem with agricultural research is that it is narrow, often taking into account only the interests of biologists. Engineering sciences have been forgotten, and the main „work horse” of agricultural production, the tractor, has largely been ignored. With the help of engineering sciences it is possible to propose an optimal set of agricultural machines for a specific type of work.

The „hobby farmer” is another topic that is not researched. Hobby farmers are usually young, smart and strong individuals who work in the city and are engaged in agriculture during their spare time. This is a contingent that could also invest in agricultural production.

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