

Investigations on agricultural equipment maintenance and storage system using an example of the selected commune in Poland

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Abstract: *Investigations on agricultural equipment maintenance and storage system using an example of the selected commune in Poland.* This work aimed at analysis of agricultural producers' approach to agricultural equipment maintenance and storage using an example of the selected commune in Poland. The carried out investigations pointed out that in majority of farms there was lack of appropriate back-up facilities for washing, corrosion removal and anticorrosive maintenance of machines. In equipment maintenance the farmers used most often the least expensive methods that required no specialistic equipment. In majority of farms the means for agricultural equipment maintenance were inappropriate; it resulted from inadequate technical knowledge and low ecological awareness of agricultural producers. The farmers very rarely used professional service in respect of high prices of parts and repairs offered by dealers.

Key words: farm, maintenance, storage, agricultural equipment

INTRODUCTION

Development of farms that carry out an agricultural goods production is significantly affected by the level of work mechanization, thus, by machine fleet equipment. However, implementation of technological progress in farms is conditioned not only by availability of modern equipment, but also by good preparation and organization of technical and service

back-up facilities and also by the state of applied tractor-machine fleet [Skrobacki and Ekielski 2012]. Wrong state of technical equipment makes impossible good and prompt execution of many farm operations.

Service is directly connected with utilization of farm equipment. Even most carefully utilized machines call for periodical inspection, repairs, storage and final disposal, that is considered in machine technical service [Rzeźnik 2002].

One of more important factors that affect the course of production means' consumption is the level of currently performed service and repairs. It is evident from investigations of Tomczyk [2010], that in the structure of agricultural tractor and machines down-times caused by technical reasons, about 25% result from the wrong equipment maintenance and storage, about 20% from faulty design and production technology, and 15% from poor quality of performed repairs.

Economic potential of the inland farms, that is lower than European standards, determines the agricultural producers to search for saving in spare parts expenses, the shortest service intervals, and seasonal equipment utilization in field operations [Juściński 2012].

The operational machine life and reliability are affected not only by difficult working conditions, but mainly by the method and place of agricultural equipment storage after maintenance operations. Generally, it is difficult to change the working conditions, but significant effects can be achieved by proper conditions of machine storage. Selection of storage place for the machine is limited by many factors; thus, it calls for the system approach and knowledge [Matuszak 2007].

The farm machine equipment that is rationally selected and utilized improves production operations in terms of good quality and agronomic time limits. It enables to reduce production costs and facilitates reproduction of agricultural equipment [Muzalewski 2008].

In the light of a wide range of problems that determine readiness of farm technical equipment, this work aimed at analysis of a practical approach to agricultural equipment maintenance and storage, using an example of the selected commune farms in Poland.

MATERIAL AND METHODS

A suitable questionnaire was developed in order to analyze the rules connected with maintenance and storage of equipment owned by farmers. It contained 25 questions of open, half-open and closed types.

The answers to questions obtained in the questionnaire should provide the following information:

- number and variety of owned equipment,

- time spent on autumn maintenance of machines and implements,
- applied operations, methods and ways of maintenance,
- applied preservatives and involved cost inputs,
- equipment repair methods and types of parts used,
- storage methods for agricultural equipment,
- knowledge of farmers in the field of agricultural machine maintenance and storage.

The investigations were carried out among agricultural producers of Masovian commune Naruszewo, in the form of directed interview based on the questionnaire. The survey was anonymous to encourage its participants to frank answers. The investigations were carried out for all machines in 30 selected farms.

The investigated farms had to meet the following criteria:

- cropland area of more than 1 ha,
- main farm income from agricultural production,
- possession of agricultural tractor with cooperating machines.

RESULTS AND DISCUSSION

Among respondents the biggest group consisted of men aged 48–57 years (33% of total number), and slightly less of men aged 38–47 years (30%). The group of men aged 18–27 years took 23%, while two groups of 7% each consisted of persons aged 28–37 years and above 58 years.

Most of investigated farms were included in area range of 26–35 ha (33%). Farms of area 16–25 ha constituted 27%

of their total number, 1–15 ha – 20%, while farms of 36–45 ha and above 46 ha made 10% each.

Animal and plant production made 30% each, while a mixed production predominated in 40% of investigated farms. Cereals were cultivated in all investigated farms, root crops in 73% of farms, oil plants in 13%, while permanent grassland in 97% of farms. In subsection “other (which one)” of that question, 30% of farms reported cultivation of maize for silage, 10% – strawberries, and 3% – vegetables.

An important stage of carried out investigations was getting knowledge on the ways and rules of agricultural equipment maintenance used by the users. The obtained answers in this respect are presented in Figure 1.

cal agents, and 33% pneumatic devices. Investigations showed that most common were the least expensive methods, where no special equipment was required. The maintenance methods that required special equipment were used exceptionally.

It is evident from Figure 2 that the highest inputs for equipment maintenance are involved in farms of the biggest area; these costs increase along with an increase in farm area. A bigger farm own more machines that call for a higher financial inputs for their maintenance.

Investigations on application of maintenance agents showed, that oils and greases were most often used; respectively in 97 and 94% of farms. Other maintenance agents were used rarely, including WD-40 preparation (17% of farms), paints (17% of farms) and cleaners (7% of farms).

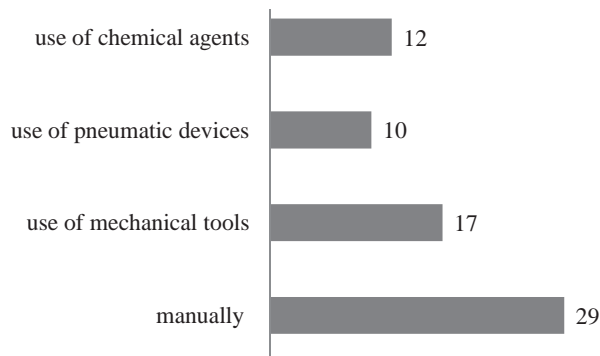


FIGURE 1. Number of farms that used mentioned methods of agricultural equipment maintenance, with consideration to several options in the same farm
Source: Own elaboration.

It was taken into consideration, that it was possible to use more than one maintenance method in the same farm. Results of investigations showed that 97% of farms used manual maintenance methods in the part of equipment, 57% of farms used mechanical devices for maintenance, 40% of farms used chemi-

Unfortunately, most often the anticorrosive protection was performed with the use of used oil that was present in every investigated farm.

Answers to the question on equipment maintenance rules showed, that 83% of machines were maintained always after completion of working season; 70% of

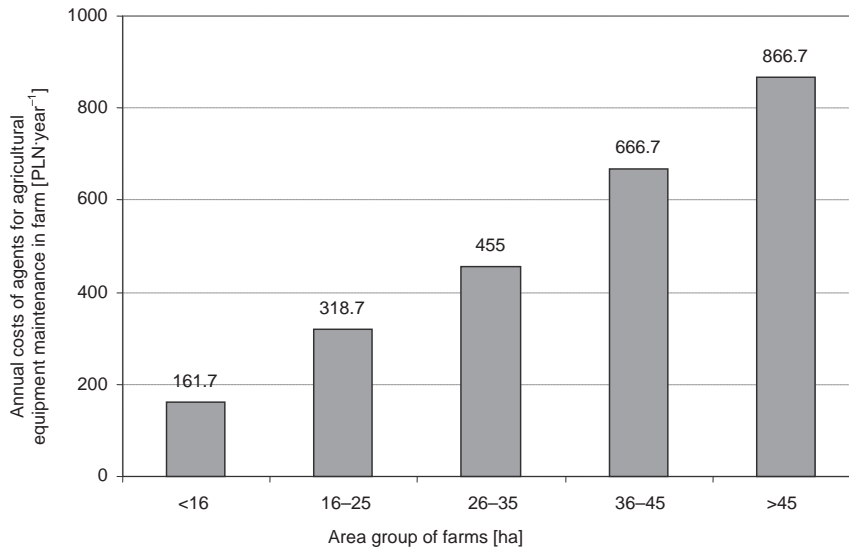


FIGURE 2. Annual cost inputs for agricultural equipment maintenance agents according to area groups of farms (cost inputs related to single farm of a given area group)

Source: Own elaboration.

machines were maintained according to estimation of machine user, and 33% according to machine operator's manual. Technical equipment was not at all maintained in 3% of farms only, although preparation of technical equipment to winter storage after working season is a key element for the equipment life and reliability [Gaworski 2011].

Considering time devoted to autumn maintenance of agricultural machines and implements one can find, that 47% of inquired persons spent on this operations 1–5 days, 40% – 6–10 days, 7% – 11–20 days, 3% – 21–30 days and 3% did not perform any autumn equipment maintenance.

Investigations on equipment failure frequency showed that failures occurred most often in tractors (57% of farms), then in grain combine harvesters (40% of farms), in tillage implements and machines (33% of farms) and in mineral

and manure fertilizer machines (17% of farms). High failure frequency of self-propelled machines resulted from their old age.

Failure frequency problem was expanded with repairs and questions on the applied methods for agricultural equipment repair, with consideration to application of several ways of repairs in a given farm. It was evident from the answers, that in 97% of farms part of repairs was performed by one-self, in 37% of farms part of repairs was performed with the help of another familiar person, in 27% of farms the equipment repairs were performed with the help of especially employed person, and only 10% of repairs was performed by service.

In repairs of agricultural machines and implements, most often there were used the substitutional parts (39%), then original parts (30%), self-made parts (16%) and craftsman-made parts (15%).

Repair and maintenance equipment at disposal of farmers was investigated also. Washing and cleaning devices were present in 70% of farms, all-purpose repair equipment in 100% of farms, and lubricating equipment in 97% of farms.

The carried out investigations showed that in 97% of farms part of equipment was stored in a garage, in 70% of farms part of equipment was kept in an open space, in 37% of farms machines were garaged under an umbrella roof, and in 10% of farms machines were stored under an individual covering.

Table 1 presents the equipment stored in compartments specially adapted for storage. The respondents could write down more than one group of equipment.

vesters (47%). Equipment stored in a garage in least number include implements for mechanical plant cultivation (3%), tillage implements and machines (10%) as well as transport means and machines used in bulky feed harvesting technology (13% each).

An infrastructure equipment of compartments for storage of machines and implements was investigated also: 93% of garages were equipped with lighting, 30% of garages with ventilation system, 7% of garages with repair channel, and 3% of buildings with waste discharge channel. None of the investigated garages was equipped with heating. Among respondents there was one person that did not have any special compartment for machine storage.

TABLE 1. Percentage of particular groups of machines and implements stored in garage (based on investigations in 30 farms)

Groups of machines and implements	Share [%]
Tillage implements and machines	10
Machines for mineral and manure fertilizing	30
Sowing and planting machines	67
Implements for mechanical plant cultivation	3
Machines for chemical plant protection	57
Grain harvesting machines	47
Root plant harvesting machines	27
Machines used in bulky feed harvesting technology	13
Machines for plant post-harvest processing	27
Transport means	13
Agricultural tractors	73

Source: Own elaboration.

It is evident from Table 1, that machines stored in a garage in greatest number include agricultural tractors (73%), sowing and planting machines (67%), machines for chemical plant protection (57%) and grain combine har-

vesters (47%). Opinion of respondents on the effect of agricultural equipment storage method on service life of equipment was investigated also. For this purpose, all answers in particular groups of machines and implements were summed up and

TABLE 2. Effect of agricultural equipment storage method on equipment service life in the farm (1 – no effect, 5 – very large effect)

Groups of machines and implements	Mean value of effect
Tillage implements and machines	3
Machines for mineral and manure fertilizing	4
Sowing and planting machines	4
Implements for mechanical plant cultivation	3
Machines for chemical plant protection	4
Grain harvesting machines	5
Root plant harvesting machines	4
Machines used in bulky feed harvesting technology	4
Machines for plant post-harvest processing	3
Transport means	4
Agricultural tractors	4

Source: Own elaboration.

divided by number of respondents. Thus, there were obtained the mean numerical values for all groups of agricultural machines and implements investigated in the survey (Table 2).

It is evident from Table 2, that in respondents' opinion, the method for grain harvesting machines storage had the biggest effect on machine service life. The farm owners admitted that the method for storage of three machine groups only (tillage implements and machines, implements for mechanical plant cultivation and machines and devices for post-harvest plant processing) had slightly lower effect of the machine service life.

The last of analyzed problems concerned the source of respondents' knowledge on maintenance and storage of agricultural equipment. As it is evident from carried out survey that considered possibility of parallel use of various knowledge sources, the essential information originated mainly from own experience of the respondents (97%). Besides, books

and guide-books were used by 43% of producers, special agricultural publications by 37%, Internet by 24%, and agricultural equipment advisers or dealers by only 20% of agricultural producers.

SUMMARY

In majority of farms there is lack of back-up facilities for washing, removal of corrosion and anticorrosive maintenance of machines. These are the investments that apparently yield no direct production effects, however, one should bear in mind that a decrease in specific agricultural production costs calls for economically justified expansion of technical equipment exploitation period. Properly performed maintenance of agricultural equipment improves operational reliability of machines.

The carried out investigations showed that the used means and methods for anticorrosive protection often raised

doubts. The farmers used most often the least expensive methods, where no special equipment was required. The agents used in agricultural equipment maintenance were in the majority improper; this resulted from poor technical and ecological awareness of agricultural producers. A highly blameworthy, but still very common, was application of used engine- or hydraulic oils in anticorrosive protection.

In analyzed farms the repairs of agricultural machines and equipment was performed in the majority by the equipment users. Realization of these operations without a suitable training and – most often – with the use of cheaper substitutional parts might yield no expected results. The farmers rarely used service stations in respect of high prices of parts and repairs offered by dealers.

A complicated design of new machines, complexity of their structure, high purchase prices and high number of electronic devices will cause that the professional service of machines for the nearest future will be more and more important.

One should inform and persuade farmers of the fact, that an increase in inputs for equipment maintenance results in a decrease in corrosive wear and contributes to reduction of expenses for service and current repairs of machines.

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Streszczenie: *Badania systemu konserwacji i przechowywania sprzętu rolniczego na przykładzie wybranej gminy w Polsce*. W pracy przedstawiono wyniki analizy podejścia producentów rolnych z wybranej gminy w Polsce do konserwacji i przechowywania sprzętu rolniczego. Badania wskazały, że w większości gospodarstw rolnych brak jest odpowiedniego zaplecza do mycia, czyszczenia z korozji i konserwacji antykorozyjnej maszyn. Do konserwacji sprzętu rolnicy najczęściej używali metod najmniej kosztownych oraz takich, które nie wymagały specjalistycznego sprzętu. Środki stosowane podczas konserwacji sprzętu rolniczego w większości badanych gospodarstw były niewłaściwe, co wynikało z niedostatecznej wiedzy technicznej oraz słabej świadomości ekologicznej producentów rolnych. Rolnicy rzadko korzystali z usług specjalistycznego serwisu, uzasadniając to wysokimi cenami części i napraw sprzętu, jakie oferowali dealerzy.

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