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STUDY ON THE IMPORTANCE OF MACHINERY MANAGEMENT IN A MODERN FARM

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Abstract

In the conditions of integration of Romania in the European Union, a profitable and modern agriculture is one of the main conditions for having a competitive economy. That is why, the management of agricultural farms, no matter what their size, is very important in achieving this goal. The paper presents studies and researches made on farm processing machinery management, which is a very important step in a good farm management. We analysed the measures processing operations which are required before the crop may be fed or stored, especially reducing machinery and drying machinery. In what concerns the reducing machinery, we have presented all the types of these machines with their particular characteristics and advantages. We also analysed their mechanisms and the possible adjustments that can be made and presented the importance of drying machines in the final result of farm management and have found the time limits for safe storage of shelled corn.

Key words**:** *machinery management, processing, machinery, adjustments, machine performance*

INTRODUCTION

In every economy, agriculture is a very important part of it, that is why its modernisation, inovation and competitiveness is a continue goal to be fullfilled [10]. In many european countries, modernisation of agriculture consists in improving production organisation and technology and asistance from the IT domain. [7]. In the process of modernisation of agriculture, a fundamental role is kept by the machinery of the farm and also to the management of processing machinery. It is known that labour productivity in agriculture, as well as in industry, has a strong impact on the farming system. [1] From this point of view, another aspect of a modern and competitive agriculture is that of using the most recent technology by the farmers [5] and also increasing the efficiency of the activity through human resources [8].

A best machinery management can only improve the farm performances and therefore improve their efficiency [3], [4].

In a farm, not all crop work is completed in the field. Thus, many times, various processing operations are required before the crop may be fed or stored.

Processing machinery can be classified as stationary and portable. The stationary types are designed primarily for large, permanent installations. These machines lend themselves well to electric power.

The portable types of machines are designed for more diversified farm operation. In most cases, they are driven by a tractor.

In this paper, we will study the following machinery: reducing machinery and drying machinery.

MATERIALS AND METHODS

The materials for study were the reducing machines and drying machines. In what concerns the reducing machinery, these farm crop machines may be classified as it follows:

-Hammer mills
-Attrition mills (or burr mills)
-Roller mills
-Cutter mills.

The first category of machines, hammer mills make reduction due to impact, as their name suggest. Attrition mills make reduction by twisting pressure, and the diference between attrition mills and roller mills reduction is normal pressure in the mlate case.The last one

machine category, cutter mills , as its name suggest, make reduction through cutting.
We must emphesize that all these 4 types can be found into one machine, in different combinations. The power consumtion of these machines is different, depending on the size of the obtained particle.

RESULTS AND DISCUSSIONS

The most important aim of a farmer is the farm productivity, and if we compare this productivity to another european countries, we can see that in this respect, Romania is situated lower than the average EU countries productivity, but it can also be observed that in the last 10 years there is a significant improvement of productivity [9].
Under these conditions, we consider that machinery management (study, adjustments, improvements) is very significant.
In what concerns the mechanisms of the reducing machines, we made studies on hammer mills, attrition mills, roller mills and cutter mills.
Hammer mills may use either free- swinging or fixed hammers. The rotor speed must be kept relatively high (2,500-3,500 rot/min) to produce pulverization. A screen that determins particle size is placed bellow the rotor, as it can be observed in Fig.1.
Attrition mills consist of 2 hard- surfaced circular plates rotating with relative motion. The material is reduced as it passes between the 2 plates.
The common burr mill has one fixed plate and the other rotates (Fig.2). In the lower part of fig.2 is presented a set of burrs.
A roller mill is a very simple reducing machine. Two rollers, spaced with a small clearance, crush the material as it passes between them.
The cutter mill mechanism is similar to that in the field harvester. The cutter mill alone will not produce a very small particle, but it is used to reduce forages to a size that other reducing mechanisms can handle.
Mills are fed by gravity or by conveyor. A cyclone separator is needed if a blower is used. The blower floats the processed material in an air stream. The cyclone separator is made to separate the heavier feed particles from the air by centrifugal force (Fig. 3).

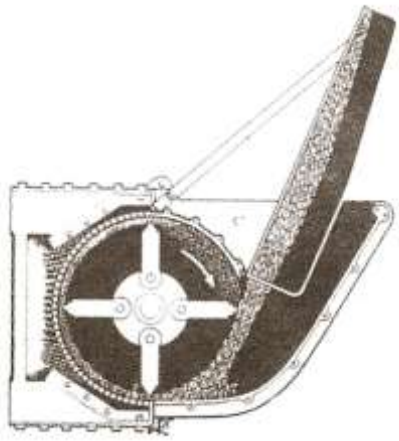

Fig. 1. Hammer mill principle
Source: [6].

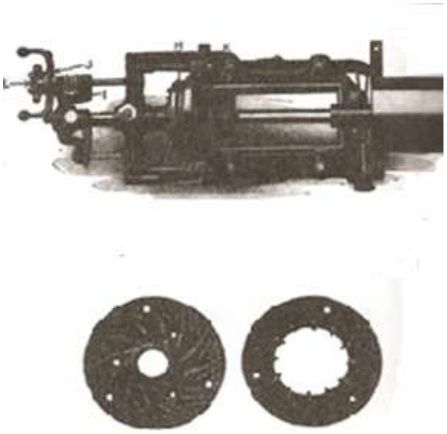

Fig. 2. Burr mill reducing mechanism
Source: [6].

Fig. 3. Cyclone separator
Source: [6].

We also analysed the adjustments that can be made to these machines.

In all cases, the particle size adjustment is the most important. In selecting a reducing machine, a buyer should be sure that the reduction mechanisms are easily replaced or sharpened. Grains and especially corn cobs have a definite abrasive effect on the hardest of chilled cast irons. The particle size is varied for each particular machine, in the following way:

- Hammer mill: vary the size of the screen openings
- Burr mills: vary spring pressure on the burrs
- Roller mills: vary openings between the rolls
- Cutter mills: vary the rate of feeding material connected to the cutter rot/min.

The power requirements for reducing machines depend on the feed rate and the fineness of grind. In Table 1 are presents the energy requirements independent of feed rate for mills.

Table 1. Energy requirements for feed grinding [kWh/t]

	Hammer mills	Burr mills
Shelled corn	6.6- 7.4	3- 5.8
Oats	11.5-14	5-14
Barley	9-14	4- 10
Ear corn	4.5- 8	-
Hay	8- 16	-
Round bales	3- 9.1	-

Source: own determination.

From Table 1 we can conclude that fine grinding requires more power than course grinding. Also, that moist grain requires more energy than dry grain. Roller mills require slighter more power than burr mills.

Considering these aspects, we can conclude that a wise machinery management also includes the adjustments and combinations of machine operations. [2].

Drying machinery

Stored farm crop materials can be spoiled and consumed by microbiological growth. Such growth can be reduced to insignificance with cool storage temperatures and low crop moisture content. The farm manager has the alternative of using natural field drying before harvesting the crop or using drying machinery after the crop has been harvested. The most probable choice will be the least total costs.

After observations, we have found the time limits for safe storage of shelled corn, as it is shown in Fig. 4.

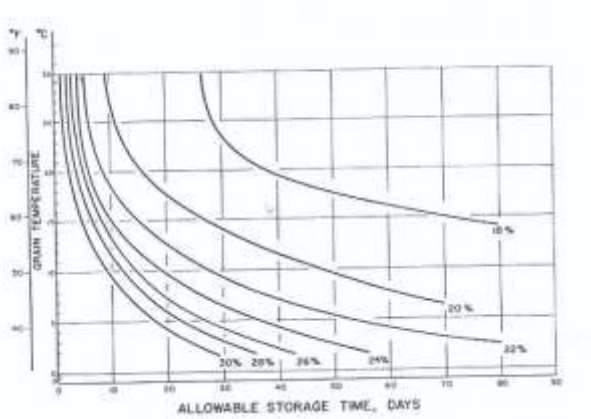

Fig. 4. Time limits for stored shelled corn at different moisture contents

Source: own determination.

In Fig. 4 is presented the dependence between storage time, measured in days and grain temperature. From this diagram we can find the time limits for safe storage of shelled corn. For long time storage, grains need to have less than 13 % moisture content wet basis. The farm manager has the alternative of using natural field drying before harvesting the crop or using drying machinery after the crop has been harvested. The least total cost choice will be probably the most attractive.

Drying principles

Stored hay and grain will lose moisture to the surrounding air as long as the air is relatively drier. The equilibrium moisture content of a crop is that content at which there is no tendency for moisture to leave the crop and enter the surrounding air. Relative humidity need to be lower than 70 % for air at 21^0 C to be in equilibrium with most grains at 12 -13 % moisture content.

CONCLUSIONS

In the first place, we concentrated over the mechanisms of the reducing machines and then we analysed the adjustments that can be made to these machines. On the other hand, we studied the drying machines and principles. Drying machinery management problems are similar to field machinery

problems and have the same importance in the final end of obtaining a good crop. Estimates of costs are used to measure the efficiency of operation and to make management decisions. As with field machines, drying machines have fixed costs and variable costs. Their fixed costs percentage would be about 13 % of the purchase price annually if the 15years life can be realized. Repair and lubrication can be estimated as 2 % from this price. Labor costs may be quite small if the dryer is automatic. In this paper we analyzed reducing machinery and drying machinery, presenting the importance of each of them in the general processing machinery management.

In what concerns the drying machines, we showed that it is important to find an equilibrium moisture content of a crop.

All the studies made in this paper showed the importance of machine management in the increase of productivity of the farm.

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