Influence of Sieve Openings Size for Hammer Mills on the Degree of Shredding and Grinding Energy Consumption for Wheat

Ovidiu MARIAN*¹, Ioan DROCAŞ², Ioan BUDĂCAN ³, Dumitru POP³, Mircea MUNTEAN¹

¹Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Manastur St., 400372 Cluj-Napoca, Romania; ovidiu.marian@usamvcluj.ro
²Faculty of Machine Building, Technical University of Cluj-Napoca, Memorandumului 28, 400114, Cluj-Napoca, Romania

Abstract: Hammer mills are machines used in agriculture to obtain concentrated fodder mix. The hammer mills grinding materials is produced upon impact of the hammer material and crushing plate located inside the grinding chamber. Depending on the hammers rotor assembly mode, the following types of mills can be used: hammer mills articulated and fixed hammer mills. The finesse of the flour obtained is directly influenced by the type of hammer and sieve used.

Keywords: milling, wheat, grinding, specific energy

Introduction. Milling cereal grains used in animal feed is a complex process depending on many factors, such as ground grain moisture, the type of sieve used (diameter of holes in the sieve), the type of mill used, the hardness of the grains and the type of hammer used.

Aims. The objectives of this paper were to determine the degree of milling and grinding and energy consumption for wheat grain according to the sieve used.

Material and Method. For experimental tests we used a hammer mill for grinding grain MB-7, 5 which was equipped with three sieves with diameter holes 3, 6 and 8 mm and hammers with one notch. To measure the grain moisture we used a moisture meter Rielà type and for energy measurement device was used Mavowatt 45 (Budăcan, 2013). In order to determine the size of the grain particles we used a RETCHS AS 300 sieving machine with the following sieve openings: 2,55 mm, 1,25 mm, 0,63 mm. The material which passed through the sieve with the 0,63 mm opening was collected into a blind sieve.

Results and Discussions. The results obtained are presented in Fig. 1.

In the figure 1 A one can observe that using a sieve with 3 mm opening, the quantity of material smaller than 0,63 mm is high (33%). This happens because the grain stays more in the milling chamber. In literature is recommended that the size of the grind particle should be greater than 1 mm [2]. The small grind particles are susceptible of dusting, cannot mix well with the animal saliva and can generate heat.

When we increase the sieve opening at 6 mm, one can observe in figure 1 B, that the quantity of grinding smaller than 0,63 mm is reduced by 10%. For the other fractions we can observe that the percentage is increasing.

Analysing figure 1 C, we can observe that a sieve with a big opening 8 mm will produce the best material for animal food. Although the sieve has a really big opening (through the 8 mm sieve opening the wheat will pass uncrushed) we did not find uncrushed seeds. The biggest fraction determined is smaller than 2,55 mm and greater than 1,25 mm. More than half of grinding material (53%) would have a size bigger than 1,25 mm.
Regarding the specific energy consumption has been observed that it decreases with increasing sieve openings from 6.54 kWh / t for sieve with 3 mm to 4.03 kWh / t for sieve with openings of 8 mm.

![Fig. 1 Results regarding the size of milled particles according to the sieve opening](image)

A – 3 mm sieve opening; B – 6 mm sieve opening; C – 8 mm sieve opening

**Conclusion.** With regard to the small fraction resulting from milling (powder below 0.63 mm) the differences are greater than about 13% from the sieve with openings of 3 mm and the one with openings of 8 mm, because of the short time of action of the hammer on the grain.

Using a sieve with a greater opening will result in a much greater quantity of product with a particle size bigger than 1.25 mm.

The energy consumption is decreasing when a sieve with 8 mm opening is used from 6.54 kWh / t for sieve with 3 mm to 4.03 kWh / t.

**REFERENCES**