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EQUIPMENT FOR CRUSHING COBS, GRAIN-COB MIXTURE AND CORN COBS

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Solving the tasks of improving the grinding process based on the use of new equipment that meets the principle of zero-waste technology acquires practical significance and is relevant for feed production. When substantiating the principle of action and operating conditions of a disk shredder, it is necessary to take into account the mutual influence of many structural, kinematic and loading parameters, taking into account the physical and mechanical properties of the processed material.

Key words: *rod, grinding, combined fodder, pellet, productivity.*

PROBLEM

The primary challenge of feed production means saturating the feed market with the right products to help feed our growing world, whose population is expected to grow by nearly 30 percent by 2050. At the same time, it also means helping to adapt to increasingly complex market forces, the impact of regulatory requirements and changes in their operations, encouraging farmers to maximize feed utilization and improve animal productivity. From the assessment of raw materials to the formulation of compound feed and solutions to increase productivity - we can increase the profitability and quality of products. The influence of the size of feed particles is a very important topic these days. This is because there are two opposing views on their use: on the one hand, a finer grind improves digestibility, and on the other hand, coarse ingredients are necessary for the natural functioning of the gastrointestinal tract (GI) [1,2].

ANALYSIS OF THE LATEST RESEARCH

As in most animal experiments with feed, the effect of feed particle size is measured on such parameters of live animal performance as feed intake and digestion time, body weight and specific feed utilization. However, a possible change in particle size should also take into account aspects of the manufacturer, such as plant efficiency (eg energy consumption and productivity), as well as changes in feed quality parameters (eg pellet quality) and classification of feed ingredients. The first step in feed production is mixing and then size reduction (grinding), which results in a reduction in grain size. As a rule, reducing the size of the particles leads of the components, which allows them to interact more intensively with digestive enzymes and acids in the gastrointestinal tract of the animal. Over the last decade, attention has shifted to a diverse structure of feed. Smaller particle sizes improved specific feed consumption in pelleted feed, but no improvement was observed for pelleted feed - but a deterioration. The decrease in the quality of pellets (appearance of smaller fractions in the feeding system) did not negatively affect productivity compared to the diet containing finely ground corn. The quality of grinding, in addition to the composition, is best influenced by the technology used (hammer grinding machine, roller chair).

THE AIM OF THE STUDY

Corn cobs have specific physico-mechanical properties that are not sufficiently studied, and at this time there are no effective methods and means of crushing that ensure obtaining cob grain of the necessary granulometric composition that meets zootechnical requirements.

RESEARCH RESULTS

The addition of crushed corn and whole grains to feed often occurs on farms, which is not related to production costs. This way of feeding is very common in Western Europe. Another version is that whole wheat grain is added to the mixer before granulation. This results in very good pellet quality and eliminates selective feed consumption. The disadvantage is the smaller size of hard grain compared to the option in which the same amount of wheat is added to the finished feed after granulation. It should also be noted that when using crushed corn grain or whole wheat grain, such quality parameters as physical characteristics (color, smell), absence of pollutants, microbiological status and nutritional value are always emphasized. The first are interesting from the point of view of feed hygiene, and the second - from the point of view of feed formulation. Of course, the implementation of crushing, grinding and granulation requires large investments (both on farms and at feed production enterprises), and the payback period is affected by many factors [3,4]. However, since they have a positive effect on animal productivity as well as feeding costs, their practical application is recommended - in addition to feeding management, which of course requires increased attention. Corn is a high-yielding product that has widely established itself as a universal crop used in grain, fodder and technical areas. In our country, corn is grown mainly in the fodder direction. Feeds using corn for the production of roughage for ruminants with crushed cobs have found considerable distribution. Further use of such fodder is advisable in combination with concentrated and juicy fodder. All components of corn have the necessary signs of good digestion by the animal body and are quite easily digested. The nutritional value of corn products meets the requirements for a rational balance of nutrients, for example, 100 kg of green mass of the plant is characterized by 32 fodder units (k.o.), and the same amount of chopped stalks already has 35 k.o. The relative yield of corn cobs is from 10% to 20% of the weight of the grain. A relative profitability of 18% can be used as an average share. In developed countries, corn harvesting is mainly done by universal harvesters with a suitable header and settings of working parameters for this operation. The removal of corn harvest residues has not yet been properly resolved. The problems are low density and mainly high moisture content in straw, which contains stems, leaves, cobs and husks. In developing countries, corn harvesters use a husking combine or pick the cobs by hand. Collected are often dried naturally. Natural drying of corn cobs contributes to a significant reduction in the total consumption of fossil fuels. After drying at the end of February or in the first half of March and threshing the grain, the corn cobs remain in the farm yard. The humidity of cobs is usually 10-12%, which is about 2% lower than that of grains [5,6].

As an object of research, the cores of corn cobs with an initial moisture content of W = 80.5%, subjected to threshing in a combine, were chosen. In accordance with the task, the search parametric indicators are shown in Table 1. The need to develop the design of the unit for preliminary grinding of rods is determined by the task of obtaining the linear dimensions of the crushed rods, which allow to ensure loading of the working area of the disc grinding machine with the screw feeding device, which ensures the final stage of the process.

Table 1. Parametric indicators of the study

Direction of research	Parameters		
	searching	constant	variables
Chemical composition, nutritional value	-	Humidity 8± 0.5%	-
Granulometric composition	Length, diameter, density	-	-
Strength properties	Shear strength limit, compression	The size of the samples	Humidity 8...20%, variation step 2%
Determination of the rational values of the parameters of the disk shredder	Average length of crushed rods and energy consumption	Humidity 14± 0.5%	The gap between the disks is 5...25 mm, the angular speed is

			10...50 s-1
Determination of the granulometric composition of crushed rods	Length, diameter, density	Humidity 8± 0.5%	-
Setting rational values of the parameters of the rod crushing process in the machine	Weighted average particle size, energy consumption, machine throughput	-	Humidity 8...20%, outlet gap 0.2...8.0 mm, groove inclina-tion 20...70o, speed 500...1000 rpm
Determination of the granulometric composition of crushed rods	Grain diameter, bulk density	-	-
Frictional properties of crushed rods and grits	Angles of natural slope and external friction	-	Humidity 8± 0.5%
	Coefficients of external and internal friction	-	The pressure on the product layer is 0.5...6.0 kPa
Deformative properties of grain	Modulus of elasticity and lateral pressure	Duration 5 min.	Humidity 8±0.5%, hydrostatic pressure H= 2600...2900 mm Hg. Art.
Aeromechanical properties of grain	Greeting speed	-	Humidity 8...20%,
	Ratio ratio of fractions	Humidity 8± 0.5%	Air speed 0.5...6.5 m/s

When solving the task, it is expected degree of linear grinding within the range of 3...5, based on the maximum length of the used rods of 150...180 mm. As a result of grinding the raw material, the average linear dimensions of the particles should be between 45 and 15 mm.

CONCLUSIONS

Two truncated conical discs with a grooved surface were chosen by the working bodies of the shredder as a technical solution that meets the requirements for obtaining crushed particles of corn stalks with sizes I...5 mm, which is determined by the conditions of rational livestock feeding. In connection with this, there is a need to empirically determine the main indicators for its optimization according to the parameters of the granulometric composition of the crushed mixture and the specific energy consumption.

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УСТАТКУВАННЯ ДЛЯ ЗДРІБНЮВАННЯ СТРИЖНІВ, ЗЕРНО-СТРИЖНЕВОЇ СУМІШІ Й КАЧАНІВ КУКУРУДЗИ

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Вирішення завдань удосконалювання процесу здрібнювання їх на основі застосування нового обладнання, що задовольняє принципу безвідхідної технології здобуває практичну значність і є актуальним для виробництва кормів. При обґрунтуванні принципу дії й умов роботи дискового подрібнювача необхідно враховувати взаємний вплив багатьох конструктивних, кінематичних і навантажувальних параметрів з урахуванням фізико-механічних властивостей оброблюваного матеріалу.

Ключові слова: *стрижень, подрібнення, комбікорм, гранула, продуктивність.*