УДК 631.363

RATIONALE OF CALCULATION OF PARAMETERS GRINDER-MIXER FOR SHEEP AND GOATS

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Annotation. *There is structural graph showing the relationship of the modules in the grinder mixer forage for their effective use in the production of value in the design of this type of equipment in the construction department in the article. From a structural graph shows that the maximum amount of interaction with the modules of the mixer-grinder mixer belongs to feed continuous and vibrating feeder. Because the quality of the mixture depends on the operation of the mixer, namely the improvement of the mixing part of the mixer-chopper lead to improved performance of the whole machine.*

Experience shows that the failure load in the diet is not enough to ensure a constant separation of the particles. In order to ensure this effect using a mixer working bodies need to create an additional braking force components of the mixture. Breaking load in feed enough to maintain a constant separation of the particles, so to ensure this effect, with the help of the working bodies of the mixer, you must create an additional breaking force. You must overcome the force of the clutch elements of feed mixture for effective mixing succulent fodder with coarse and concentrated component, y with a specific breaking load sufficient to separate its components. The ratio of adhesion strength to a specific breaking load generated by the weight force, is one measure that shows how many times the additional breaking force must be greater than the mass of the material. This technique is the basis for the development of these machines and their working groups. The results of theoretical developments are of great practical interest for development of the conditions of small cattle in the south of Ukraine and Jordan.

Keywords: ***feed mixer, feed, forage mixture, the coefficient of friction, livestock requirements***

Introduction. Improving the efficiency of the process of mixing of feed for the sheep and goats can be achieved by applying the mixing of the working body. Such a body is able to qualitatively move groups of different sizes of particles from one position to another [1–4, 6].

In addition, effective mixer should provide a continuous process with minimal cost of energy and labor. It is also important to take into account the fact that the quality ration can be obtained only from the ground components, the dimensions of which correspond to the zoo technical requirements [5, 7].

Formulation of problem. So now an urgent task is to ensure that the livestock industry of Ukraine and Jordan prepare forage new appliances, including mixers and feed. To achieve this objective it is necessary a deeper study of the process of preparation of multicomponent forage mixtures, as well as ways to reduce energy and material consumption in the process.

Analysis of recent research results. In [1, 6–15] revealed the main provisions of the theory of blending, systematization and refinement of process parameters and design of mixers.

Technology calculation of mixers provides the definition of supply and capacity, the need for them to drive, as well as the main design parameters: the size of the container, the size and speed of working organs [3, 4].

Qualitative analysis of the movement of the bulk material in the drum with a blade attachment is made in [15]. In particular, when mixing distinguished: rubble movement, the movement together with the blade, the blade movement, free fall from the blade. Accounting for these factors, only clearly insufficient in the development of modern faucets.

Developed [16-18] differential equations of motion of a material point, describing every move that simplify the design work, but allow for practical calculations with sufficient accuracy.

A system of nonlinear differential equations that describe the movement of product particles on the surface of the cone rotating at a constant angular velocity about a vertical axis [19]. Unfortunately, other sectional profiles were studied in inadequately unify and prevent settlement system.

Analysis of published data shows [7, 9, 10] that the most appropriate mixing process to explore the theoretical and experimental way, but it is necessary to theoretically justify structural and technological parameters of the working body of the mixer, which comprises mixing components will effectively move, alternately changing its position array [8, 11], which is not done.

Thus, the analysis of literary sources and the practice of growing small cattle show at the absolute relevance of the elements of theoretical studies of the process of creating equipment for mixing feed mixtures.

Purpose of research. The purpose of work is to carry out theoretical studies of the process of mixing of feed for the sheep and goats and to develop mathematical models that adequately describe the technological process of preparation of a three-component feed mixture.

To achieve this goal it is necessary to solve the following tasks:

- On the basis of theoretical and experimental studies to develop and create a structural graph showing the relationship of modules in the feed grinder-mixer for efficient use of their production;
- Theoretically justify the process of mixing coarse, succulent and concentrated feed, as well as the parameters of the working bodies of the mixer is an independent module universal grinder-mixer.

Results of research. In the process of theoretical studies adopted a working hypothesis about the possibility of using the mixer feeds a continuous rotating hopper. The hopper consists of two truncated cones connected by smaller bases, on the inner surface of which is secured wrapped, complete with blades. The blades are set at a distance from one another with an extension cord that allows you to effectively mix the course, juicy, concentrated and feed, as well as receive a homogeneous feed mixture.

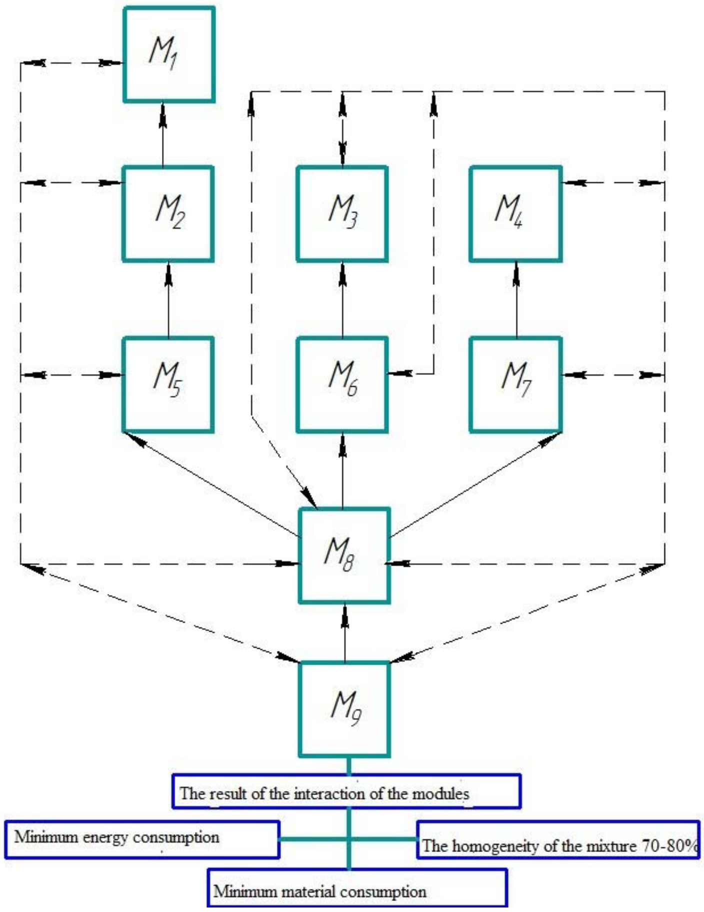

Fig. 1. Structural graph showing the relationship of the modules in the grinder-mixer feed: M_1 – chopper roughage; M_2 – elevator broken rice roughage; M_3 – succulent fodder chopper; M_4 – chopper concentrated feed; M_5 – dispenser chopped roughage; M_6 – dispenser of crushed succulent feed; M_7 – dispenser of crushed concentrated feed; M_8 – vibrating feeder mixer; M_9 – mixer continuous feed; attitude of submission and subordination; ratio of the interaction.

For a visual representation of the circuit modules interaction and analysis of the entire machine is proposed structural graph (Fig. 1). From a structural graph shows that the maximum amount of interaction with the modules of the mixer-grinder mixer belongs to feed continuous and vibrating feeder. Because the quality of the mixture depends on the operation of the mixer, namely improving the mixing of the mixer-grinder will result in improving the efficiency of the entire machine as a whole.

To develop a plan of theoretical studies, based on our analysis, it is necessary to highlight the most significant structural and technological parameters that influence the feed mixer efficiency continuous (Fig. 2).

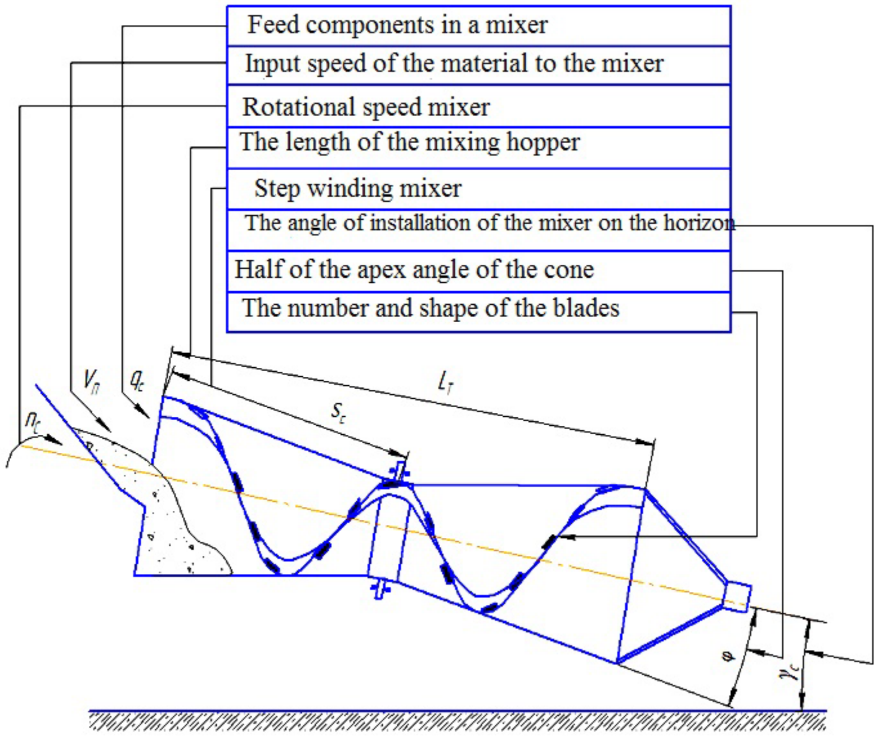

Fig. 2. The theoretical justification of the research plan.

Input to the mixer speed of the material depends on the mode vibrating feeder M8 (Fig. 1). Maximum performance Q_f vibrating feeder must be less than or equal to the performance of a continuous feed mixer Q_{com} and hence the translational speed of descent of the material with a vibrating pan feeder v_n must be less than or equal to the speed of material moving along a mixer V_f hopper mixer.

When solving a differential equation, which describes the movement of the mixture in the hopper, the entry speed of the material to the mixer should be adopted for the initial conditions.

Hopper speed must provide the mode of operation, in which the bulk of the material will be moved to the winding blades and cone hopper surface will facilitate movement. Blender hopper length should be such that a change in position that alternately layers will be as many times as necessary to achieve the desired degree of homogeneity of the feed mixture.

Step winding mixer, the number and shape of the mixer blades have to provide continuous movement of the material and it does not prevent the change of position of the layers shown in Fig. 1.

Mixer installation angle relative to the horizon regulates the transport capacity of the cone, which should be in the range of rational values, in which the bulk of the material will be moved to the winding blades.

Half apex angle of the cone in combination with the dimensional parameters of the cone determines the magnitude and the magnitude of the inertial forces involved in the process of moving the component of the force of gravity. On this basis, it can be argued - this parameter is important and requires a scientific substantiation of its rational meaning.

The proposed mixer has the ability to transport feed cone surface installed at a certain angle to the horizon, and spiral wound.

Performance conical surface is determined from the following considerations (see Fig. 3).

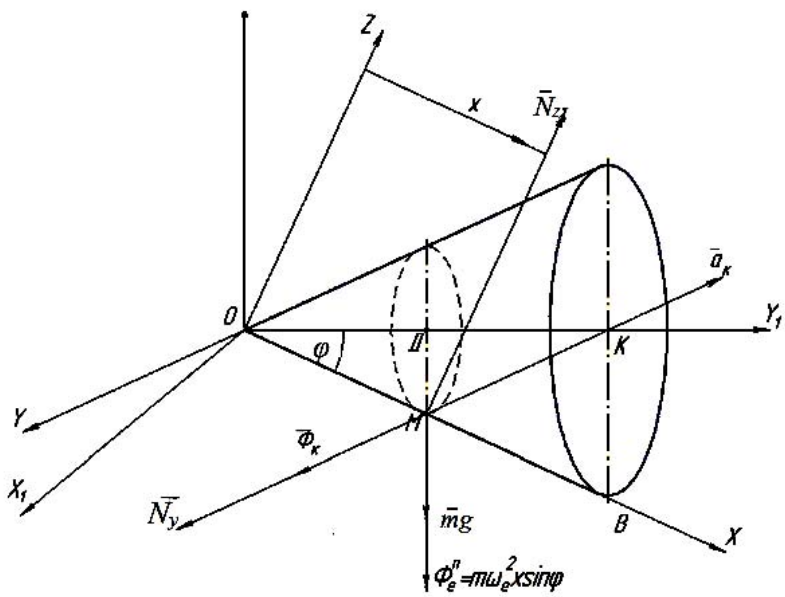

Fig. 3. Determination of the speed of the particle feed mixture on the surface of the cone.

OB segment revolves around the c axis OY_1 constant angular velocity ω_e. According to the guide point OB moves M. At the initial time point M is located at the point O and the relative length of OB is not moved.

It is necessary to find the relative velocity of a point M at time segment OB, when the distance OM = L, and to determine what force provides the pressure point M on the segment OB at this time.

The mass of the point M is m_i. Movement of the point M along the guide OB, which moves relative movement is a relative velocity and relative acceleration rotary movement guide OB is a portable motion with an angular velocity

Consider the relative motion of the point M. We introduce a moving XYZ coordinate system with its origin at the point O, and list the forces that act on the point M in its relative motion [19–21]:

- gravity $G = m \times \overline{g}$;
- OB reaction rail $\overline{N} = \overline{N}_y + \overline{N}_z$;
- Inertia translational motion;
- Inertia of the Coriolis force $F_k = -m \times \overline{a_k}$;
- friction force $F_{tr} = P \times n_{dtr}$; In this case, *P* – normal pressure force.

In a figurative point M movement rotates uniformly around the circumference relative OY_1 axis. In this case, a portable acceleration consists of only one normal acceleration $F_{tr} = P \times n_{dtr}$; MD, where MD – rotation radius of the point M with respect to the axis OY_1:

$$MD = x \times sin\varphi, \P \quad (1)$$

where: φ – half of the apex angle of the cone, *φ* = const.

Since the acceleration is directed along the radius to the point D, portable inertial force F_n^n directed along the radius of the MD in the opposite direction from the portable acceleration $\overline{a}_n^n$:

$$\overline{F}_e^n = m \times \omega_e^2 \times x \times sin\varphi. \quad (2)$$

From the expression (2) that a portable inertial force F_n^n depends on the coordinate *x* - point accommodation M.

Acceleration and direction module is defined by the formula [23]:

$$\overline{a}_\kappa = 2 \times \left(\overline{\omega}_e \times \overline{V}_r \right). \quad (3)$$

The vector carrying the angular velocity is directed from the origin on the axis of rotation OY_1, the relative velocity is directed along the rail OB. By the rule of the vector product of the Coriolis acceleration vector is directed perpendicular to the plane of OBK in the opposite direction towards the axis OY.

The Coriolis force of inertia is directed in the direction opposite to the direction of acceleration:

$$a_n = 2 \times \omega_n \times V_r \times sin\left(180° - \varphi \right). \quad (4)$$

The frictional force in the opposite direction from the direction of movement of the point M along the track.

Let us write the fundamental law of the relative motion of point M:

$$m \times \overline{a}_{r_n} = \overline{G} + \overline{F_n^n} + \overline{F_n} + \overline{N} + \overline{F}_{nn}. \qquad (5)$$

We project the expression (5) on the coordinate axes OXYZ:

$$\begin{cases} m \times a_{r_x} = m \times g \times \sin\varphi + F_e^n \times \sin\varphi - m \times g \times K_{dtr} \times \cos\varphi; \\ 0 = F_\kappa + N_y; \\ 0 = m \times g \times \sin\varphi + N_z. \end{cases} \qquad (6)$$

Since the particle moves along the feed generator is not only sliding, but also rolling, the strength of the particles forming the normal pressure is reduced by the characterizing rolling.

Rolled power [19, 20]:

$$Q = \frac{\kappa}{r_i} \times P, \qquad (7)$$

where: κ – coefficient of rolling friction mm; r_i – the radius of the feed particles, mm.

Since the action of sliding friction force is reduced by the amount of force being rolled, then:

$$F_{mp} = \left(1 - \frac{\kappa}{r_i} \right) \times P \times K_{dtr}. \qquad (8)$$

The relative acceleration [20]:

$$F_{mp} = \left(1 - \frac{\kappa}{r_i} \right) \times P \times K_{dtr}. \qquad (9)$$

Substituting equation (2), (4) and (9) in the first expression (6):

$$\frac{m \times V_r dV_r}{dx} = m \times g \times sin\varphi + m \times \omega_e^2 \times$$
$$\times x \times sin^2\varphi - \left(1 - \frac{\kappa}{r_i} \right) \times m \times g \times K_{dtr} \times cos\varphi. \qquad (10)$$

Divided into *m*:

$$\frac{V_r dV_r}{dx} = g \times sin\varphi + \omega_e^2 \times x \times$$
$$\times sin^2\varphi - \left(1 - \frac{\kappa}{r_i} \right) \times g \times K_{dtr} \times cos\varphi. \qquad (11)$$

The mathematical transformation:

$$V_r dV_r =$$
$$= \left(g \times sin\varphi + \omega_e^2 \times x \times sin^2\varphi - \left(1 - \frac{\kappa}{r_i} \right) \times g \times K_{dtr} \times cos\varphi \right) dx, \qquad (12)$$

$$\int V_r dV_r =$$
$$= \int \left(g \times sin\varphi + \omega_e^2 \times x \times sin^2\varphi - \left(1 - \frac{\kappa}{r_i} \right) \times g \times K_{dtr} \times cos\varphi \right) dx, \qquad (13)$$

$$\frac{V_r^2}{2} = g \times sin\varphi \times x + \omega_e^2 \times sin^2\varphi \times \frac{x^2}{2} - \\ -\left(1 - \frac{\kappa}{r_i}\right) \times g \times K_{dtr} \times cos\varphi \times x + C, \quad (14)$$

$$\frac{V_r^2}{2} = g \times sin\varphi \times x + \frac{1}{2} \times \omega_e^2 \times sin^2\varphi \times \\ \times x^2 - \left(1 - \frac{\kappa}{r_i}\right) \times g \times K_{dtr} \times cos\varphi \times x + C, \quad (15)$$

$$V_r^2 = 2 \times g \times sin\varphi \times x + \omega_e^2 \times sin^2\varphi \times \\ \times x^2 - 2 \times \left(1 - \frac{\kappa}{r_i}\right) \times g \times K_{dtr} \times cos\varphi \times x + C. \quad (16)$$

Thus, the relative speed is determined by the formula:

$$V_r = \sqrt{2 \times g \times sin\varphi \times x + \omega_e^2 \times sin^2\varphi \times x^2 - 2 \times \left(1 - \frac{\kappa}{r_i}\right) \times g \times K_{dtr} \times cos\varphi \times x + C}. \quad (17)$$

where: x – distance traveled by point M from the beginning of movement.

We find the pressure force Q of M on the guide.

This requires the reaction N_y and N_z of expression (6).

$$N_y = -m \times \omega_n \times V_r, \quad (18)$$

$$N_z = -m \times g, \quad (19)$$

$$Q = N = \sqrt{N_y^2 + N_z^2}. \quad (20)$$

Thus, the solution of differential equations can determine the speed of movement of the point M, the distance traveled and the acting forces.

The constant of integration (C) takes into account the fact that the feed components enter the mixer from the boot vibrating chute with an initial linear velocity of 0,15 m/s, which is set empirically.

Consequently:

$$V_r = \sqrt{2 \times g \times sin\varphi \times x + \omega_e^2 \times sin^2\varphi \times x^2 - 2 \times \left(1 - \frac{\kappa}{r_i}\right) \times g \times K_{dtr} \times cos\varphi \times x + 0,15}. \quad (21)$$

Performance cone rotating mixer - the ability to move a certain amount of mixture per unit time t with V_f rate determined from the expression (17).

$$Q_T = \xi \times \rho_c \times S_2 \times V_r, \quad (22)$$

where: ξ – coefficient of filling of the smallest cross section of the cone; ρ_s – density of the mixture in kg/m^3; S_2 – the area of the smallest cross section of the cone, m^2.

Based on (21) and (22):

$$Q_T = \xi \times \rho_c \times S_2 \times \sqrt{2 \times g \times sin\varphi \times x + \omega_e^2 \times sin^2\varphi \times x^2 - 2 \times \left(1 - \frac{\kappa}{r_i}\right) \times g \times K_{dtr} \times cos\varphi \times x + 0,15}. \quad (23)$$

This expression is unknown component flow area. sectional area of the flow of the mixture:

$$S_2 = S_{seg} + S_f, \tag{24}$$

where: S_{seg} – segment area, m^2; S_f – area of the figure formed by a curve, the circle and the vertical passing through the point ($x_в y_в$), m^2.

Segment area [21]:

$$S_{seg} = \frac{R_O^2}{2} \times \left(\frac{\pi\mu}{180} - sin\mu \right), \tag{25}$$

where: R_o – circle radius, *m*; μ – the angle between the lines connecting the center with the points of intersection and intersecting circles grad.

The trajectory of the outer layers of the particles is a curve described by a parabola.

Consequently, S_f area can be determined from the expression:

$$S_f = \int_{n_n}^{n_1} \left(\int_{-\sqrt{R_O^2 - x^2}}^{nn^2 + bn + n} dy \right) dx. \tag{26}$$

The expanded form:

$$S_f = \int_{n_n}^{n_1} \left(nn^2 + bn + n + \sqrt{R_O^2 - x^2} \right) dx, \tag{27}$$

Combining (24), (25) and (28) we obtain:

$$S_2 = \frac{R_O^2}{2} \times \left(\frac{\pi\mu}{180} - \sin\mu \right) + \int_{x_в}^{x_1} \left(ax^2 + bx + c + \sqrt{R_O^2 - x^2} \right) dx. \tag{28}$$

Coordinates x_1 found from the condition that the straight line joining the point ($x_в y_в$), and point A. Therefore:

$$S_2 = \frac{R_0^2}{2} \times \left(\frac{\pi\mu}{180} - sin\mu \right) + \int_{-\frac{b}{2a}}^{\frac{-2\times\kappa\times c_1 + \sqrt{D}}{2\times(1+\kappa^2)}} \left(ax^2 + bx + c + \sqrt{R_O^2 - x^2} \right) dx. \tag{29}$$

Combining (22) and (29) we obtain:

$$Q_t = \xi \times \rho_c \times \frac{R_O^2}{2} \times \left(\frac{\pi\mu}{180} - sin\mu \right) + \int_{-\frac{b}{2a}}^{\frac{-2\times\kappa\times c_1 + \sqrt{D}}{2\times(1+\kappa^2)}} \left(ax^2 + bx + c + \sqrt{R_O^2 - x^2} \right) dx \times$$
$$\times \sqrt{2 \times g \times sin\varphi \times x + \omega_y^2 \times sin^2\varphi \times x^2 - 2 \times \left(1 - \frac{\kappa}{r_i} \right) \times g \times K_{dtr} \times cos\varphi \times x + 0{,}15}. \tag{30}$$

On the basis of (21) it is necessary to calculate the traffic cones performance under such conditions, in which the feed mixture will be stable move, but moved to the minimum volume. This need is due to the fact that in terms of mixing layers, the bulk of the material should be moved wrapped with blades and the cone should contribute to the movement, providing sliding and rolling particles.

On the basis of the calculation of the model (30) the dependence of the performance of the rotating cone mixer when the above conditions. When solving a differential equation, which describes the movement of the mixture in the hopper, the entry speed of the material in the mixer is taken as the initial conditions.

The calculation incorporated the following parameters: the length of the cone of 0,75 m, the maximum and minimum diameter of the cone 0,5 and 0,25 m, respectively, the helical pitch of 0,75 m, height 35 mm winding. Mixer installation angle relative to the horizon regulates the transport capacity of the cone, which should be in the range of rational values, in which the bulk of the material will be moved to the winding blades.

Half apex angle of the cone in combination with the dimensional parameters of the cone determines the magnitude and the magnitude of the inertial forces involved in the process of moving the component of the force of gravity. On this basis, it can be argued – this parameter is important and requires a scientific substantiation of its rational meaning.

Empirically found that each 5 degree rise (lowering) of the spiral casing leads to a decrease (increase) in the spiral productivity 1,5–3,0%. This is due to a decrease (increase) in working of the spiral length. The proposed and tested in industrial conditions feed mixer design with a continuous rotating hopper, inner cone surface of which is equipped with a wound to the shoulder blades and extensions.

The calculation showed that half of the apex angle of the cone φ should be 12 degrees. From the above:

$$Q_c = 0{,}125 \times \varepsilon_z \times \left(D_p^2 - D_{cp}^2\right) \times s_c \times \omega_c \times \rho_c \times f_h \times \frac{l_{pc}}{l_{oc}}. \quad (31)$$

Since the winding is completed L-shaped blades, and the blades are set at a distance from one another, the transport ability of the helix will be reduced. One part of the feed mixture layer will be raised to the height of the blades greater than the angle of repose of its components and peppered, and the other part oscillate at a variable radius with a simultaneous axial movement. The maximum capacity of vibrating feeder Q_p must be less than or equal to the performance of the mixer feeds a continuous Q_{com}, and, consequently, the forward speed of descent of the material from the vibratory feeder tray v_n must be less than or equal to the speed of the material moving along a generator bunker V_f mixer.

Analysis of mathematical models allows us to conclude that half of the apex angle of the cone φ should be 12 degrees, and the bunker speed of 20 rev/min. The overall performance of the mixer will be 0,122 kg/s.

Conclusions

1. On the basis of theoretical and experimental studies designed structural graph showing the relationship of the modules in the grinder mixer forage for their effective use in the production of value in the design of this type of equipment in the construction department. Because the quality of the mixture depends on the operation of the mixer, namely the improvement of the mixing part of the mixer-chopper lead to improved performance of the whole machine. To improve the quality of mixing winding cone mixer is provided not only L-shaped blades and rectangular extensions, which allows the feed mixture to raise the layers at different heights from h_1 to h_3.

2. Theoretically grounded process of mixing coarse, succulent and concentrated feed, as well as gives the parameters of working bodies of the mixer. At the same time the necessity of using an independent module design scheme of universal grinder-mixer, which is the basis for the development and validation of designs shredder feed of base feeding of sheep and goats. the bulk of the material should be moved wrapped with blades and the cone should contribute to the movement, providing sliding and rolling particles.

References

1. *Holodyuk, V.* (2010). Theoretical and experimental research shredders with rotary knives. Scientific and technical progress in the development of machinery and mechanization of agricultural materials: nauk.-tech. conf. Conferences. Vinnytsia national agrarian university, 45–56. http://repository.vsau.org/card.php?id=1784.

2. *Komkov, V. M., Lysenko, V. N.* (2014). Features of technological line processing in animal feed stem at the energy balance of the process. Bulletin of Sumy National Agrarian universytet. Seriya "Mechanization and automation of production processes". issue 11 (26), 83-86. http://www.promelectro.com/page-production_2.html?locale=ua

3. Pat. 70668 Ukraine, V02S18 IPC. 06. Wood-feed mixer. Brahinets, M. V., Bakharev, D. M., Atum Mohammad al . patent owner Lugansk National Agrarian universyty. 201113043. appl. 07.11.2011. publ. 25.06.2012., bull. №12.

4. *Kudinov, E. I., Boiko, I. G.* (2013). Analysis methods of grinding grain feed on their energy content. KNTUA, Bulletin 273, 198-204. www.khntusg.com.ua/files/sbornik/vestnik_95/6.pdf.

5. Feeding sheep // (Electronic Resource). Access: http://zhivotnovodstva.net/index/2-4.html.

6. *Harabazhyu, A. A.*, *Levdanskyy, E. Y., Levdanskyy, A. E.* (2000). Energysaveed rotary-centrifugal mill for fine grinding and wet lumpy materials. Proceedings of the National Academy of Sciences of Belarus. Seryu fyz.-tech. Science, 2, 125–131.

7. *Berd John.* (2008). Engineering Mathematics. M.: Publishing Home "Dodeka XXI», 544.

8. *Bargo, F., Muller, L. D., Delahoy, J. E., Cassidy, T. W.* (2002). Performance of high producing dairy cows with three different feeding systems. J. Dairy Science Vol. 85, 11, 2948–2963. http://extension.psu.edu/animals/import/dairy/nutrition/pdf/supplementing-pasture-withtmr.pdf.

9. *Volvak, S. F.* (1998). Justification process and operating parameters of the flexible compact universal prepare fodder grinding unit in option roughage: Dis .... candidate. Sc. Sciences: 05.20.01. Lugansk: LSHI, 244.
10. The continuous-running fodder mixer (2013). Mohammad Alatoom. Materialy IX International praktickal conference «Introduction a technology: step to future – 2013». Praha: PH «Education and Science». Dil 24, 16–19.
11. *Zikovych, S. N., Zheltunov, M. G.* (2006). In principle scheme foodstuff pellet production from mixture green fire-proof compounds fodder crops and forage. Bulletin of the State Agrarian University Altay, number 3 (23), 66–68.
12. *Sementsov, V. I.* (2008). Justification process parameters enrichment of fodder biologically active fodder additives centrifugal mixer: Dis .... Candidate Sc. Sciences: 05.05.11. Kharkiv, 186.
13. *Brahynets, N. V., Bahar, D. N., Mohammad Al-Atum*. (2014). Theoretical Studies indicators power machinery work continuously stern action mixer. Journal of Kharkov National Technical University of Agriculture Petro Vasilenko. Technical livestock systems and technologies. Issue 144. Kharkov: KNTUA, 189–195.
14. *Pivovar, V. S., Gnatyuk, G. P.* (2008). New technologies forage mixture preparation and distribution on cattle farms. MEAT cause: Each month industrial-Journal. 1, 66–69.
15. *Nazarov, S. I., Bober, A. A.* (1989). Improved grinder-mixer stern [Text]. Tractors and choppers machines, 5, 39–40.
16. *Hermezov, D. M.* (2006). Application forage distributer - mixer - Increase productivity pledge horned cattle. Technique APK, 4, 46–47.
17. *Novytskyy, A. V.* (2015). Study probability infallibility funds for work and will make distributed as system of „Man-Machine” [Text]. Motrol. Lublin, Vol. 16, 3, 96–102.
18. *Karabinesh S. S.* (2016). Holography. Control of quality parts. [Text]. Germany, Berlin, Saabryuken, LAP, 213.
19. *Bratishko, V. V.* (2007). Justification process of two-stage crusher and parameters of green fodder for pigs and water fowl. dis .... Candidate Sc. Sciences: 05.05.11. Glevaha, 169.
20. *Bratishko, V. V.* (2005). Search rational design of green chopper feed // Scientific Bulletin of Lviv National Academy of Veterinary Medicine. Named by S. Z. Ґzhytskoho. Volume 7, 4 (27). Part 1. Lviv: LKT LNAVM, 3–9.
21. *Konoplyn, A. N.* (2008). Improvement processes centrifugal separation of bulk materials: Dis. .... Candidate Sc. Sciences: 05.20.01. Voronezh, 144.

ОБГРУНТУВАННЯ ПАРАМЕТРІВ КОРМОЗМІШУВАЧІВ ДЛЯ ДРІБНОЇ ХУДОБИ

Альатум Мохаммад Фаїз Ахмад, С. С. Карабиньош

Анотація. *З структурного графа випливає, що максимальна кількість взаємодій з модулями подрібнювача-змішувача належить змішувача кормів безперервної дії і його вібраційному живильники. З огляду на те, що якість суміші залежить від роботи змішувача, то вдосконалення саме змішує частини подрібнювача-змішувача призведе до підвищення ефективності роботи всієї машини в цілому.*

Досвід показує, що руйнівне навантаження в кормі недостатнє для забезпечення постійного розділення частинок.

Для того щоб забезпечити цей ефект за допомогою робочих органів змішувача, необхідно створити додаткове зусилля гальмування компонентів суміші. Для забезпечення даного ефекту, за допомогою робочих органів змішувача, необхідно створити додаткове руйнівне зусилля. Для ефективного змішування соковитих кормів з грубою і концентрованою складовою, необхідно подолати силу зчеплення елементів кормосуміші з питомим розривним навантаженням достатнім для розділення її компонентів. Співвідноення адгезійної міцності до питомої руйнівного навантаження створюваної силою ваги, є тією мірою, яка показує, у скільки разів додаткове руйнівне зусилля повинно перевищувати масу матеріалу. Це становить основу методики для розробників таких машин і їх робочих органів. Наведені результати теоретичних розробок мають значний практичний інтерес для умов розвитку малого скотарства на півдні України.

Ключові слова: ***кормозмішувач, корми, кормова суміш, коефіцієнт тертя, зоотехнічні вимоги***

ОБОСНОВАНИЕ ПАРАМЕТРОВ КОРМОСМЕСИТЕЛЕЙ ДЛЯ МЕЛКОГО СКОТА

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Аннотация. *Из структурного графа следует, что максимальное количество взаимодействий с модулями измельчителя-смесителя принадлежит смесителю кормов непрерывного действия и его вибрационному питателю. Ввиду того, что качество смеси зависит от работы смесителя, то совершенствование именно смешивающей части измельчителя-смесителя приведет к повышению эффективности работы всей машины в целом.*

Опыт показывает, что разрушающая нагрузка в корме недостаточна для обеспечения постоянного разделения частиц. Для того чтобы обеспечить этот эффект с помощью рабочих органов смесителя, необходимо создать дополнительное усилие торможения компонентов смеси. Разрушающей нагрузки в кормах недостаточно для обеспечения постоянного разделения частиц, поэтому для обеспечения данного эффекта, при помощи рабочих органов смесителя, необходимо создать дополнительное разрушающее усилие. Для эффективного смешивания сочных кормов с грубой и концентрированной составной, необходимо преодолеть силу сцепления элементов кормосмеси с удельной разрывной нагрузкой достаточной для разделения её компонентов. Отношение адгезионной прочности к удельной разрушающей нагрузки создаваемой силой веса, является той *мерой, которая показывает, во сколько раз дополнительное разрушающее усилие должно превышать массу материала. Это составляет основу методики для разработчиков таких машин и их рабочих органов. Приведенные результаты теоретических разработок имеют значительный практический интерес для условий развития малого скотоводства на юге Украины.*

Ключевые слова: ***кормосмеситель, корма, кормовая смесь, коэффициент трения, зоотехнические требования***

УДК 631.333.6

ОБГРУНТУВАННЯ ПАРАМЕТРІВ РОЗКИДНОГО ПРИСТРОЮ МАШИНИ ДЛЯ ВНЕСЕННЯ ТВЕРДИХ ОРГАНІЧНИХ ДОБРИВ

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Анотація. *Впровадження інтенсивних технологій вирощування сільськогосподарських культур вимагає підвищення родючості грунту за рахунок внесення добрив і хімічних меліорантів.*

Органічні добрива включають речовини тваринного чи рослинного походження. До них належать: гній, гноївка, торф, компости, рослинна маса (сидерати).

Кількість і якість органічної речовини в грунті – гумусу в основному визначає властивості грунту: рівень потенційної родючості, водний режим, ступінь аерації, ємність поглинання, буферність та інші.

Обробіток сільськогосподарських культур викликає зниження вмісту гумусу, а отже і родючості грунту. Внесення необхідних норм гною забезпечує підтримання рівня гумусу на вихідному рівні.

Важливим фактором підвищення родючості грунту є якісне внесення органічних добрив, тому удосконалення технічних засобів для їх внесення є актуальним питанням. Існуючі розкидні пристрої кузовних машин для внесення твердих органічних добрив не в повній мірі задовольняють агротехнічним вимогам по якості подрібнення та рівномірності розподілу добрив по полю. Розроблено конструкцію машини для внесення твердих органічних добрив з розкидним пристроєм, барабани якого встановлені під кутом 45° до напрямку руху і обладнані змінними зубами.