Study of the Dependence of the Rotor of a Small Size Feed Distribution Device on the Number of Rotations and the Number of Blades

Dilshod Khudaynazarov * [1], Yusuf Axmedjanov [1], Fotima Jamolova[2], Shokir Tursunov[3], Odil Toshbekov[3]

[1]Tashkent State Technical University, Tashkent, Uzbekistan
[2]Yangiyer Branch of Tashkent Institute of Chemical Technology, Sirdarya, Uzbekistan
[3]Termez state university, Termez, 190111, Uzbekistan

Xudoynazarov.Dilshod@inbox.ru

Abstract. According to the analysis, it was found that 85 percent of the cattle and poultry in livestock are raised on family farms, private and peasant farms, and due to the lack of small-scale devices used for distributing feed for these farms, feed distribution is labor-intensive and performed manually.

Taking into account the above, a small-scale innovative feed distribution device was developed for small livestock farms with 20-30 head of cattle. The results of the research were determined based on the requirements of family farms, private and peasant farms, and small livestock farms. According to the identified research analysis, the main indicators of the feed spreading device and its technological scheme were developed. The effect of the height and width of the feed pouring window of the developed feed distribution device on the quality of feed distribution was studied in the research.

The quality of distribution of coarse feed largely depends on the number of blades and the number of revolutions of the rotor. Taking this into account, based on the performance and size of the spreading device specified in the initial requirements and specifications, 1, 2, 3 and 4 shovels were prepared.

Keywords: Shovels, rotor, roughage, ground corn, ground straw, ground alfalfa, bunker.

1 Introduction

In the world, the use of high-quality and resource-efficient feed preparation technology and devices to strengthen the feed base of animal husbandry occupies one of the leading positions. "Worldwide 5.4 bln. There are more than 100,000 livestock, and taking into account the need to grind and distribute a large amount of feed to feed them", it requires the widespread implementation of feed grinders and distributors with low metal and energy consumption for high-quality grinding and distribution of feed at low costs [1]. According to this perspective, it's critical to broadly implement

A. M. Bozdoğan et al. (eds .), *Proceedings of the 5th International Conference on Research of Agricultural and Food Technologies (I-CRAFT 2025)*, Atlantis Highlights in Sustainable Development 8,
https://doi.org/10.2991/978-94-6239-666-1_65

equipment that evenly distributes and grinds feed at the necessary level. The development of novel scientific and technical solutions of resource-efficient technologies for grinding grain and coarse feed, preparing and distributing full-value feed from them, and the technical means that apply them is the focus of scientific and research work being done worldwide[2-3]. The development of energy and resource-saving systems that provide livestock with a combination of straw, alfalfa hay, and other coarse feed in accordance with the specified criteria is given particular attention [4].

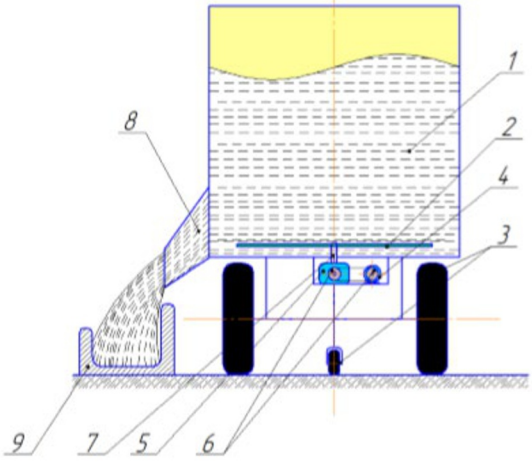
In order to explain their technological process and working part characteristics, it is crucial to first mechanically grind rough and grain feeds before creating devices that feed livestock the same amount of feed made from their mixture [5].

In the world, scientific research is being carried out in priority directions, such as the creation of small grinders and feed distribution devices for farms with few livestock, on the improvement of technologies and technical means of grinding coarse and grain feeds and their distribution to livestock [6,12].

2 Materials and methods

As a result of studying the operation of different types of feed spreaders, a design of a feed spreader for small livestock farms with few livestock was developed (Fig.1).

Device nutrients put for hopper 1, plank-shaped food thruster 2, wheels 3, electric motor 4, worm reducer 5, pulleys 6, shaft 7 and t reading novi consists of 8 . Go to Ozu spreader work in the process to the bunker put nutrients pour out shaft is placed in the middle of the hopper to the shaft a flat plate is installed .



1-bunker; 2-planar eat it pusher ; 3-wheels ; 4-electric motor; 5-worm reducer; 6-pulleys ; 7-shaft; 8-pouring trough; 9-manger

Fig. 1. Small sized eat it spreader technological scheme

When the shaft rotates, so does the plank by joining becomes and as a result from the center under the influence of the evasive force feeds to the sides of the hopper towards moves[7] .

Plank-shaped eat it pusher continuously rotation as a result nutrients pushing goes and pressure side of the bunker with by opened window in the form of a portion through out out sends [8].

Different numbers of plates were tested in order to select the optimal number of plates for the device to distribute roughage at the same rate (Fig. 2).

a) 1 piece spade; b) 2 piece spade; c) 3 piece spade; g) 4 piece spade

Fig. 2. Different number of spades

GOST 20915-75 "Agricultural machinery. Methods for determining test conditions", GOST 34748-2021 "Agricultural machinery. Feed distributors. Test methods" and O'z DSt 3240:2017. "Feed mixtures. Technical specifications" The methods given in the standard method manual were used [9].

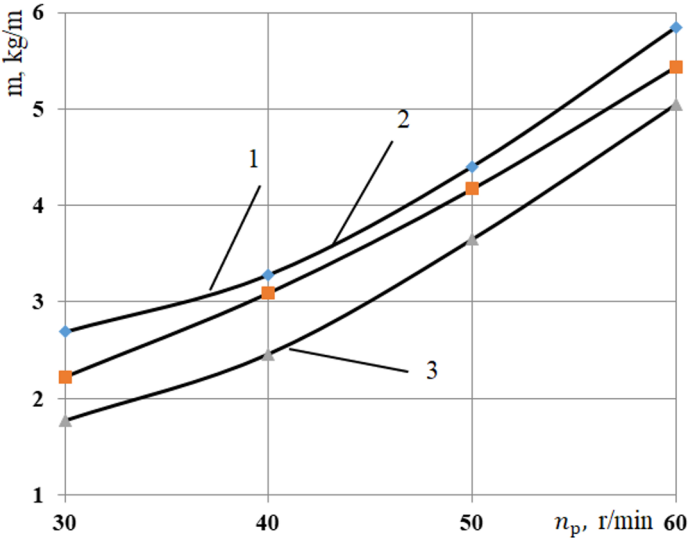
In order to ensure the same composition of coarse feed distributed in all experiments on researching the technological process and working parts parameters of the feed dispenser, coarse feed with the same composition was prepared based on the results of experiments on the morphological composition of feed [10]. The values of the mass and composition of the samples obtained in each experiment, repeated 10 times, were subjected to statistical processing based on the existing methodical manuals, and their average value M_{aver}, standard deviation s and coefficient of variation V were determined. To ascertain how feed distribution affects the feed distribution device's quality, the feed distribution plate shaft's revolutions range from 30 to 60 r/min, the shovels range from one to four pieces, the feed pouring window's width ranges from 30 to 45 cm, its height ranges from 20 to 40 cm, and the spillway's slope was examined by varying it from 200 to 350 [11].

3 Results

During the experiment, according to the single-factor experiment procedure, the remaining parameters of the working part of the device were set, namely the number of blades: 2, the width of the discharge window: 40 cm, the height of the discharge window: 30 cm, the slope of the discharge window: 35 °, the gap between the blades and the bottom of the hopper: 8 cm, the gap between the blades and the hopper wall: 20 mm, and the height of the working surface of the blades: 20 mm. formed As a

criterion for evaluating the quality of the device, the average amount of feed distributed per meter of the length of the feed distribution site was taken [7].

Experiments have shown that as the number of revolutions of the rotor increases, the amount of distributed feed also increases.



1) corn 2) alfalfa 3) straw

Fig. 3. Change in the amount of coarse feed distribution depending on the number of rotor revolutions

When analyzing the results of experiments on spreading corn, it was found that the average rotor speed was 2.68 kg/m at 30 rpm, 3.28 kg/m at 40 r/min, 4.4 kg/m at 50 r/min, and 60 r/min, it was found to increase to an average of 5.85 kg/m.

When testing ground alfalfa, it was found that the rotor rotation speed increased to an average of 2.22 kg/m at 30 r/min, 3.09 kg/m at 40 r/min, 4.17 kg/m at 50 r/min, and an average of 5.43 kg/m at 60 r/min.

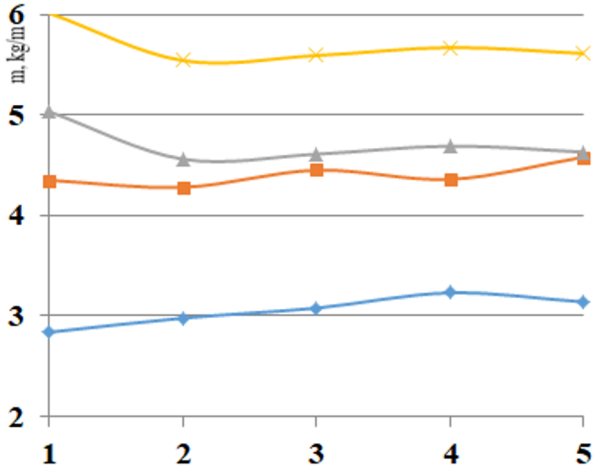
When the experiment was conducted in the same condition with crushed straw, it was found that the rotor rotation speed increased to an average of 1.77 kg/m at 30 r/min, 2.46 kg/m at 40 r/min, 3.65 kg/m at 50 r/min, and an average of 5.05 kg/m at 60 r/min (Fig. 3).

According to the results of the above experiments, if we take into account that the quality of the distribution of crushed corn, alfalfa and straw should be distributed in the range of 4-5 kg/m for corn and alfalfa, and 3-4 kg/m for straw, then this requirement is met when the number of rotations of the distributor rotor is 50 r/min. Therefore, the number of rotations of the paddle rotor was selected as 50 r/min [8].

On this basis, in the next stage of the experiment, the number of blades was determined based on the above number of rotor revolutions, that is, the rotor revolutions were 50 r/min, the width of the discharge window was 40 cm, the height of the discharge window was 30 cm, the slope of the discharge window was 35 ^{O}, the gap between the blades and the bottom of the hopper was 8 cm, the gap between the

blades and the hopper wall was 20 mm, and the height of the working surface of the blades was 20 mm.

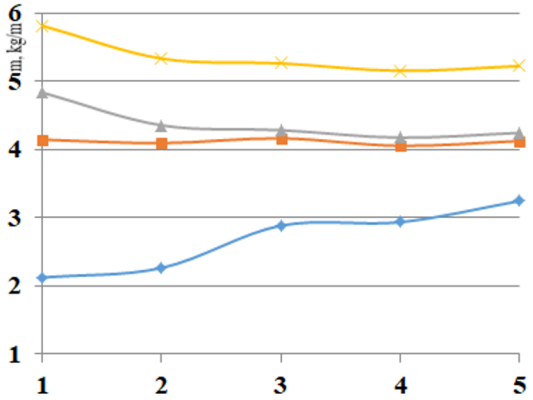
When analyzing the results of the experiments on the distribution of corn stalks, when the number of planks is 1 piece, the average is 3.05 kg per meter, when there are 2 pieces, 4.4 kg, 3 pieces are 4.7 kg, and when there are 4 pieces, the average is 5.68 kg per meter (Fig. 4).



1) 1 piece spade; 2) 2 piece spade; 3) 3 piece spade; 4) 4 piece spade

Fig. 4. Variation in the distribution amount of crushed corn stalks depending on the number of feed spreader boards

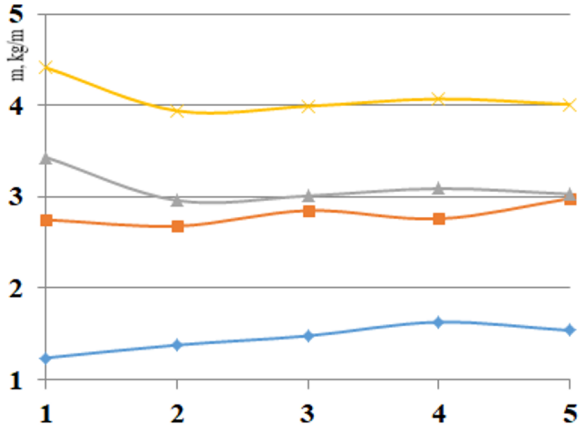
Analyzing the results of the experiments on the distribution of alfalfa stalks, when the number of planks is 1 piece, the amount of feed spilled per meter is on average 2.68 kg, when there are 2 pieces, 4.11 kg, 3 pieces, 4.37 kg, and when there are 4 pieces, it is an average of 5.35 kg. and it was found that with the increase in the number of planks, the amount of distributed feed also increases (Fig. 5).



1) 1 piece spade; 2) 2 piece spade; 3) 3 piece spade; 4) 4 piece spade

Fig. 5. Variation in the distribution amount of chopped alfalfa hay depending on the number of feed spreader boards

When experimenting with straw stalks in this case, the average weight per meter is 1.45 kg when the number of planks is 1, 2.8 kg when there are 2, 3.1 kg when there are 3, and 4.08 kg when there are 4. it was found to increase (Fig. 6).



1) 1 piece spade; 2) 2 piece spade; 3) 3 piece spade; 4) 4 piece spade

Fig. 6. Variation of the distribution amount of chopped straw depending on the number of feed spreader plates

The quantity of one-time feed in the livestock's daily ration was taken into consideration when choosing the number of feed spreader plates for the distribution of crushed corn, alfalfa, and straw from coarse feed, based on the analysis of the results of the aforementioned experiments.

4 Conclusion

Experimental investigations indicate that the amount of coarse feed that should be delivered once in the livestock's daily ration is between 4-5 kg/m for maize and alfalfa and 2-3 kg/m for straw [13]. This is accomplished when the feed distribution device's plate rotates at a rate of 50 revolutions per minute.

When distributing crushed corn, alfalfa, and straw from roughage, it is advised to accept the number of plates of the feed distribution device as two pieces, taking into consideration the quantity of one-time feed in the livestock's daily ration.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

References

1. Borotov A, Bekzhanov S, Nurjan D, Tursunov J, Tursunov Sh, Boykulov U, Ernazarov K and Karshiev F 2023 IOP Conf. Series: Earth and Environmental Science 1284 012013
2. Borotov A , Choriev R , Boykulov, U and Khatamov A 2023 E3S Web of Conferences 390 04038
3. Hasanov S., Mardonov U., Ongboyev A., Ismatov M., INFLUENCE OF A MAGNETIC FIELD ON HSS TOOL WEAR/LIFE AND THE INTENSITY OF EXTERNAL MACHINING ENVIRONMENTS IN TURNING International jurnal of mechatronics and applied mechanics https://ijomam.com/issue-16/ iyun 2024.
4. Mamatov FM , Karshiev FU , Borotov AN , Rasulov AD and Shamayev YJ 2023 IOP Conference Series: Earth and Environmental Science 1231(1) 012008
5. Sattarov NE , Borotov AN and Choriev RK 2023 IOP Conference Series: Earth and Environmental Science 1231(1) 012036
6. Xudoynazarov D.X., Umarov U.E., Yunusova M.U., Ungboyev A.M. E3S Web of Conferences 486, 02004 (2024) https://doi.org/10.1051/e3sconf/202448602004 AGRITECH-IX 2023 7 February 2024 .
7. Mardonov, U., Khasanov, O., Ismatov, A., & Baydullayev, A. (2023, August). Studies Concerning Water-Based Coolants Under Magnetic Field During a Metal-Cutting Process (Turning). In International Conference on Reliable Systems Engineering (pp. 308-317). Cham: Springer Nature Switzerland. Doi: https://doi.org/10.1007/978-3-031-40628-7_26
8. Choriev R.K., D Khudaynazarov., Israilova D.A., IOP Conference Series: Earth and Environmental Science 1076 (2022) 012074 https://iopscience.iop.org/article/10.1088/1755-1315/1076/1/012074
9. Sulaymonov R., Dusiyorov J., Omonov Z. Research on the efficiency of saw gene cleaner. Publishing house State Unitary Enterprise “Fan va Tarakkiyot”. Tashkent, №4/2023.-4 b.
10. Hasanov S., Mardonov U., Ongboyev A., Ismatov M., INFLUENCE OF A MAGNETIC FIELD ON HSS TOOL WEAR/LIFE AND THE INTENSITY OF EXTERNAL MACHINING ENVIRONMENTS IN TURNING International jurnal of mechatronics and applied mechanics https://www.scopus.com/record/display.uri?eid=2-s2.0 85197351635&origin=recordpage iyun 2024.
11. Mamasobirov U.M., Shoobidov Sh.A., Kovalevskiy V.I. Compensation for chain gearing errors by longitudinal modification of the sprocket teeth. International Journal of Mechatronics and Applied Mechanics Volume 1, Issue 9, Pages 232 – 2382021
12. Komil Astanakulov, Fazliddin Kurbonov and Farida Isakova. Investigation of the rotation number of a fish feed distribution device disc apparatus. E3S Web of Conferences 381, 01001 (2023) https://doi.org/10.1051/e3sconf/202338101001
13. Komil Astanakulov, Fazliddin Kurbonov, Farida Isakova. Granulometric Composition and Dimensional and Mass Parameters of Granular Feed Distributed to Fish. I-CRAFT Agriculture and Food Technologies, 4-7 (2024) https://icraft-conference.com/