



## PHYSICO-MECHANICAL PROPERTIES OF FEED TYPES USED FOR FEEDING LIVESTOCK IN PEASANT AND PRIVATE AUXILIARY FARMS

Khudaynazarov Dilshod Khushvaqtovich<sup>1</sup>

Dusiyorov Jakhongir Jalil ugli<sup>2</sup>

<sup>1-2</sup>Tashkent State Technical University, university str. 2,  
Tashkent 100095, Uzbekistan

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**Abstract.** Livestock in Uzbekistan is mainly raised in small family livestock farms with 5-10 head of cattle or 50-60 head of sheep. Although small equipment is available for these farms to grind feed, but due to lack of feed distribution equipment, feed distribution is labor intensive and done manually. Taking this into account, the device used in the distribution of feed for small farms was developed and the physical and mechanical properties of the distributed feed were studied. According to the results of the experiments, crushed straw, crushed alfalfa and crushed corn were selected as distributed roughage, and their volumetric mass and natural angle of inclination were determined.

**Keywords.** Feed spreader, ground straw, ground alfalfa, ground corn, volumetric mass, natural angle of inclination.

Currently, there are feed preparation and distribution devices designed for large livestock farms, while feed shredders have been developed for use on small livestock farms and private family farms. But due to the lack of feed distribution equipment for small farms, this work is done by hand. This leads to low work quality and high labor costs [1].

In agricultural production, various structural and technological schemes are used for the preparation and distribution of feed in livestock farms. The most common technology for feeding young cattle on farms is the distribution of feed by mobile spreaders. The specificity of feed preparation and distribution processes for small cattle farms indicates the need to develop specific solutions for the mechanization of feed distribution in these farms [2].

Nowadays, in world practice, liquid feed distributors, which combine the operations of moving the feed, grinding and mixing, are widely introduced, which leads to a decrease in operational and other costs for the preparation and distribution of feed. But since these feeders are designed for large livestock farms, they do not work well when used in small farms with 5-10 head of cattle or 50-60 head of sheep [3].

For this reason, it is urgent to develop a device that distributes crushed coarse fodder for livestock in small family livestock farms according to the daily ration in the same qualitative manner.

In the study of the technological process of distribution of coarse feed, it is necessary to study some physical and mechanical properties of coarse feed to justify the parameters of the spreader[4, 5].

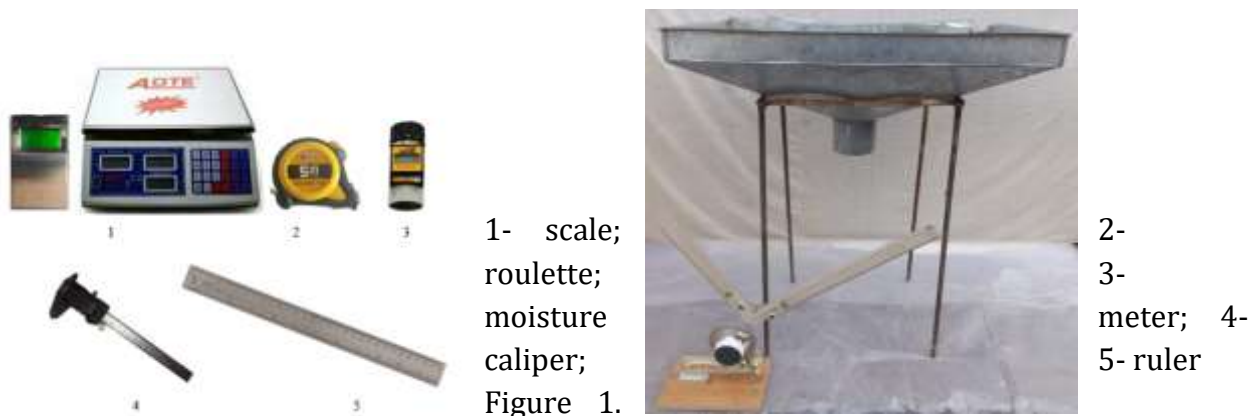
When feeding coarse fodder to cattle in livestock farms, they are ground to the specified size depending on the type of livestock, that is, according to zootechnical requirements, the length of coarse fodder should be 3-5 cm for black cattle, 1-3 cm for sheep and goats. Taking into account the above, the physico-mechanical properties of ground corn, wheat straw and alfalfa stems from the most commonly used coarse feeds in farms were studied as preliminary data

necessary for further research to justify the construction and parameters of the device used in coarse feed processing.

Experiments to determine the physical and mechanical properties of ground corn, straw and alfalfa stalks GOST 20915-2011. "Selskohozyaystvennaya technique. Methody opredeleniya usloviy ispytaniy" and "Physical properties of plant and animal materials" were carried out based on the methods presented in normative documents [6, 7].

The research program developed on the basis of these methodological manuals included the determination of the length, thickness, mass of crushed wheat straw, alfalfa hay and corn stalks and the ratio, density, friction angle and coefficient of their constituents.

A ruler, a ruler, a barbell circle, an AOTE electronic scale, a Wile 55 moisture meter, an inclined plane device, and a special protractor device for determining the angle of natural alignment were used as measuring instruments for determining the size-mass indicators of ground corn, straw, and alfalfa stalks (Fig. 1).



1- scale;  
roulette;  
moisture  
caliper;  
Figure 1.

2-  
3-  
meter; 4-  
5- ruler

### Measuring instruments

The results obtained in the experiments were treated with the methods of mathematical statistics, and their statistical characteristics were determined, that is, the mean value of the  $M_{urt}$ , the mean square deviation, the coefficient of variation  $\sigma$ , etc.

In the development of devices for distribution of crushed coarse feed, it is necessary to know the condition of the processed material, that is, the volumetric mass of the crushed coarse feed intended for distribution and the natural angle of inclination.

In order to determine the volume mass of rough feed, i.e. crushed straw, alfalfa and corn stalks, each component was repeated 30 times during the experiment, the mass of the feed in a cylindrical container with a volume of 1 m<sup>3</sup> was weighed on an AOTE electronic scale, and the volumetric mass of the feed was determined using the following expression:

$$M_V = \frac{M_g}{V_b} = \frac{M_g}{\pi R^2 h} \quad (1)$$

where,  $M_g$  – Mass of coarse feed in 1 m<sup>3</sup> cylindrical container, kg;

$V_b$  – container volume, m<sup>3</sup> (1 m<sup>3</sup>);

R – bunker radius, m (R=0,5 m);

h – bunker height, m (h=0,5 m).

According to the results of the experiment, the volumetric mass of coarse feed, that is, the average value of ground straw is 64.7 kg, the average square deviation is 4.35, the coefficient of variation is 6.72%, the average value of ground alfalfa is 114.5 kg, the average



square deviation is 5.13, the coefficient of variation We can see that 4.48% and the average value of ground corn stalk was 125.3 kg, the average square deviation was 3.68, and the coefficient of variation was 2.94% (Table 1).

Table 1

Volumetric mass of ground coarse feed

№	Stalk type	Volumetric mass, kg			Average squared deviation, $\sigma$	Coefficient of variation, V, %
		$X_{min}$	$X_{max}$	Average value, $M_{o'rt}$		
1	Straw stalk	58	71	64,7	4,35	6,72
2	Alfalfa stalk	108	124	114,5	5,13	4,48
3	Corn stalk	120	131	125,3	3,68	2,94

In order to determine the angle of natural accumulation of ground roughage, a container with a funnel located at a certain height, which ensures the free accumulation of feed, and a special angle measuring conveyor device for determining the angle of accumulation, were measured separately 30 times for each type of feed (Fig. 2).



Figure 2. Determination of the angle of natural accumulation

When determining the natural alignment angle of ground roughage, the average angle of alignment of ground straw is  $29^{\circ}$ , its average square deviation is  $3^{\circ}$ , the coefficient of variation is 10.53%, the average angle of deviation of ground alfalfa is  $32^{\circ}$ , the average square deviation is  $2^{\circ}$ , the coefficient of variation is 8.84%, and ground corn we can see that the average deviation angle of the stem is  $34^{\circ}$ , the average square deviation is  $4^{\circ}$ , the coefficient of variation is 11.67% (Table 2).

Table 2

Natural deviation angle of coarse feeds

№	Stalk type	Angle of scattering, grad			Average squared deviation, $\sigma$	Coefficient of variation, V, %
		$X_{min}$	$X_{max}$	Average value, $M_{o'rt}$		
1	Straw stalk	25	33	29	3	10,53
2	Alfalfa stalk	28	36	32	2	8,84



3	Corn stalk	26	38	34	4	11,67
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