

RESEARCHING THE PARAMETERS OF THE TRANSMISSION IN A FORAGE CHOPPING DEVICE

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Abstract. *In the article, the parameters of the transmission shaft of the device that cuts and chops green stalk feed are determined. The developed device is designed for small family farms. The feed fractions and the conclusion are presented according to zootechnical requirements.*

Keywords. *livestock, maize, wheat, sorghum, and legumes are grown, widely.*

Introduction. Achieving good results in livestock, fisheries and poultry feeding depends on the type and quality of feed provided to them. Animal feed, concentrated feed and additional feed are used in livestock, fishery and poultry feeding. In Uzbekistan, maize, wheat, sorghum and legumes are grown, and sorghum and maize grains are widely used as bran and bran concentrate feed .

Excessive consumption of concentrated feed for livestock, fisheries and poultry leads to be increased body fat. Among the above-mentioned feeds, the use of green feed helps to prevent the accumulation of fat in the body of fish and poultry and promotes rapid growth and development. Green stalk feeds come from a variety of plants, including corn stalks, cane, alfalfa, legumes, and more. In order to provide livestock, fisheries and poultry feed with green stalks, it is necessary to grind them. Taking into account the above, the analysis of today's existing devices research and development work were carried out to create a small and compact green stalk feed chopper. As a result of research and experiments, a feed chopping device for livestock, fisheries and poultry was developed. The parameters of the transmission shaft installed on the developed device were studied experimentally.

During the operation of the device, the green stalk feed is transferred to the feed trough and from it to the chopping drum through a rod. Since the shape and some parameters of the shaft that the food chopper conveys to the drum are directly related to the process of chopping food in the device, it is necessary to determine its main parameters depending on this process.

Feed transfer and chopping process is affected by the shape of the trough, length L_n , width V_n and angle of inclination α_{uz} .

According to the analysis of the working process of the existing devices for manual feeding of stalked feed to the feed chopper, in order to facilitate the feed transfer, the width of the transmission

channel should be wider at the beginning, narrowing towards the last part, and at the end, the chopping device should be able to pass the feed suitable for the work performance.

In that case, the shape of the transmission shaft can be taken in the form of a quadrangular prism with a large and small base.

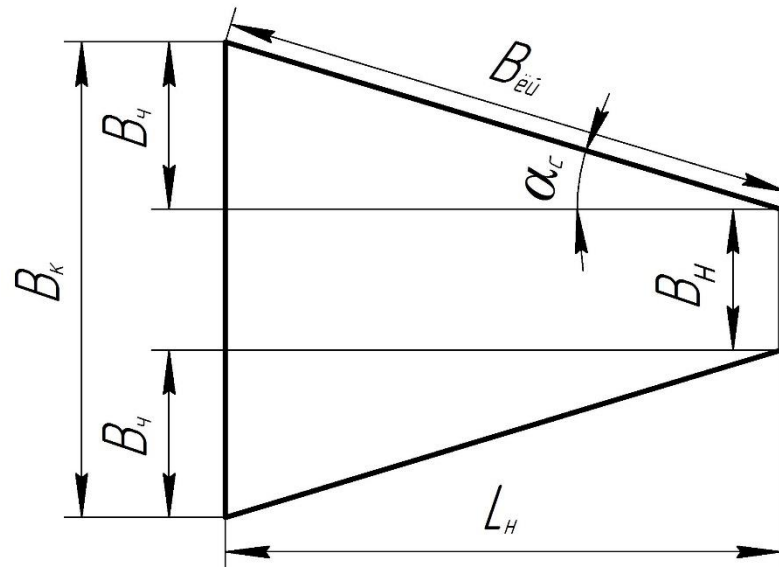


Figure 1. Scheme for determining the dimensions of the transmission shaft

The width of the front part of the trough

$$B_k = B_n + 2B_{ch}, \quad (1)$$

where B_k is the width of the front part of the transmission channel, m;

B_n – the width of the last part of the transmission line, m;

B_{ch} – the width of the outer part of the transmission line, m.

According to the scheme in Fig. 1

$$B_{ch} = L_n \operatorname{tg} \alpha_c, \quad (2)$$

where L_n is the length of the transmission line, m;

α_c is the angle of inclination of the edge of the transmission channel, grad.

(2), the width of the front part of the beam

$$B_k = B_n + 2L_n \operatorname{tg} \alpha_c. \quad (3)$$

In order to transfer the feed with low resistance to the feeders, the slope angle of the edge of the transmission shaft should be smaller than the friction angle of the feed. If we look at the experimental data, the minimum friction angle of corn and alfalfa stalks in the green state is $\varphi_{\min} = 25 - 28^\circ$ considering that 25° between.

We determine the length of the transmission shaft based on the length of the smallest stalks in the stalk feed being transferred to the chopper, i.e.

$$L_n \geq l_n^{\min}, \quad (4)$$

where l_n^{\min} - the length of the smallest stalks in the ground feed, m.

If $l_n^{\min} = 62.4$ cm, the length of the transmission shaft should be 65 cm.

If this condition is met, it is ensured that even the smallest stalks in the mass being transferred are transferred without falling.

V_n of the part of the transmission shaft that feeds the feed into the chopping device from the condition of delivering the feed to the device suitable for its performance, and it is as follows

$$B_n = \frac{q}{h \rho k_{uz} V_{uz}}, \quad (5)$$

where q is the work output of the chopper, kg/s;

h - the thickness of the feed being sent to chopping, m;

r - the density of the feed sent to chopping, kg/m³;

k_{uz} is a coefficient that takes into account the periodicity of feed transfer; $k_{uz} = 0.5-0.8$ when feed is transferred by hand.

B_{uz} - feed transfer speed, m/s.

If $q = 0.142$ kg/s; $h = 0.02$ m; $r = 118.2$ kg/m³; It turned out that if $V_{uz} = 0.44-0.5$ m/s, then $V_n = 18.3-22.1$ cm. For constructive convenience, we take $V_n = 20$ cm.

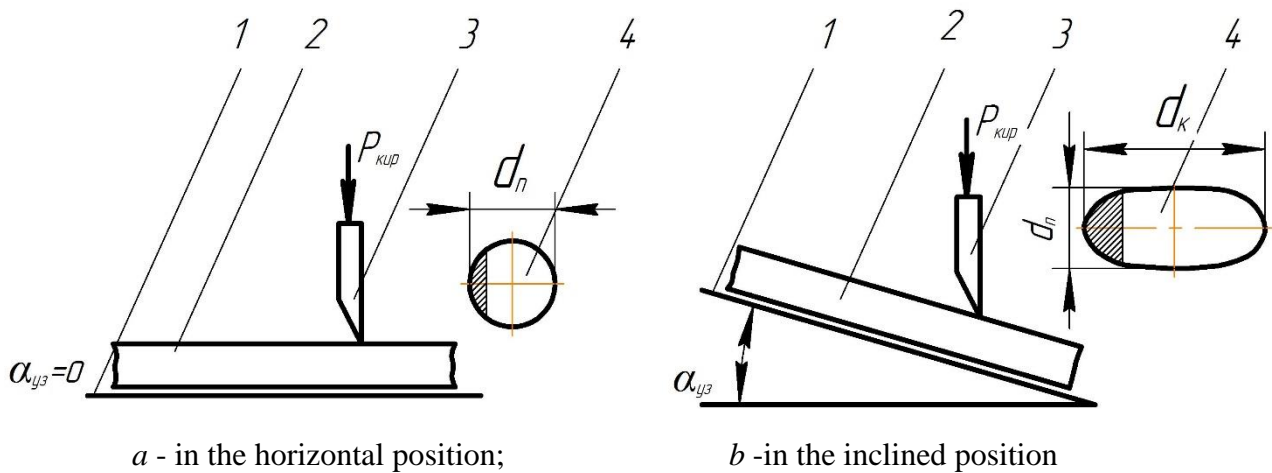
$V_n = 20$ cm, $L_n = 65$ cm, and taking into account that $\alpha_c = 8-10^\circ$ is acceptable for the transmission of feed with low resistance to the feeders and for structural convenience, according to expression (3) the width of the front part of the transmission shaft is B_k It follows that $k = 38.2-43.4$ cm. We take $B_k = 40$ cm.

The inclination of the transfer bar directly affects the transfer of stalks to the blade and the cutting angle, and ultimately the resistance to cutting and the cutting length.

For this reason, we analyzed the slope angle of the trough.

There can be 2 situations when transferring stalks to cutting:

1. Transfer the stalks horizontally to the drum blade of the chopper (Fig. 2, a);
2. Stalks are obliquely transferred to the chopper drum blade at an angle (Fig. 2, b).



a - in the horizontal position;

b - in the inclined position

1-st transmission line; 2-nd stalk; 3-rd blade; 4-stalk diameter

Figure 2. Schematic diagram of the state of transmission of stalks to shearing

According to the 1st case, the shearing force is maximum when the stalks are transferred horizontally to the blade or the blade is vertical to the stalk, i.e. [5; 6]

$$\alpha_{uz} = 0 \Rightarrow P_{kir} = P_{max} \cdot \quad (6)$$

In case 2, there are two different cases. In this case, if the angle of transmission of the stalks is smaller than the angle of friction, the shearing force will be smaller than the maximum value, but higher than the minimum value. If the angle of transfer of stalks is greater than the angle of friction, the shearing force is minimal, that is [5; 6]

$$\alpha_{uz} < \varphi \text{ when } \Rightarrow P_{min} < P_{kir} < P_{max} \cdot \quad (7)$$

$$\alpha_{uz} > \varphi \text{ when } \Rightarrow P_{kir} = P_{min} \cdot \quad (8)$$

where φ is the friction angle of the stalks, degrees.

However $\alpha_{uz} > \varphi$, the cross-sectional surface of the trimmed stalk is elliptical (Fig. 2, b). For this reason, it is not allowed that the angle of transmission of the rods is too large than the angle of friction. If the reason $\alpha_{uz} > \varphi$ is, the large diameter of the ellipse cross-section of the stalk may be greater than the cutting length specified by zootechnical requirements, $d_{\kappa} > l_{\kappa up}$ i.e.

Therefore, in order to ensure that the crushed stalks are conveyed with as little friction as possible, the angle of inclination of the chute should be

$$\alpha_{uz} > \varphi_{\min} \quad (9)$$

If the minimum friction angle of corn and alfalfa stalks in the green state is $\varphi_{\min} = 25 - 28^{\circ}$ taking into account that it $\alpha_{uz} = 27^{\circ}$ between.

Conclusions. According to theoretical researches, in order to transfer the crushed feed to the device and its supply channels with a comfortable and low resistance, the length of its transfer channel should be 65 cm, the width of the front part of the channel should be 40 cm, the width of the part connecting to the supply channels should be 20 cm, and the slope of the channel should be 27° .

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