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Abstract. Currently, special attention is being paid to the development of cattle-raising, fisheries and poultry in Uzbekistan. Cattle-raising, fisheries and poultry feeding green forage providing their intensive increasing as well decreases the gathering of additional oil in them. Therefore, a chopping device was produced to cut green crops, such as clover, maize as well legumes. Since the quantity and arrangement of cutter-bars in the rotor depends on the quantity and placement of the cut feeds to be of same length, the quantity of cutter-bars has been explored theoretical and experimental researches. According to theoretical researches, the greater the quantity of cutter-bars in the feed chopping rotor, the greater the work efficiency and the shorter the length of cutting. During the experiments, when the quantity of rotations of the rotor was 1500 rpm and the quantity of rotating of the chopper was 175 rpm, 6 cutter-bars were installed on a rotor with a diameter of 200 mm. It was found that metal consumption and cost were reduced compared to 8 cutter-bars. It is recommended to install 6 cutter-bars on a rotor with a diameter of 200 mm.

1. Introduction
Achieving to effectiveness in cattle raising, fishery as well poultry feeding depends on the sort and quality of feed given to them [1, 2, 3]. Cattle raising, fishery and poultry feed are used in nutritional feeds, concentrated feeds and supplementary feeds. [4, 5, 6]. In Uzbekistan, maize, wheat, sorghum and leguminous crops are grown [7, 8, 9], and bran and meal concentrates from sorghum and maize grains are widely used [10].

Consumption of concentrated feed in cattle raising, fisheries, and poultry may increase body fat leads to an increase. 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 stem forages come from different types of plants, including maize stems, legumes, cane, clover and others. As an aim to provide cattle raising, fisheries and poultry feed with green stems, it is necessary to chopp them [11, 12, 13]. Taking into account the above, the analysis of today's existing machines and equipment [14, 15, 16, 17, 18] were observed to create a small and compact green stem feed chopping. Because of research and experiments, a feed chopping device for cattle raising, fisheries and poultry was developed. Experiments were carried out by installing different quantities of cutter-bars on the rotor of the chopping installed on the developed device.

2. Methods
The laws were used to study the parameters of the cutter-bars installed in the rotor of the food chopping. Difference of the compatibility of the achieved theoretical researches was performed by experimental researches. Maize and clover stalks were cut during the experiments. The operation efficiency of the

equipment was defined by the ratio of fractions in the cut feed between 5 and 10 mm as well 10 and 20 mm, also bigger than 20 mm. The processed feed was divided into parts with a size of up to 5 mm, a size of 5 mm to 10 mm, a size of 10 mm to 20 mm, and a size bigger than 20 mm, and their fractional composition was determined on laboratory sieves. According to the specified requirements, ground feed for fish and poultry should contain more than 50% of fractions with a size of up to 5 mm, more than 30% of fractions between 5-10 mm, and more than 20% of fractions with a size of 10-20 mm and bigger.

3. Results and Discussions

The main parameters of the chopping rotor knife are its installation angle b, knife sharpening angle g, chamfer width v f , rear installation angle θ and cutting angle ps k , as well as thickness d and knife width bn. It is desirable that the sharpening angle of the knife knife is in the range of 24-30 O when chopping green stem feed.

In existing devices, cutter-bars with a thickness of 2 mm to 15 mm are used, taking into account the thickness, moisture content and shear resistance of the different material to be crushed. The thickness of the knife should be less considering that the production unit will chopp low-resistance but high-moisture green stem feed. Because the use of thick cutter-bars when chopping grass with high moisture content increases the resistance and dehydrates the feed.

Therefore, we take its thickness in the range of 2-5 mm, more precisely, d = 3 mm. Only to ensure sufficient strength of the knife, it is required to make it from steel with hardness 55-60 HRC, bending resistance CPM S90V, carbon content higher than 0.6%.

Then, according to the thickness of the knife and the angle of sharpening, the width of its knife will be as follows (Fig. 1 a).

$$b_f = \frac{\delta}{\sin \gamma} \text{ or } b_f = \delta\sqrt{1 + ctg^2\gamma} \ . \tag{1}$$

If we take into account the thickness of the knife δ = 3 mm, the sharpening angle γ = 25°, then b_f = 7.1 mm.

a)   b)
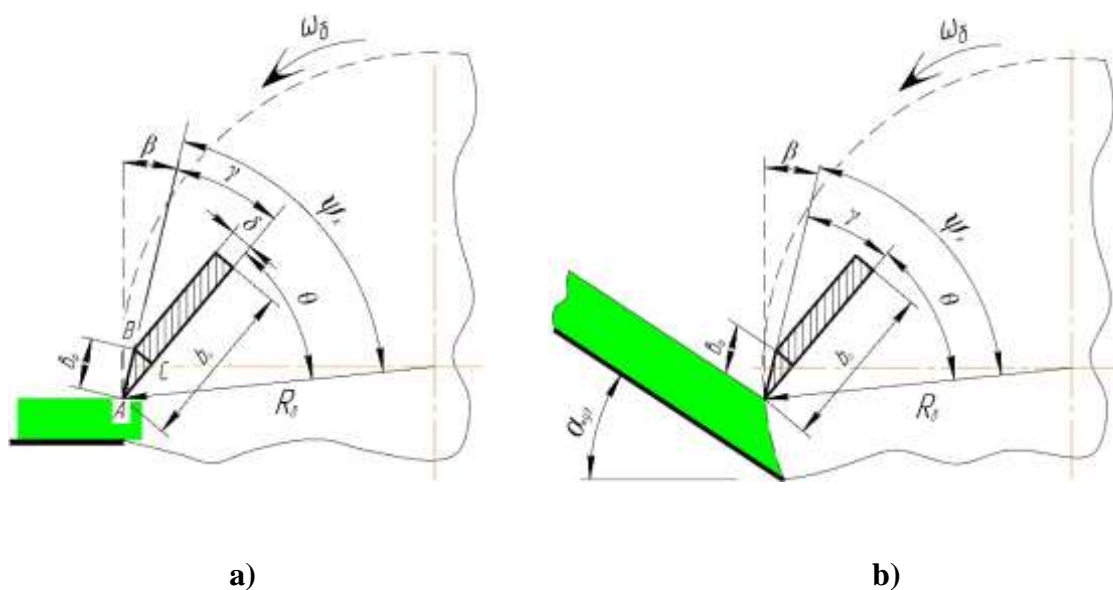
Figure 1. The scheme for determining the knife parameters

Based on the diagram in Fig. 1 b, the knife installation angle is as follows

$$\sin \beta = \frac{R_b^2 + b_f^2 - \left(R_b - b_f \cdot \dfrac{V_{uz}}{V_b} \right)^2}{2R_b b_f} \, , \tag{2}$$

where R_b is the radius of the crusher rotor, m.

b_f – width of knife face, m;

V_{uz} – speed of transmission of stems, m/s;

B_b – rotor speed, m/s.

Taking into account the expression (1), the expression (2) changes as follows

$$\sin \beta = \frac{R_b^2 + \delta^2 \left(1 + ctg^2\gamma\right) - \left(R_b - \delta\sqrt{1 + ctg^2\gamma} \cdot \dfrac{V_{uz}}{V_b} \right)^2}{2R_b \delta\sqrt{1 + ctg^2\gamma}} \, . \tag{3}$$

According to the installation b and the sharpening angle g of the knife, the rear installation angle of the knife and the cutting angle ps_k are as follows

$$\theta = 90^o - \left(\beta + \gamma\right). \tag{4}$$

$$\psi_\kappa = \gamma + \theta = 90^o - \beta . \tag{5}$$

(3) shear angle according to the expression

$$\psi_\kappa = 90^o - \arcsin\left[\frac{R_b^2 + \delta^2 \left(1 + ctg^2\gamma\right) - \left(R_u - \delta V_1 + ctg^2\gamma \cdot \dfrac{V_{uz}}{V_b} \right)^2}{2R_b \delta\sqrt{1 + ctg^2\gamma}} \right]. \tag{6}$$

Based on research, in order to determine the efficiency of cutter-bars in the chopper rotor on the quality of chopping green stem feed, experiments were conducted by installing 2, 4, 6, and 8 cutter-bars in the rotor.

Initially, when the quantity of rotor cutter-bars was changed from 2 to 8 pieces with an interval of 2 pieces, the quantity of fractions up to 5 mm in the cut mass was from 24.9 to 54.9 per cent, and the quantity of fractions from 5 to 10 mm was from 30.1 percent. increased to 40.7%, the quantity of fractions between 10-20 mm decreased from 24.4% to 4.2%, and the quantity of fractions bigger than 20 mm decreased from 20.6% to 0.2% (Table 1).

Table 1. Changes in the degree of crushing of maize stalks depending on the quantity of cutter-bars in the threshing rotor

No	Composition of ground feed by fractions	The chopping is in the rotor quantity of cutter-bars, pcs			
		2	4	6	8
1	up to 5 mm, %	24.9	38.6	54.4	54.9
2	up to 5-10 mm, %	30.1	35.1	39.7	40.7
3	up to 10-20 mm, %	24.4	19.7	5.4	4.2
4	Bigger than 20 mm, %	20.6	6.6	0.5	0.2

In clover stems, when experiments were conducted in the same order, the quantity of fractions up to 5 mm increased from 24.1% to 52.2%, the quantity of fractions up to 5-10 mm increased from 28.9%

to 39.4%, and the fractions up to 10-20 mm increased. from 24.2% to 7.6%, the quantity of fractions bigger than 20 mm decreased from 22.8% to 0.8% (Table 2).

Table 2. Changes in the degree of cutting of clover stalks depending on the quantity of cutter-bars in the chopper rotor

No	Content of chopped forage by fractions	The chopping is in the rotor quantity of cutter-bars, pcs			
		2	4	6	8
1	up to 5 mm, %	24.1	37.2	51.6	52.2
2	up to 5-10 mm, %	28.9	34.7	38.6	39.4
3	up to 10-20 mm, %	24.2	18.4	8.7	7.6
4	Bigger than 20 mm, %	22.8	9.7	1.1	0.8

According to the results of the above performed experiments, the required chopping quality of maize and clover stalks in the green state was determined when the quantity of cutter-bars installed in the rotor was 6 and 8 pieces. The quantity of fractions up to 5 mm in the ground mass is 54.4 and 54.9 percent in maize, 51.6 and 52.2 percent in clover, the quantity of fractions up to 5-10 mm is 39.7 and 40.7 percent, and 38 ,6 and 39.4 percent, and the fractions bigger than 10 mm, that is, up to 20 mm and bigger than 20 mm, are 4.2-5.4 percent when chopping maize and 7.6-8.7 percent when chopping clover, and 0.2-0.5 percent and 0.8-1.1 percent, it was determined to be at the level of the specified requirements.

But when there are 8 cutter-bars installed on the rotor, the metal consumption of the chopping and the costs of its preparation increase. For this reason, the quality of the prepared food has not changed at a high level, so it is reasonable to accept the quantity of cutter-bars installed in the chopping rotor as 6 pieces.

4. Conclusions

1. It is known from theoretical studies that the quality and quantity of fractions of the ground feed in the chopping device varies depending on the quantity of cutter-bars.

2. When the quantity of cutter-bars installed on the chopper rotor in the device is 6 pieces, the quantity of fractionation from 5 mm to 10 mm has increased, the quantity of fractions up to 20 mm and bigger than 20 mm has decreased, and while chopping the feed to the required size, metal consumption and cost have been reduced compared to 8 pieces of cutter-bars. was determined. Therefore, the quantity of cutter-bars in the chopping rotor should be taken as 6 pieces.

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