

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Substantiation Of The Design Parameters For Feeders For Cattle.

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### ABSTRACT

Analysis of the structure of energy consumption in the technological process of the cattle farms (cattle) milk and meat production shows that a significant percentage (30-35%) is occupied by the processes associated with the delivery and distribution of feed. Currently in cattle, widespread technology of hay, formed into rolls. However, the problem associated with the cutting and distribution of animals such feed, as this process requires additional equipment and energy costs. Therefore, an alternative feeding rolled feed for cattle is the development and implementation of special devices (smokerlyser), which is provided by the process of feeding under free or restricted access of animals to them. Currently existing types of feeders for feeding cattle developed by several research institutes and design bureaus of the Russian Federation do not meet the zootechnical requirements. They are usually bulky and material-intensive, provide enough fronts simultaneously feeding groups of animals, allow for significant losses of feed. The article presents information on the verification of structural parameters, feeders for cattle, providing animal feeding various types of forage, including hay and haylage in bales. The design of the feeders also allows you to capture the animal while conducting veterinary-sanitary measures. The results of industrial testing of prototypes developed by the trough. The material presented can be used in the design of feeders for various purposes, as well as in the design and manufacture of feeders under conditions of smallholdings and farms.

**Keywords:** Hay, silage, hay feeder, cattle, feed loss.

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## INTRODUCTION

To increase the efficiency and competitiveness of cattle breeding is impossible without modernization of farms based on the latest technologies and technical means. On reserves to reduce the degree of influence on labor costs, the productivity of cows and young cattle, feeding animals among other basic technological processes is of particular importance.

The main source of energy, protein and biologically active substances for cattle are bulky fodder in the form of hay, haylage and silage.

Traditional and most common ways of harvesting, transporting and distributing hay significantly reduce its quality due to the scattering of leaves and inflorescences which have more valuable food advantages and contain valuable nutrients. In many regions of the country, including in the agricultural enterprises of the south of Russia, the technology of harvesting forages with pressing into bales and coils is of increasing interest, which significantly reduces these losses during transportation and storage. However, there is a problem with grinding and distribution of feed, since this process requires additional devices, and, consequently, investment and energy costs [1-2].

The solution of this problem should be a device that meets the requirements of universality both in species and in the sex and age groups of farm animals and in relation to the basic types of nutrition fed by these animals. The use of feeders for hay and haylage makes it possible to exclude the use of cutting machines and distributors of feed distributors, to significantly reduce the cost of labor and energy, since they are loaded, as a rule, every 2 ... 3 days.

Existing types of feeders for feeding cattle are usually cumbersome and material-intensive, allow for significant feed losses and do not provide a front for the simultaneous feeding of a group of animals in accordance with zootechnical requirements. In addition, an analysis of various designs of feeders for hay and haylage of foreign production showed that they also have the following serious shortcomings:

- significant forage loss;
- do not have universality with respect to different types of farm animals;
- are not universal with respect to the distribution of different types of feed.

This makes it necessary to improve the design parameters of the hay and hay feeder in the direction:

- universality in relation to the sexual and age groups and the pedigree composition of cattle;
- universality with respect to the types of food distributed (loose, pressed);
- elimination of irretrievable feed losses;
- providing the most comfortable conditions for the process of feed consumption;
- the possibility of carrying out other activities with animals (sampling of blood, hoof treatment, etc.).

## MATERIALS AND METHODS

At the Stavropol State Agrarian University a prototype of a hay and haylage feeder was developed for universal use (Fig. 1) [3-4].

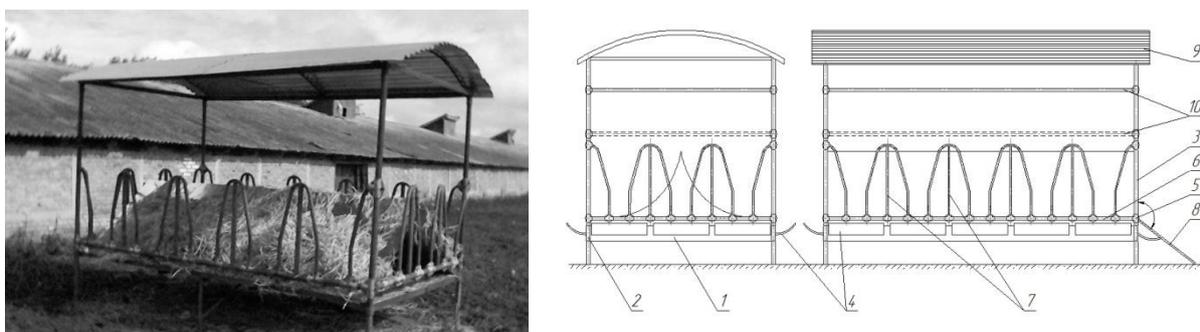


Figure 1: General view and diagram of the device for hay and haylage (patent No. 2269260)

This is a trough 1 with a sliding bottom, in the corners of which there are sleeves 2, in which vertical stands 3 are inserted, which serve as supports.

Along the perimeter of the outer side of the chute 1 are spring-loaded food shops 4. To the posts 3, with the clips 5, the bases 6 are fixed to fix the dividing arcs 7. The bases 6 and the dividing arcs 7 in the assembly form a dividing (feeding) mesh. The side dividing gratings 8 on the posts 3 are rigidly mounted to ensure loading of the hay and hay holder. At the upper ends of the shelves 3 there is a roof 9, as well as stops 10, the position of which can be adjusted in height.

The lower part of the gutter consists of two sheets, pivotally connected on each side, on the rise, which forms inclined surfaces through which loose, crushed and loose remains of roll hay, as well as maize silage, moves to the edges of hay and hay [5-6].

Before using the hay and hay feeder, the feeder is set to a height suitable for species of animals and age and sex groups. Then the distance between the dividing arcs also varies, depending on the biometric parameters of the animals. Loading is done by the front loader or directly from the tractor trailer on either of the short sides of the hay and hay device, which are fixed movably on the basis of the dividing arcs.

Based on the acceptable waiting time of the animal in the trough and the creation of the most comfortable conditions during feeding, the optimum population for self-training for 12, 16 and 24 feeding places was determined (Fig. 2). The obtained data show that the optimal ratio of the number of feed sites and the number of animals served is 1: 5.

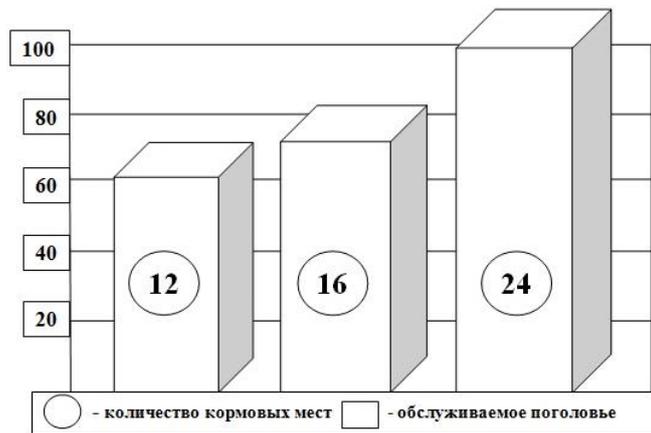


Figure 2: Optimal loading of the hay and hay feeder with a different number of feed sites

An important role is played by the separation grid, the design of which should limit the displacement of animals with each other and minimize the loss of food.

To determine the optimal design of food grids, the time of the animal was carried out for various structural designs (Figure 3).

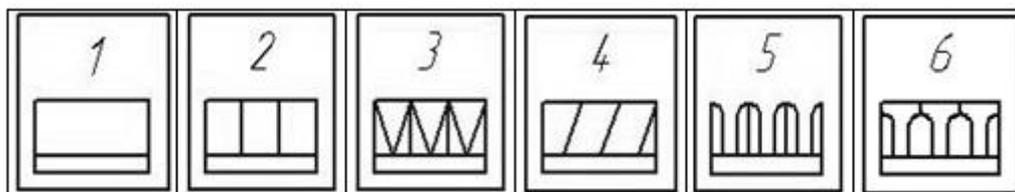
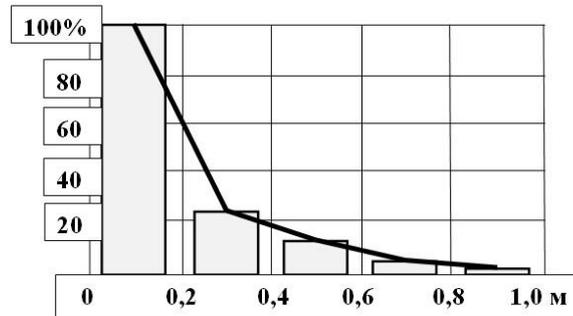


Figure 3: Forms of the investigated limiters

The most complete set of requirements meets the grippers under number 5. The design parameters of this fencer are determined taking into account the measurements of animals and their physiological characteristics and implemented in a pilot sample a hay and hay feeder.

## RESULTS AND DISCUSSIONS

Observations of the process of feeding cattle using a hay and hay feeder have revealed that animals lose a significant part of their feed in a certain area 1 meter wide from the edge of the hay and hay feeder. As a result of the studies, the distribution of losses along the perimeter of the feeding front was determined as a function of the distance from the edge of the trough for hay and haylage (Fig. 4).



**Figure 4: Distribution of feed losses ( % ) depending on the removal of the edge of the feeder for hay and haylage**

The graph shows that most of the losses are in the area of 0...0.4 m from the edge of the feeder for hay and haylage. Therefore, installation of a perimeter trough for hay and haylage on the outside of the traps feed (POS. Figure 4 1) with the amount of departure from the edge of 0.3 meters, can reduce its loss by 70...80%.

Feeder for hay and haylage equipped in stationary premises and in the exercise-feed yards. Height of their arrangement from a floor to top of a forward Board shall make: at a trough for cows-0,6 m, at a trough for calves - 0,4 m.

Production tests of the developed feeder for hay and haylage were carried out on the dairy farm and feed cattle in SHP "Podgornoe" Georgievsky district. As a result, its technological advantages are confirmed in comparison with mass-produced models of self-feeders. Technical and economic calculations showed that the payback period of investments in its production does not exceed two years.

The variants of planning feedlots for cattle, as well as family dairy farms with the use of self-feeders are developed.

## CONCLUSIONS

Materials of theoretical studies on the justification of the design parameters of the feeder for hay and haylage, methods of experimental research, as well as devices and equipment used for this purpose, were presented at inter-University scientific and international scientific conferences.

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