Fattening of culled cattle with the use of complex feed additives in the diets in the conditions of Yakutia

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Abstract. The paper presents the results of a study to determine the effectiveness of complex feed additives in the fattening of culled cattle in the conditions of Yakutia. To conduct the experiment, 3 groups of culled cattle were formed. The use of complex feed additives from local natural raw materials in the feeding of culled cattle on fattening allowed increasing the live weight by 1.58% and 0.26%. To determine the safety of experimental feed additives, the clinical parameters of the body of experimental animals were studied. It was found that there was no significant difference between the groups and all the indicators were within the normal range, which in turn proves the harmlessness of complex feed additives. At the end of the experiment, a control slaughter of experimental animals was carried out. When analyzing the data of animal slaughter, it was found that the experimental groups were superior to the control group in terms of parameters: the mass of the steam carcass by 5.53% and 3.61%, the mass of visceral fat by 9.39% and 1.77%, the slaughter mass by 6.07% and 3.87%, the slaughter yield by 2.76% and 2.06%. Next, the organoleptic evaluation of meat products was performed. According to the results of the evaluation of boiled meat, it was found that the experimental groups exceeded the control group by 12.92% and 8.33%, and exceed the roasted meat by 11.87% and 8.19%. Thus, complex feed additives showed effectiveness in fattening culled cattle in the conditions of Yakutia.

1. Introduction
In winter, the need for full-fledged feeding increases many times in farm animals, especially when the duration of the cold period is more than 7 months. With insufficient feed supply during this difficult period, as well as poor feed quality in combination with an imbalance of nutrients and minerals in the diets of animals, they lead to worsening of metabolism, affecting health, reproduction, safety and productivity negatively [1, 13, 15].
However, there is other information [2, 5, 6, 11, 12] where it is indicated that the creation of optimal feeding conditions ensures a more complete realization of the genetic potential of animals in a variety of breeding conditions.

In Yakutia, the predominance of coarse feed in the structure of the cattle diet has a significant share [10]. The conducted studies to determine the effectiveness of different types of feeding in cattle breeding established that, depending on the age, season, and availability of feed, animal diets should be structured according to the ratio of dairy, bulk feed, and mixed feed, including feed additives [13].

Non-traditional animal feed is widely used in the world. Non-traditional feed sources of protein and energy can include petrochemical raw materials, lignin-cellulose materials, keratin waste, leather waste, non-protein nitrogen, urban and kitchen waste, activated sludge, waste of plant and animal origin, including animal excrement and the contents of the digestive tract. Recently, the actual direction in the production of additives is occupied by microbial protein (or unicellular protein): algae, bacteria, yeast and mold, synthetic feed products. In addition, the possibility of using waste from logging production, including pine needles, is relevant in animal feeding, as conifers contain a large amount of carotene, vitamin C, iron, and manganese. Needles contain more ascorbic acid compared to lemon and orange (by 5-6 times). There is carotene 100-250 mg and vitamin C-10 thousand mg per kg of dry matter of needles. It is noted that needles can be fed to animals in green form. At the same time, the effectiveness of coniferous flour for large and small cattle, pig and poultry farming was noted. It is also noted that due to the high concentration of essential oils in them, their inclusion in the diet is strictly limited. This can be corrected by using additional extraction, evaporation, or processing in flour production [3].

Currently, the introduction of various non-traditional feed resources in cattle breeding, such as halite waste, zeolites, sapropel, dolomite flour, phosphogypsum, defecate and vermiculite, is sufficiently justified [14].

The aim of research: to evaluate the effectiveness of complex feed additives from local raw materials in feeding culled cattle on fattening in the conditions of Yakutia.

The objectives of research:
- to study the meat productivity of animals;
- to study the quality of meat products.

2. Material and research methods
A scientific and economic experiment on fattening culled Simmental cattle was organized in the farm “Lonkur” of the Suntarsky district. 3 groups of animals with 10 heads each were formed, which were divided into a control group and two experimental groups. The duration of the experiment was 30 days. The level of feeding, the daily supply of basic feed, and the conditions of keeping animals in all groups were identical and differed in that the experimental groups received additional complex feed additives according to the experimental scheme.

The daily diet of fattened animals met the required modern feeding standards [8, 9]. For animals of the experimental group II, in addition to the basic diet, 75 g of coniferous flour and hongurin 0.7 g/kg of live weight were given together with 65 g of Kempendyaysk salt. Animals from the III experimental group had 120 g of coniferous flour, hongurin in the norm of 0.8 g/kg of live weight and 50 g of Kempendyaysk salt with the basic diet. The chemical composition of coniferous flour is presented in Table 1.

The chemical composition of hongurin zeolite is presented in [4].

The effect of experimental feed additives on the physiological state of animals at the beginning and at the end of each experiment was determined by measuring the main clinical indicators of the body (body temperature, respiratory rate and pulse).

To study the effect of complex feed additives from local natural raw materials on the physiological parameters of the animal body, we studied the clinical parameters of the body. At the end of the experiment, a control slaughter of animals was carried out.
Table 1. Chemical composition of coniferous flour.

| Indicators        | Measure unit | Contain  |
|-------------------|--------------|----------|
| Dry matter        | %            | 20.7     |
| Crude protein     | %            | 6.9      |
| Carbohydrates     | %            | 32.8     |
| Crude fat         | %            | 9.6      |
| Crude fiber       | %            | 10.5     |
| Organic acids     | %            | 9.6      |
| Other organic substances | %       | 2.5      |
| Raw ash           | mg%          | 7.4      |
| Calcium           | %            | 0.5      |
| Phosphorous       | %            | 0.4      |
| Potassium         | %            | 2.3      |
| Magnesium         | %            | 0.3      |
| Ferrum            | mg           | 174      |
| Copper            | mg           | 12.6     |
| Manganese         | mg           | 197      |
| Carotene          | mg           | 168      |
| Vitamin E         | mg           | 220      |
| Vitamin B         | mg%          | 8.0      |
| Vitamin C         | mg           | 127.3    |
| Vitamin P         | mg           | 27.8     |

3. Results and discussion

In order to determine the effectiveness of complex feed additives in the feeding of culled fattening adult cattle, the experiment was organized on the basis of the Lonkur farm in the Suntarsky district. The studies were conducted on 3 groups of culled Simmental cattle. Each group has 10 heads. The conditions of housing in all groups were the same, except for the use of complex feed additives in the diets of the experimental groups of animals. The average daily diet is shown in Table 2.

Table 2. Average daily diet of culled cattle.

| Indicators         | Standard | Groups                        | I - control | II - experimental | III - experimental |
|--------------------|----------|-------------------------------|-------------|------------------|-------------------|
| Meadow hay, kg     | 12       |                               | 12          | 12               | 12                |
| Mixed grass haylage, kg | 5     |                               | 5           | 5                | 5                 |
| Mixed feed, kg     | 4        |                               | 4           | 4                | 4                 |
| the diet contains: |          |                               |             |                  |                   |
| Exchange energy, MJ| 124      |                               | 124.1       | 124.1            | 124.1             |
| Dry matter, kg     | 13.5     |                               | 13.51       | 13.51            | 13.52             |
| Digestible protein, g | 700    |                               | 1123.3      | 1146.57          | 1161.75           |
| Crude fiber, g     | 2700     |                               | 3628.17     | 3698.76          | 3759.27           |
| Starch, g          | 1050     |                               | 1624.23     | 1683.64          | 1734.14           |
| Sugar, g           | 770      |                               | 539.3       | 558.07           | 578.11            |
| Crude fat, g       | 405      |                               | 413.54      | 420.14           | 429.96            |
| Calcium, g         | 31       |                               | 69.73       | 71.26            | 72.23             |
| Phosphorous, g     | 21       |                               | 38.34       | 39.05            | 40.23             |
| Sulphur, g         | 18       |                               | 28.8        | 29.17            | 30.75             |
| Ferrum, mg         | 675      |                               | 795.12      | 805.05           | 820.56            |
The analysis of the animal diets showed that the content of the main nutrients, as well as the metabolic energy, meet the requirements of the standards of feeding cattle [8, 9]. In terms of mineral substances, a number of indicators show a shortage of elements such as cobalt, iodine, etc., that is typical for a biogeochemical province.

The inclusion of complex feed additives from local natural raw materials in the feed rations of culled livestock affected the live weight indicators (Table 3).

**Table 3.** Change in live weight of culled livestock (M±m, n=10), kg.

| Indicators                  | Groups                        |
|-----------------------------|-------------------------------|
|                             | I - control                  | II - experimental | III - experimental |
| Beginning of fattening      | 467.8±1.41                   | 466.4±1.66       | 464.2±0.99         |
| End of fattening            | 495.0±2.10                   | 502.8±1.82*     | 496.3±2.33         |
| Live weight gain per experience | 27.2±1.80                  | 36.4±2.57*      | 32.1±2.45          |
| Average daily growth, g     | 453.3±30.00                  | 606.67±42.76*   | 535.00±40.78       |

*Note: *P > 0.95

During the experiment, the animals of the control group had a live weight of 495 kg with an increase of 453.33 g per day, while in the II experimental group these indicators were different and amounted to 502.8 kg of live weight with an average daily growth of 606.67 g, the intermediate position was occupied by animals from the III experimental group who received 496.3 kg of live weight with an increase of 535 g per day.

Thus, the inclusion of complex feed additives in the diets of culled cattle allowed to increase the live weight by 1.58% (P>0.95) and 0.26%, respectively.

In order to determine the effect of complex feed additives on the physiological state of experimental animals, the main clinical indicators of the body were studied (Table 4).

**Table 4.** Main clinical indicators of culled cattle (M±m).

| Indicators                  | Standard                   | Groups                        |
|-----------------------------|----------------------------|-------------------------------|
|                             |                             | I - control                  | II - experimental | III - experimental |
|                             | at the beginning of experiment |                             |                   |                   |
| Body temperature (°C)       | 37.5-39                    | 38.1±0.38                   | 38.03±0.09       | 37.8±0.17         |
| Heart rate (1 min)          | 50-80                      | 65.33±6.44                  | 64.67±6.49       | 66±4.73           |
| Respiratory rate (1 min)    | 15-30                      | 18.67±1.2                   | 19±0.58          | 19.67±0.67        |
|                             | at the end of experiment    |                             |                   |                   |
| Body temperature (°C)       | 37.5-39                    | 38.2±0.46                   | 38.37±0.32       | 38.17±0.15        |
The inclusion of feed additives in the diets of animals affected the consumer qualities of meat such as tenderness, succulence, taste, smell and color. High scores were given to the samples of boiled meat of the experimental groups. At the same time, the best results were characterized by samples of the II experimental group, which surpassed the control group in these indicators by 14.29%, 13.64%, 9.14%, 9.57%, 18.28% and an average score of 12.92%.

Intermediate estimates were obtained in the samples of the experimental group III, which exceeded the control group in the above mentioned indicators by 9.57%, 9.14%, 4.64%, 4.71%, 13.64%, in the average estimate of 8.33%.

Analysis of the data of clinical parameters of the body of experimental animals showed that there was no significant difference between the groups. At the same time, all the clinical parameters of the animals did not go beyond the established physiological norms. In turn, this proves that experimental complex feed additives do not have a negative effect on the animal body and contribute to increasing meat productivity.

Thus, experimental mineral, organomineral and complex feed additives in cattle feeding showed effectiveness in increasing their productivity, contributing to the better realization of the genetic potential of animals.

To determine the effectiveness of complex feed additives from local natural raw materials on the indicators of meat productivity of animals, at the end of the experiment, a control slaughter of 3 heads from each group was performed. The data of the control slaughter of animals are presented in Table 5.

### Table 5. Indicators of culled cattle slaughter, (M±m).

| Indicators                    | Groups       |
|------------------------------|--------------|
|                              | I - control  | II - experimental | III - experimental |
| Pre-slaughter live weight, kg | 497.33±1.86  | 503.67±2.4        | 499.2±2.65         |
| Mass of steam carcass, kg    | 277.33±2.03  | 292.67±6.17*      | 287.33±2.6*        |
| Mass of visceral fat, kg     | 13.53±0.5    | 14.8±0.55         | 13.77±0.18         |
| Slaughter weight, kg         | 289.87±2.53  | 307.47±6.7        | 301.1±2.66*        |
| Yield of carcass, %          | 55.76±0.22   | 58.1±0.95*        | 57.58±0.24**       |
| Yield of fat, %              | 2.52±0.09    | 2.94±0.1*         | 2.76±0.03          |
| Slaughter yield, %           | 58.28±0.3    | 61.04±1.04*       | 60.34±0.23**       |

Note: *P>0.95; **P>0.99

Analysis of the data of the control slaughter of animals showed that the young bulls of the control group were inferior to the animals from the II and III experimental groups in terms of pre-slaughter weight by 1.27% and 0.34%, in terms of the mass of the steam carcass by 5.53% (P>0.95) and 3.61% (P>0.95), in terms of the mass of visceral fat by 9.39% and 1.77%. Therefore, the animals of the experimental groups had a slaughter weight greater than that of the control group by 6.07% and 3.87% (P>0.95).

The yield of carcass and fat differed by groups and was in the control group 55.76% and 2.52%, in the II experimental group – 58.1% and 2.94%, and the III experimental group – 57.58% and 2.76%.

Slaughter yield in the control group averaged 58.28%, which is less than the average of the animals II and III experimental groups at 2.76% (P>0.95) and 2.06% (P>0.99).

Thus, the use of complex feed additives from local natural raw materials in the feeding of culled cattle on fattening showed effectiveness and had a positive impact on meat productivity.

To determine the quality of meat products, we conducted a tasting evaluation of meat with different processing (roasted and boiled meat, as well as broth) in accordance with the method [7] on a 9-point scale. When evaluating roasted and boiled meat, differences were found by groups.

The inclusion of feed additives in the diets of animals affected the consumer qualities of meat such as tenderness, succulence, taste, smell and color. High scores were given to the samples of boiled meat of the experimental groups. At the same time, the best results were characterized by samples of the II experimental group, which surpassed the control group in these indicators by 14.29%, 13.64%, 9.14%, 9.57%, 18.28% and an average score of 12.92%.

Intermediate estimates were obtained in the samples of the experimental group III, which exceeded the control group in the above mentioned indicators by 9.57%, 9.14%, 4.64%, 4.71%, 13.64%, in the average estimate of 8.33%.
The evaluation of roasted meat also confirmed the trend of superiority of the experimental groups over the control group. The best ratings were received by the samples of the II experimental group, which surpassed the control group in tenderness by 19%, succulence by 9.14%, taste by 8.6%, smell by 18.28%, and color by 4.64% and average rating by 11.87%. The second best result was in the III experimental group, which, according to these indicators, were higher than the control group by 14.29%, 4.64%, 4.3%, 13.23%, 4.64% and an average score of 8.19%.

The organoleptic evaluation of the broth was performed. At the same time, it was found that the samples of the II and III experimental groups were characterized by relatively better parameters in terms of smell, taste and richness.

At the same time, the relationship between appearance and richness was established. According to the average assessment of the broth in the control group was 7.42 points against the indicators of the II experimental group – 8.08 points, in the III experimental group – 7.75 points. It is established that the use of complex feed additives from local natural resources in the feeding of fattened cattle contributes to the improvement of the consumer qualities of meat.

Consequently, the use of complex feed additives from local natural resources in the feeding of fattened cattle contributes to the improvement of the consumer qualities of meat.

4. Summary
The inclusion of complex feed additives from local natural raw materials in the diets of culled cattle on fattening allowed to increase the live weight to 502.8 and 496.3 kg, the average daily growth in live weight to 606.67 and 535 g. Animal slaughter data indicate the effectiveness of feed additives in feeding livestock on fattening. In the experimental groups, the meat productivity was higher compared to the control group in terms of pre-slaughter weight by 1.27% and 0.34%, in terms of the mass of the steam carcass by 5.53% (P>0.95) and 3.61% (P>0.95), in terms of the slaughter weight by 6.07% and 3.87% (P>0.95). The yield of carcass and fat in the II experimental group was 58.1% and 2.94%, and in the III experimental group was 57.58% and 2.76%. The slaughter yield in the II and III experimental groups is higher compared to the control group by 2.76% (P>0.95) and 2.06% (P>0.99).

Organoleptic parameters of meat products were studied, it was found that according to the average assessment of boiled meat, the control group was inferior to the II and III experimental groups by 12.92% and 8.33%. According to the average scores of roasted meat, the experimental groups II and III exceeded the control group by 11.87% and 8.19%.

Thus, the conducted studies showed the effectiveness of complex feed additives from local natural raw materials in feeding culled cattle on fattening in the conditions of Yakutia.

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