Feeding farm animals based on the new innovative total mixed ration (TMR) technology

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Abstract. The main part of the meat products produced in the country is beef. Currently, the number of cattle is over 12 million, of which 94% are livestock, and 90% are meat products. The efficient use of livestock feed plays an important role in improving digestion and increasing productivity. Feeding the animals with Korean total mixed ration (TMR) technology leads to improved feed efficiency and, at the same time, increased productivity. In this regard, research work on the application and implementation of TMR technology in farms of the population of Uzbekistan for cattle is relevant. This article presents the results of studies of feeding using Korean technology in households.

1. Introduction
Adequate feeding of farm animals is one of the main factors in increasing the productivity of animal husbandry. The meat productivity of farm animals varies depending on their breed, sex, age and genetic characteristics, and most importantly - on the feeding rate. When assessing the quality of meat, the ratio of muscle and adipose tissue is assessed. The protein content of beef ranges from 15.75% to 24.8%, and the quality of the meat is determined by the ratio of the amino acid tryptophan to the amino acid hydroxyproline. The less hydroxyproline in meat, the better the quality of the meat. When the ratio of tryptophan and hydroxyproline is 4.5-5.0, the meat is considered to be of high quality [1-3].

The tenderness and pleasant taste of meat is determined by the amount of fat accumulated in the range of muscle tissue [4, 5], the percentage of adipose tissue in meat can be up to 10-45%, depending on the age, sex and feeding rate of the animal. Another key metric is the meat to bone ratio. As the age and fatness of cattle increases, the percentage of bones in meat decreases and averages 4:1, the calorie content of 1 kg of meat depends on the protein content of the meat, especially the fat between the muscles [6]. The average calorie content of 1 kg of meat is 1230 kcal, and the average calorie content is 2880 kcal.

The bulk of the mixed feed produced in the country is wheat bran, the nutritional value of which is much lower than that of cotton, soybeans, sunflower meal and corn, wheat, barley grains, the bulk of which is indigestible fiber.

In this regard, the development of the most optimal and affordable methods of production of beef in farms and households is one of the main challenges facing the industry. To this end, scientific work is being carried out on the application of Korean technology in cooperation with the KOPIA center for...
the development of intensive feeding technology using cheap feeds enriched with protein, vitamins and minerals, as well as chopped juicy and roughage feeds mixed with compound feed. In 2015-2017, the Research Institute of Livestock and Poultry, in cooperation with the Korean KOPIA Center in Uzbekistan, conducted a study on feeding and fattening young cattle using Korean TMR technology. According to research, gobbies raised using Korean technology had a higher live weight, as well as a higher quality of meat. Therefore, taking into account the fact that the bulk of the livestock now falls on the population, in the period 2018-2020, work is underway to introduce this technology at home. According to Nasyrov (2011) [7] and Bulyshev (1990) [8], the growth of calves slows down with age. Consequently, the amount of feed consumed per 1 kg of added weight also increases. For example, calves at the age of 1-3 months consume 3-4 kg of feed for a gain of 1 kg, for 6-month-old calves, 3.5-4 kg of feed are consumed for each kilogram of weight gain, and at the age of 12-18 months, 8-10 kg of feed. According to Ashirov (1994) [9], Watter (2009) [10], and Kuhn et al. (2013) [11], the shorter the period of adaptation of animals to the type of feeding during the year, the more stable the assimilation of nutrients. This is because the nutrients that enter the animal's stomach and the enzymes that are produced in the stomach to digest food will also be constant. Scientist, Nasyrov (2011) [7], who created an advanced school in the republic for the production of high-quality and cheap beef, came to the conclusion that when sowing alfalfa and catch crops in saline areas after cotton, salinization is prevented, and the amount of humus in the soil increases by 0.39%, the level of phosphorus and potassium decreases to 3.7, 14.5 and 46 mg/kg, respectively. When organizing a crop rotation system for cotton and wheat, with subsequent transplants of mung bean, beans, alfalfa, intermediate forage crops and corn, an increase in humus in the soil is observed. According to Mukhammadiev et al. (2014) [12], an experimental version of wheat straw silage fermented with Aspergillus terreus Uz CF-74 for 20 days contained 25.6% fiber, 33.6% fiber in the control, the protein content in the experiment was - 8.8%, in the control - 3.2%, the amount of pH in the experiment - 4.5%, in the control - 5.8%. The expected productivity can be achieved by satisfying the need for protein in animal feeding. To do this, you can use protein-rich foods such as soybean meal, sunflower meal, fish meal, meat and bone meal, cotton meal, feed yeast, and artificial proteins to replenish the protein the animal needs.

2. Research Methodology
The main goal of the study is the effective use of feed, strengthening the fodder base, increasing the meat productivity of local livestock, organizing work on the production of high-quality and export-oriented meat on a scientific basis, increasing the income of the population and creating a meat breed in the republic. In 2018, research work began in the Republic of Karakalpakstan, Khorezm, Navoi, Bukhara, Tashkent, Fergana regions. Also in 2019, research work began in Surkhandarya, Kashkadarya, Syrdarya, Jizzakh, Namangan, Samarkand and Andijan regions. 30 households in each oblast were given 3 heads of young animals, one grass chopper, tanks for mixing feed and corresponding concentrates, and feeding the animals according to Korean TMR technology was established. Within the framework of the project, 1,170 heads of young cattle were transferred to 390 households in 13 regions, which will be fed for 20 months. The rations were developed in accordance with Korean feeding standards, taking into account the age, body weight and sex of the young cattle. In addition, high quality corn and triticale seeds are delivered to each household for cultivation, and advice on cultivation methods is provided. The main objectives of the study are:
- organization of the use of Korean TMR technology when feeding young cattle at home;
- preparation of cattle for fattening using TMR technology;
- increasing meat productivity and improving the quality of cattle meat using TMR technology in households;
- development of quality standards for meat of cattle raised using TMR technology;
- creation of the foundations for the creation of beef cattle breeds in Uzbekistan using local cattle breeds, which will serve for the production of quality meat;
- Organization of the cultivation of triticale and corn at home;
- to increase the incomes of the population due to cattle feeding using TMR technology;
- organization of seminars and trainings in each region in cooperation with Korean scientists;
- to identify the most advanced households in feeding Korean cattle and recommend them to travel to the Republic of Korea to improve their qualifications.

3. Results and Discussion

For the research, 3 heads of experimental animals were purchased for 30 households in all regions of the republic (Table 1).

In 2018, studies were carried out in 2 districts of the Republic of Karakalpakstan: i.e. in 20 households of the Khojaili region, in 10 households in the Beruni region, 30 households in the Yangiari region of the Khorezm region, 30 households in the Karmana region of the Navoi region, in 30 households in the Furgat region of the Fergana region, in 30 households in the Yuki chirkich, Kuyichirkich, Tashkent, Yangiyul region and in 30 households of the Alat district of the Bukhara region, each of which was selected young cattle aged from 3 to 6 months.

When choosing households, they turned to the district and chose the area with the best livestock. On the recommendation of the regional khokimiyat, livestock buildings were identified and studied in turn. Agreements were signed with each selected household in cooperation with the institute and the KOPIA center. According to the terms of the contract, the selected household must have conditions for breeding cattle, the homeowner must have the skills and interest in animal husbandry, have land for planting corn and triticale, provide experimental livestock with grass feed, share information with the information received, adhere to the specified technologies, etc.

| Region                  | Number of households | Number of heads transferred to households | Total number of goals |
|-------------------------|----------------------|------------------------------------------|-----------------------|
| **2018 year**           |                      |                                          |                       |
| Republic of Karakalpakstan | 30                   | 3                                        | 90                    |
| Navoi region            | 30                   | 3                                        | 90                    |
| Tashkent region         | 30                   | 3                                        | 90                    |
| Fergana region          | 30                   | 3                                        | 90                    |
| Khorezm region          | 30                   | 3                                        | 90                    |
| Bukhara region          | 30                   | 3                                        | 90                    |
| **2019 year**           |                      |                                          |                       |
| Andijan region          | 30                   | 3                                        | 90                    |
| Samarkand region        | 30                   | 3                                        | 90                    |
| Kashkadarya region      | 30                   | 3                                        | 90                    |
| Namangan region         | 30                   | 3                                        | 90                    |
| Jizakh region           | 30                   | 3                                        | 90                    |
| Surkhandarya region     | 30                   | 3                                        | 90                    |
| Sirdarya region         | 30                   | 3                                        | 90                    |
| **Total:**              | **390**              | **3**                                    | **1170**              |

In households, the main dimensions of young cattle were taken into account (height at the withers, oblique body length, chest circumference). After 6 months of experiments, the highest live weight in animals was observed in the Fergana region. Their average live weight was 188.2 kg, and the average live weight for the project was 177.9 kg. When analyzing the increase in live weight by region for 6 months.
As a result of the analysis of the increase in live weight of animals during 6 months in animal households of the Republic of Karakalpakstan, an average of 74.7 kg, and the daily gain of 416 g, while the average daily gain of calves in the farms of the Khorezm region was 83.5 kg, and the daily gain - 463 g, in the Navoi region the average daily gain of calves was 87.7 kg, the daily gain of 486 g, the average daily gain of calves in the farms of the Fergana region is 96.4 kg, the daily gain of 533 g, in the farms of the Tashkent region this figure was respectively 97.3 kg. and 540 BC.

The following types of feed were used for feeding cattle (Table 2).

| Feed type                          | Water (%) | Protein (%) | Fat, EE (%) | Ca (%) |
|------------------------------------|-----------|-------------|-------------|--------|
| Kontskorma                         | 10.30     | 35.66       | 0.88        | 5.73   |
| Meal                               | 10.89     | 16.07       | 1.29        | 13.82  |
| Wheat cake                         | 12.41     | 14.77       | 3.88        | 4.67   |
| Wheat stillage                     | 11.71     | 11.35       | 1.53        | 1.58   |
| Corn                               | 13.68     | 7.35        | 3.48        | 1.16   |
| Corn grain                         | 13.09     | 7.38        | 3.28        | 1.33   |
| Rice cake                          | 11.81     | 13.59       | 16.95       | 8.09   |
| Roughage                           | N/A       | N/A         | N/A         | N/A    |
| Rice straw                         | 14.47     | 5.41        | 1.24        | 10.49  |
| Rice straw haylage                 | 39.14     | 2.54        | 0.64        | 7.36   |
| Alfalfa                            | 10.89     | 16.07       | 1.29        | 13.82  |
| Wheat stalks                       | 8.97      | 3.89        | 1.05        | 6.16   |
| Corn stalks                        | 10.69     | 4.35        | 1.29        | 13.82  |
| Sudanese grass (during flowering)  | 73.97     | 1.85        | 1.17        | 2.35   |
| Sudanese grass (cob)               | 83.77     | 1.39        | 0.26        | 1.47   |
| Sorghum Sudanese grass (during flowering) | 60.00 | 2.89        | 1.29        | 3.35   |
| Sorghum, Sudanese herb (cob)       | 60.00     | 4.02        | 1.29        | 3.35   |
| Food leftovers                      | N/A       | N/A         | N/A         | N/A    |
| Leftovers of bread                 | 35.03     | 9.64        | 4.53        | 2.16   |
| Apples (barda)                     | 11.30     | 15.26       | 2.01        | 10.01  |
| Starch flour (potatoes)            | 12.71     | 1.64        | 0.34        | 1.01   |

Feeding young cattle using TMR technology, in comparison with traditional feeding, led to their rapid growth. According to the analysis of feed consumption per 1 kg of live weight gain of young cattle in the Republic of Karakalpakstan, 7.2 feed units were consumed, 6.5 feed units in Khorezm region, 6.1 feed units in Navoi region, 5.6 feed units in Fergana and 5.5 feed units in Tashkent regions. This testifies to the effective use of feed when feeding young cattle.

When studying the meat productivity of cattle raised using Korean technology for 20 months, a bull with an average live weight was selected, whose meat yield was 421 kg, slaughter yield was 55%. A comparative study of the cross-section of the 11th and 12th ribs using the Korean technology and the cross-section of the 5th and 6th ribs using the Japanese technology revealed the formation of fat between the muscle fibers, that is, the formation of marble pulp.

The study also analyzed economic indicators (Table 3). Thus, the table shows that the profit from raising cattle using local technology amounted to 47,426 thousand soums, according to Korean technology - 75,878 thousand soums, the profitability of local technology - 30.2%, Korean technology - 45.9%. When feeding according to Korean technology, the resource saving coefficient was 1.05.

Thus, from the data of the diagram, it can be seen that the profit received using local technology amounted to 204,300 thousand soums, general expenses - 156,874 thousand soums, net profit - 47,426 thousand soums. The profit received from feeding according to the Korean technology amounted to
240,906 thousand soums, general expenses - 165,028 thousand soums, net profit - 75,878 thousand soums.

| Table 3. Economic assessment of indicators of TMR technology |
|-----------------|-----------------|-----------------|-----------------|
| Indicators      | Unit of measure | Local thousand soums | Korean thousand soums |
| Profit          | thousand soums  | 204300           | 240906           |
| General expenses| thousand soums  | 156874           | 165028           |
| Income          | thousand soums  | 47426            | 75878            |
| Economic efficiency | thousand soums  |                  | 28452            |
| Profitability   | %               | 30.2             | 45.9             |
| Resource saving ratio |                |                  | 1.05             |

A cost-benefit analysis of local and Korean feeding techniques is shown in the diagram below.

**Figure 1.** Cost-effective feeding based on Korean technology

4. Conclusions
So, according to the research results, it was found that feeding using the Korean technology is effective. When feeding cattle using the new Korean technology, the profitability was 45.9%, and the resource saving factor was 1.05.
Currently, the institute is working on breeding breeding bulls for selection work, selected as a result of selection from local cattle. These bulls will be used to create meat breeds of animals in the future and provide quality meat to the population.

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