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Evaluation Of Youngstock Fatness Of Beef Breeds And Its Interrelation With Live Weight And Productivity.

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ABSTRACT

It is not enough to have high productive animals and sufficient quantity of high quality feed stuff for effective beef production. In the production of meat, the primary objective is the proper management of their effective use. Animals in production teams have different body weight, and the rate of feeding of beef-producing animals is calculated, mainly, taking into account their live weight. This is a wrong-headed approach because animals in a group can have the same body weight and have different energy need depending on the fatness status. In other words, the rate of animals feeding should vary not only depending on the body weight, but also taking into account the fatness status of animals. The regrouping of animals, depending on the fatness, becomes a necessary technique in the beef production technological process. This will allow saving expensive feeding stuff, because in the beef cost structure a large share of the cost is accounted for by feed stuff (about 60%). The purpose of the research is to determine the relationship between the body weight and appraisal by points of the fatness of young stock; to determine how much the body weight changes when the fatness changes by 1 point, and to adjust the feeding rates, depending on the fatness status of the animals. Studies were conducted on the young stock of Hereford and Kazakh White-headed cattle. In order to conduct the research, the method of correlation, regression and statistical analysis was used. In the course of the research, it was determined that there is a high positive relationship between the body weight and the animal fatness appraisal by points (r = 0.74 - 0.76 for Hereford and r = 0.81 - 0.79 for Kazakh White-headed cattle). This allowed us to determine the regression coefficients between the signs. It has been established that an increase in fatness by 1 point increases the live weight of young growth of Hereford cattle by 26.1 - 26.7 kg, and in calves of Kazakh White-headed breed by 28.9 - 32.2 kg, which made it possible to determine the necessary changes in the nutritional level upwards for the young growth of Hereford with a fatness of 1 point by 2.45 and 2.67; 2 points by 1.84 and 2.00; 3 points by 1.22 and - 1.33; 4 points by 0.61 – 0.67 EFU [Energetic Feed Unit], respectively, for heifer calves and male calves. For the young growth of Kazakh White-headed cattle these values were: 2.56 and 2.84; 1.92 and 2.13; 1.28 and 1.42; 0.64 and 0.71 EFU. So, the studies show that monitoring the fatness status of the young stock, dividing the animals into groups with different nutritional status and feeding arrangement, depending on the fatness status, are the necessary techniques for economic efficiency achieving in young-stock breeding.

Keywords: Beef cattle breeding, young stock; Kazakh White-headed and Hereford breeds; body condition score; live [body] weight; nutritional level.

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INTRODUCTION

It is impossible to consciously control the growth and development of animals and to derive maximum benefit from their breeding without knowledge of the nature of development and growth of the organism.

The management of the herd, which is the unifying factor in the organization of production, is responsible for managing the growth and development of the organism; the correct and prompt solving of management issues on the farm ensures successful production and achievement of high economic indicators. The poor development of herd management has become the main cause of the economic failures of many meat farms. In Russia GOST «Sloughter cattle. Determination of fatness» is used for determination of fatness of livestock. It is used in order to determine the fatness of livestock when animals are handed over to the meat-packing plant, when it is already impossible to undertake something for improvement of fatness of the cattle. The fatness should be defined directly during the fattening period, and on its basis, if necessary, a quick decision for feeding improvement should be taken.

For effective management of herd, it is necessary to have a reliable tool for assessing the fatness of beef cattle, which would allow to take rapid decisions on changes in the livestock feeding program [1, 2]. All rates of feeding of young growth are developed depending on the live weight and productivity. Such a tool can be a score of the fatness of young growth, which is closely related to body weight and productivity. We used a 5-point fatness assessment system to assess the fatness of the young stock, although many researchers suggest using a 9-point system [3, 4, 5, 6].

In our opinion, for evaluation of fatness of beef cows, a 9-point rating system should be used, and a 5-point evaluation system is sufficient to assess the fatness of the young stock. For justification of approach to the solution of the problem, we have defined the correlation coefficients between the scores of young animals' fatness, the live weight and the productivity of the young stock. Having discovered a high positive rectilinear connection between these signs, the coefficients of regression between the live mass, productivity and fatness of the young were determined.

Animals with unequal heredity and specific features, strict selection by age, live weight and fatness, respond differently to the conditions of feeding, maintenance and exploitation. This is due to the different genetic potential caused by various heredity of the organism. Despite the careful selection of animals into groups by age, weight and fatness, each individual, due to unequal heredity and individual characteristics, will react differently to the conditions of feeding and maintenance. However much the breeders try to create the same conditions for all animals, they will differ in rate of growth among themselves. Our research, conducted earlier on beef cows, showed that the duration of pregnancy of the early maturing Angus breed was 272-273 days, while in the Limousine breed, as a longer growing breed, the period of intrauterine development was 278-280 days, and within the groups the difference in the birth dates of calves reached up to 29 days. This example shows that even during intrauterine development, animals differ in growth rate [2].

Young growth with low growing power, at the age of 15-20 months, lags 28-31% behind its peers in live weight. Such animals in the group usually have 4-8% of the number of all animals. Growing laggards in the growth of animals leads to an overexpenditure of feed stuff, to decrease in the intensity of growth of other animals, increase in feed costs per unit of output and a rise in the cost of production and, as a consequence, to decrease in the economic efficiency of production. Animals lagging behind in growth should be culled the herd during breeding, without waiting for the end of the fattening technological cycle.

Animals in the herd, by virtue of this, will grow with varying intensity, and have different fatness. The fatness of livestock is understood as the reserves of nutrients and energy reserves stored in the body in the form of fat. It depends on many factors: on the level of animals feeding, on age, physiological condition, breed and other factors. Fatness has a great influence on the animal's body weight, the amount of meat content in the carcass of beef, the amount of internal fat and important body functions (reproductive abilities, resistance of the organism and others). Many researchers note that with the increase in the fatness of livestock, the mass of beef carcass, the yield of carcass, the mass and yield of internal fat, the slaughter mass and the slaughter yield increase [2, 7, 8].

J. Whitey, In Stephens V., Weaver D. argue that the mass of cows, without the contents of the

forestomaches, with a fatness of 3 points has a living weight of 382 kg. With an increase in fatness to 9 points, the live weight reached 519 kg, so it increased by 1.36 times. This was due to the increase in fat and its relative percentage [12].

Many researchers argue that the living weight of animals largely depends on the state of fatness of livestock [9, 10, 12]. But, it should be noted that the living mass cannot be the only criterion for evaluation of fatness of the cattle and energy reserves in the animal's body, because the body weight depends on many factors. For example, it depends on the fullness of the tripe, the timing of the pregnancy of the cow. Animals with the same live weight can have different fatness, while animals with the same fatness can have completely different living weight [16].

In his studies Parsons S.F. shows the dependence of the fatness of the animal on the subcutaneous fat thickness [12].

The criterion for assigning an animal to one or another category of livestock fatness is the level of development of muscle tissue and the amount of deferred subcutaneous fat. Calves up to three months old have a small number of fat cells. With age, their number increases, and they form solid fat accumulations.

In the earliest stages, fat is only part of the muscles and is not stored as a separate tissue. Fatty tissue is deposited with age on the kidneys and in the omentum. Subsequently, lipid tissue begins to occupy a place among the muscle fibers. Storing fat between the muscle fibers shows the "Intramuscular Fat". In fast-growing breeds of beef-producing animals, intermuscular fat is deposited more than in dairy or combined breeds of cattle.

The next stage, depending on the breed, is the accumulation of fat under the skin in a loose connective tissue. It gives the well-fed cattle a rounded shape. The storage of subcutaneous fat in cattle when fattening begins with the hindquarters - from the tail head, tuber of the ischium, knee folds, pelvis, waist, dewlap, etc. [16].

It is known that the amount of muscle fibers is laid in the period of embryonic development, and in the postembryonic period of the animal the increase in the musculature occurs only due to the enlargement of the muscle fibers. Their quantity after birth does not change, they become thicker and longer. In addition, it was found that the diameter of the muscle fibers depends on the state of fatness of cattle. A well-fed one-year-old calf can have the same thickness of muscle fibers with an old, depleted cow. If the conditions of feeding worsen, the diameter of the fibers decreases and in exhausted animals can be restored to normal size provided that the feeding is improved [20].

Insofar as fat tissue is especially critical in the body of animals, the condition of livestock fatness is of great importance for maintaining health, reproductive functions and productivity. In the storing of fat in the body there is a well-known sequence of storages on different anatomical parts. In young animals in the initial fattening period, fat tissue is deposited on the internal organs and between the muscle bundles, then accumulation takes place in the subcutaneous tissue, and at the end of the fattening period in young animals and in older animals, fat is stored in muscle tissue.

With the storage of fat in different anatomical areas there is a certain proportionality. Accumulation of fat in one part is accompanied by an increase in fat in other places. Therefore, the determination of the sequence of adipose tissue deposition provides insight only into the changes in the proportions in certain ratio.

Intermuscular fat is localized in loose connective tissue in the form of accumulations between individual muscles and a group of muscles. Fatty tissue accumulates around large blood vessels and nerves, performing a protective function for them. Intramuscular fat is deposited in separate muscles between the fibers and is included in the structure of the cells. Intramuscular fat loosens the bunches of muscle tissue, and this fat determines the "Marbling" of the beef.

Subcutaneous fat tissue is localized in large amount around the tail head, on mammals, tubers of the ischium, coupling, sides along the ribs, behind the shoulder blades, in the groin area, on the sternum. Sometimes the deposition of fat reaches a thickness of 4-6 cm or more. Between the time of deposition of lipid

tissue and the development of the body there is a direct link. Knowledge of such regularities made it possible to develop a system of scoring of the fatness of cattle. Fat deposition prevails in those areas where there is intensive growth in the period after birth [20].

Our research prove the need to use of coefficients of correlation and regression between live weight, productivity and a system of scoring the nutritional status of young beef cattle to adjust the level of feeding in order to achieve the desired fatness and fodder saving.

The studies were conducted by the order of the Ministry of Agriculture of Russia at the expense of the federal budget in 2016 as part of the research work of the Federal State Budgetary Educational Institution of Higher Education "Samara State Agricultural Academy" "Development of practical guidance for the scoring of the fatness of beef cattle and its application in herd management."

The purpose of this work is to establish the relationship between the scores of the young animals' fatness with the body weight and the regression coefficient, followed by the use of regression coefficients for modification of the feeding program of the young growth.

In the course of the studies, the relationship between the scoring of fatness and the live weight of young animals of different breeds was first revealed, which allowed to define the regression coefficients and to calculate the changes in the feeding level of the young to achieve the desired live weight and fatness during feeding.

MATERIAL AND METHODS

The material for the study was the young stock at the age of 7 months. The studies were conducted during the annual integrated assessment of beef cattle (appraisement) in 2016 in the Samara region. The target of the research was the relationship between the scores of fatness and live weight and the productivity of young beef cattle.

For justification of use of scoring of fatness for a herd management, the relationship (correlation coefficient and regression coefficient) between the body weight, the average daily weight gain, and the fatness of the young were determined. The correlation coefficient was calculated as a phenotypic correlation for a large sample. The regression coefficient was determined as the product of the correlation coefficient by the quotient of dividing the standard deviation of one characteristic by the standard deviation of another characteristic. For the experiment, four groups of animals were formed consisted from 66 calf and 44 bulls from Hereford breed, 32 calves and 50 bulls of Kazakh White-headed breed. The fatness of livestock was determined by visual inspection of animals and by probing on a 5-point scale for assessing the fatness of young beef cattle.

Biometric data processing was carried out according to the method generally accepted in animal science.

RESULTS OF RESEARCHES AND THEIR DISCUSSION

During the experiments the correlation and regression coefficients were determined between the live weight of young growth, the average daily gain and fatness of young animals estimated in points. For the determination of the regression coefficient, the correlation coefficient was used, the correlation determinations were the variability of each trait under study.

Body weight, a score of fatness, the productivity of the young and their variability were determined with regard to the sex of the animals.

According to the body weight, the bulls of the Kazakh White-headed breed surpassed their Hereford peers by 16.7 kg, (7.96%) and calves - by 9.8 kg (4.85%). The greatest variability of body weight was observed in the group of bulls of Hereford breed - 12.0%, in bulls of Kazakh White-headed breed - 11.8% (Table 1).

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Among the heifers of the Kazakh White-headed breed, the coefficient of variability was greater. This indicates that the Kazakh White-headed breed is less consolidated by the traits under study.

The bulls were the most well-fed, they had the same fatness in both breeds - 4.5 points, with the same coefficient of variability, while the fatness of the heifers was slightly lower, 4.2 and 4.1 points, respectively. Variability in the group of Kazakh White-headed breed was higher than that of Hereford breed by 1.1%.

Table 1 - Variability of live weight and fatness of young growth

Indicator	Breed			
	Hereford		Kazakh White-headed	
	bull-calves	heifers	bull-calves	heifers
Live weight (M), kg	210,0	202,0	226,7	211,8
Mean square deviation (σ), kg	25,2	20,2	27,1	22,8
Coefficient of variability (C_v), %	12,0	10,0	11,8	10,8
Mean arithmetic error, kg	4,40	3,40	4,90	4,90
Fatness score	4,5	4,2	4,5	4,1
Mean square deviation (σ), point	0,51	0,30	0,50	0,44
Coefficient of variability (C_v), %	11,6	9,8	11,6	10,7
Error of the arithmetic mean, score	0,11	0,09	0,10	0,14

A study of the coefficient of correlation and regression between livestock and live weight of young growth showed a high degree of rectilinear interdependence of signs (Table 2).

In all cases, the correlation coefficient was high, positive and rectilinear, within the limits of 0.74 to 0.81. This is the reason to use them when determining the regression coefficient. It is established that when the fatness of animals changes by one point their living weight changes by 26.1 - 32.2 kg.

Knowing how much energy feed units are needed per kilogram of growth of body weight, it is possible to calculate and make adjustments to the feeding program of young animals taking into account their fatness.

Coefficients of correlation and regression had a high degree (P> 0.999) of certainty. In the course of the studies, the level of the young's productivity and the coefficient of correlation and regression between the average daily growth and fatness of cattle were also determined.

Table 2 - Coefficients of correlation and regression between fatness and live weight of young growth

Indicator	Breed			
	Hereford		Kazakh White-headed	
	bull-calves	heifers	bull-calves	heifers
Correlation coefficient (r)	0,74	0,76	0,81	0,79
The regression coefficient (R)	26,7	26,1	32,2	28,9
Reliability of correlation coefficient (td)	0,999	0,999	0,999	0,999
Reliability of regression coefficient (td)	0,999	0,999	0,999	0,999

Analysis of the productivity indicators of young growth (Table 3) demonstrates that they were not high enough in both groups. This can be explained by the fact that the young stock was grown in the summer without feeding with concentrated fodder. The bulls of the Kazakh White-headed breed differed by the

highest productivity among young stock - 858.5 g, which is 7.7 g more than in bulls of Herefords with an unreliable difference in the indexes taken into account (P <0,95).

Table 3 - Average daily weight gains and their variability

Indicator	Breed			
	Hereford		Kazakh White-headed	
	bull-calves	heifers	bull-calves	heifers
Average daily weight gain, g	850,8	791,8	858,5	767,7
Standard deviation (σ), g	112,3	83,9	117,6	96,7
Coefficient of variability (C_v), %	13,2	10,6	13,7	12,6
Error of the arithmetic mean, g	17,7	16,1	17,1	20,0

Among the heifer calves, the productivity was higher for the representatives of Hereford breed - 791.8 grams, which is more than for their contemporaries of Kazakh White-headed breed by 24.1 (3.14%). According to the magnitude of the sign, the mean square deviations of the indicator in the groups are also different.

The coefficient of variability was in the range from 10.6 to 13.7%, with slight variations in the breed and sex of animals.

The coefficient of correlation and regression between the average daily gain and fatness of the young growth, determined by a 5-point scale is presented (Table 4).

The coefficient of correlation between the productivity of young stock and the scoring of fatness was high in all groups, was positive in a straightforward manner. It is important to note that among the Hereford young growth, both among bull-calves and heifers, the correlation coefficient made 0.86. The same correlation coefficient (0.78) was also found in young Kazakh White-headed breed.

The regression coefficient has allowed to reveal that change of fatness of young stock by 1 point leads to change in live weight of the bull-calves by 136.8 and 148.4 g per day.

Among heifers, change of fatness of the cattle by 1 point leads to change of live weight by 100.4 and 109.1 g per day (P> 0.999).

Table 4 - Coefficient of correlation and regression between average daily weight gain and fatness of young growth

Indicator	Breed			
	Hereford		Kazakh White-headed	
	bull-calves	heifers	bull-calves	heifers
Correlation coefficient (r)	0,86	0,86	0,78	0,78
The regression coefficient (R)	148,4	100,4	136,8	109,1
Reliability of correlation coefficient (td)	0,999	0,999	0,999	0,999
Reliability of regression coefficient (td)	0,999	0,999	0,999	0,999

Knowing how many kilograms you need for changing the live weight on order to achieve the required fatness, you can determine how much you need for changing the level of animals feeding (Table 5).

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Table 5 - Change of feeding level (rate) of young growth with body weight of 200 kg, EFU

Body condition score, point	Desirable fatness, point	Breed			
		Hereford		Kazakh White-headed	
		bull-calves	heifers	bull-calves	heifers
1	5	rate+2,67	rate+2,45	rate+2,84	rate+2,56
2	5	rate+2,00	rate+1,84	rate+2,13	rate+1,92
3	5	rate+1,33	rate+1,22	rate+1,42	rate+1,28
4	5	rate+0,67	rate+0,61	rate+0,71	rate+0,64
5	5	rate(5,0)	rate(4,7)	rate(5,0)	rate(4,7)

For example, to achieve the desired 5 points, it is necessary to increase the feeding level by 1.33 energy feed units in the bull-calves of Hereford breed, having a fatness of 3 points, and in the heifers - by 1.22 EFU.

CONCLUSION

As can be seen from the above, there is a high, rectilinear positive relationship between the live weight of the young growth, the average daily weight gain, and the grade of fatness. The found coefficients of regression allow to define change of the live weight of young stock when the fatness is changed by 1 point. This is the basis for making adjustments in the feeding program for young stock, which will ensure the desired fatness by the end of fattening and the high economic effect of young stock growing.

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