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THE THEORETICAL AND PRACTICAL FUNDAMENTALS FOR INCREASING THE MEAT PRODUCTIVITY OF HORNED CATTLE.

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THE THEORETICAL AND PRACTICAL FUNDAMENTALS FOR INCREASING THE MEAT PRODUCTIVITY OF HORNED CATTLE.

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The USSR is a vast country with most different climatic conditions which is the reason for the great diversity of the cattle breeds.

The prevailing majority of horned cattle in the USSR is of the dairy and granger's breeds, which stipulates the necessity of alloting a considerable part of research to developing methods of increasing the meat productivity of the granger's, as well as of the dairy breeds.

The role of nutrition has been experimentally proved as a powerful factor for altering the properties of cattle. By means of correct selection of rations for breeding and fattening the percentage of meat on the bones, as well as yield of raw fat increases by 18 to 20% and totals up to 60% and higher. The weight of the carcass simultaneously more than doubles (Rostovtsev, 1958). Intensively grown animals usually provide carcas-

ses with well developed muscles because latter develop during the early period of life and a delay in growth owing to underfeeding during this period causes a reduction in the development of the muscular tissue. In the case of subsequent high-quality feeding a trend is observed to the deposition of fat with a comparatively negligible development of the muscular tissue.

The consumption of nutrients per 1 kg of gain alters, as is known, depending on the age of the animals. The following amount of feed units is used according to the rates adopted in the USSR: at the age from 6 to 12 with a daily gain of 600 g - 9.3 feed units, with a daily gain of 1000g - 7.2 feed units; at the age from 12 to 18 months - 10.6 and 7.8 feed units respectively, with adult animals and with a daily gain of 600g respectively 12.6 feed units, and in the case of an 800g daily gain - 10.5 feed units.

Thus, young animals consume per kg of gain 3.0 - 3.5 feed units less as compared with adult animals. Their meat, as the nutritiousness is concerned, is of higher value as it contains a relatively higher percentage of protein and less fat.

We have studied the growth of young stock of the red steppe breed at the cattle breeding state farm "Lyubomirovka" of the Dnepropetrovsk Region, grown with reduced and optimum rates of feeding, when 870 kg of feed units have been consumed in one group up to the age of 12 months and 1475 kg of feed units in another group per animal (Rostovtsev, 1957). The gain was higher in the second group which was especially noticeable at the age from 6 to 12 months. At the age from 12 to 18 months, when the

animals became older, the gain in this group turned to be lower. This group had the advantage in the development of muscular and bone tissue at the early stages (period of intensive growth) and was inferior at the older age when the intensive deposition of fat commenced. The weight gain higher at this time in the underfed group because the growth of muscles and skeleton continued in the young stock (as if compensating the former period).

Growth of young stock of red steppe breed under influence of different degree of feeding (cattle breeding state farm "Lyubomirovka", Dnepropetrovsk Region).

Feeding	Live weight, kg				Average daily gain, g		
	At birth	6 months	12 months	18 months	Up to 6 months	From 6 to 18 months	From 12 to 18 months
Optimum	32.4	184.2	301.0	376.0	843	649	417
Reduced	27.7	135.2	165.4	254.0	597	170	492

At optimum feeding the young stock was prepared for slaughtering earlier and at the age of 18 months could be delivered for meat supplies with a weight of 370 - 380kg.

Our investigations have determined vast possibilities for improving the performance and developing home meat breeds by means of intensive feeding of the animals from their birth. The Kostroma breed may serve as an illustration. The high properties of this cattle after slaughter are illustrated by the results

of fattening two-year old gelders (cattle breeding state farm "Karavayevo") and slaughtering them on reaching a live weight of 549 kg. The dressing percentage yielded 58.8%, including meat on bones - 53.9%. The carcass contained 74.5% of meat, 4.8% of fat and 17.3% of bones. Heavy hides have been received with a weight of 47.60 kg.

According to the data of soviet scientists, namely: Charvinsky and Maligonov, the organs and tissues grow most intensively during the period of insufficient feeding suffer most of all owing to underfeeding. Investigations at the Karaganda agricultural experimental station have confirmed the reverse dependence, namely: under favourable conditions of feeding the organs and tissues, which grow most intensively during this period, develop most advantageously (Lanina, 1959).

Fattening as a means for increasing the meat productivity of horned cattle.

The meat of horned cattle is widely used in the nutrition of human beings. The best grades of beef are distinguished by high caloricity, are rich with easily digestible high value protein, iron, phosphorus.

During the 2.5-3 month period of fattening it is possible to increase the weight of adult cattle by 17 to 20%, to increase the yield of meat and fat by a minimum of 10% and to improve sharply the quality of the product.

Approximate composition of meat of cattle of different nourishing

Nourishing of cattle	Water %	Protein %	Fat %	Per 1 kg of meat kcal
Lean	74.2	20.6	3.5	1200
Moderate	71.0	20.0	8.0	1580
Fat	56.3	18.9	24.5	3070

Intensive growing and fattening of young horned cattle with the expense of 2.5-3 thousand feed units makes it possible to reach a live weight of 430-460 kg at the age of 18-20 months, while some animals reach the weight of more than 450-500 kg.

According to our data, as well as the data of the All-Union Research Institute of Livestock Breeding the young cattle of the Simmenthaler, Swiss, black-particolour and other breeds reached a live weight of 440-500 kg at the age of 18 months and yielded a dressing percentage of 58-63% (meat on bones and fat). Gelded calves crossbreeds of the black-particolour and Kostroma breeds, have been shown at the USSR Exhibition of Achievements of the National Economy in 1959 with the average live weight of 584 kg at the age of 25 months, as well as the Simmenthaler breed with a live weight of 541 kg and Kalmik breed (at the age of 1 year 9 months) with a live weight of 492 kg (Rostovtsev, 1961).

We have carried out an experiment at the state farm "Omsky", "Vrachevo-Gorky" and "Nizhne-Krimsky" in order to determine the effectiveness of winter fattening of young dairy cattle (Ros-

tovtsev, 1951, 1961-c). In the case of winter fattening (92 days) of black-particolour gelded calves at the age of 17-18 months with a ration, consisting of corn silage - 55%, hay and straw - 15%, and concentrated grain feed - 30%, the following high results have beeb obtained: a daily gain of 700-763 g; dressing percentage (meat on bones and fat) - 55%, the meat contained 19-20% of protein and 8-10% of fat.

Simmenthal cattle is characterized by high intensity of growth and rapid fattening. Intensive growing and fattening of young Simmenthal stock has been organized at the cattle breeding state farm "Chervonij Veleten" of the Kharkov Region. At the age of 20-22 months the fattened animals reached an average live weight of 548 kg, i.e. increased their weight by 24.3%. The yield of meat (on bones) and fat on slaughtering the cattle reached 62.3%, including 55.6% of meat. The average weight of fresh hides equalled 41.2 kg. During the first year each calf consumed about 1470.2 feed units with an average daily gain of 871.2 g. Approximately 1913 feed units have been consumed during the second year and up to the age of two years the average daily gain reached 750 g. About 6.6 feed units have been consumed per 1 kg of gain (Rostovtsev, 1960).

Similar results on the yield of meat and fat have been obtained when fattening hybrid three-year old gelders of Simmenthaler breed at the cattle breeding state farm "Lenkuznetsky" of the Kemerovo Region (Rostovtsev, 1957), Grown with a reduced degree of feeding, they increased their weight during the period of fattening by 20.1% and weighed on the average 550 kg. The

dressing percentage (meat on bones and fat) equalled 63.1%.

When slaughtering two-year old gelders of this breed at the USSR Exhibition of Achievements of the National Economy in 1960, the daily gain reached 1431 g at consumption of 5.7 feed units per 1 kg of gain; the meat and fat yield reached 57.7%.

Fattened gelders of the Kurgan breed at the cattle breeding state farm "Kurgansky" of the Kemerovo Region reached a live weight of 525 kg; the dressing percentage totalled to 62.8%, including 54.8% of meat on bones. Heavy hides have been produced with an average weight of 39.4 kg (Rostovtsev, 1958).

Our work on fattening and slaughtering red steppe gelded calves has illustrated that the live weight of young cattle when fattening this specialized dairy breed increases by 21-22%. The gelders weighed 487 kg at the age of 2-2.5 years. The yield of meat and fat reached 62.4%, including 240 kg of meat on bones, i.e. 53.8%, 38.2 kg of raw fat, i.e. 8.6%. The weight of the fresh hide reached 30.6 kg (Rostovtsev, 1961-a).

The problem of the desirable age of the fattened cattle is solved differently, depending on the local conditions, quality of the cattle, trend of economy, provision with fodder. Young cattle at the age of 12-14 months, as well as animals of an older age (20 months) are set up for fattening at zones provided with native ranges and fodder for winter keeping. Specialized fattening economies or inter-collective farm fattening points have been set up in some regions of the country at sugar-refineries, distilleries, ginneries, etc. for more complete utilization of the waste of the food industry during the winter period.

Young cattle better remunerates the fodder by weight gain owing to the fact that they consume more fodder per unit of live weight than adult animals and more nutrients remain for the formation of weight gain after covering the consumption required for vital functions. Beside that, the weight gain in young cattle contains less dry matter and fat than it is in the case with adult animals which results in a lower consumption of fodder per unit of weight gain.

The period of fattening should continue so long as to utilize completely and most effectively the capacity of the animals to develop muscular and fatty tissue with an economic consumption of fodder. Untimely stoppage of fattening is the cause for a considerable loss of meat products. Excessively fat meat is produced with a high expense of nutrients in the case of too lengthy fattening. At the beginning of fattening (during the first decade) the animals rapidly gain weight which is stipulated mainly not by the deposition of meat and fat, but by the filling of the alimentary canal. Then the gain is stabilized, drops by the end of the fattening term and finally stops if the fattening process continues after the optimum term. These changes are due to the fact that at the early stages of fattening some amount of meat rich with water is grown in the organism which considerably increases the weight gain, then the amount of fat steadily increases and less of protein. The fat supplants the water in the muscular tissue. With an increase of the percentage of fat the calloricity of the gain increases with a si-

multaneous step up in the consumption of nutrients per unit of gain.

With correct labour organization, according to our data, 2.5-3 months are required for fattening adult cattle, 3-4 months for 2-3 year old cattle, 6-7 months for one year old stock and 8-9 months for calves. The rates of feeding range from 7.5 to 10.5 feed units depending on the age, live weight and planned gain. Different kinds of local fodder, which are produced at the economy - silo, root crops, hay, straw, waste of the food industry, are usually used during the stabling period. Summer graziery of cattle is widely applied in the Kazakh SSR, Republics of Central Asia and other regions among other ways of fattening. Good provision of pasture fodder in these regions and correct technique of graziery make it possible to provide 80 - - 100 kg of gain with adult cattle, 100-120 kg with young cattle, 130-140 kg with 5-6 month old calves during a grazing period of 110-120 days without any other additional feeding.

Evaluation of meat quality

As is known, it is important to know the content of protein and fat in the meat in order to evaluate the latter. The chemical composition of meat varies greatly depending on the age and nourishing of the animals. It has been mentioned earlier that the percentage of water in the meat reduces with the age and increase of fattiness, but the relative percentage of protein remains quite constant during the entire period of growth. It reduces only with the increase of fattiness and content of fat. When a well nourished calf is slaughtered, more than 30%

of the carcass consists of fat. The content of fat reaches 40% and more in case of excessive fattiness. The content of mineral matter is characterized by negligible changes bound with the age and fattiness. The percentage of mineral matter in the fatty tissue is negligible and the muscular tissue is highly important as the source of some mineral elements. Beef contains more mineral matter as compared with pork and mutton. The following amount of mineral elements is held in muscular tissue according to the results of research carried out at the Institute of Nourishment of the Academy of Medical Sciences of the USSR (Vasilyeva et al, 1962).

Mineral content of different kinds of meat
(milligrampercent)

Meat	Potassium	Calcium	Magnesium	Phosphorus	Iron
Beef	344	17	23	211	2.9
Pork	273	11	21	218	2.2
Mutton	267	13	22	214	2.9

The distribution of fat in the organism is of essential importance for evaluating the meat productivity of cattle. Subcutaneous fat, as compared with internal fat, is characterized by high technological properties, namely: lower melting point and higher iodine number. The animals of meat breeds have an advantage as compared with dairy breeds by the relative distribution of fat: they have more subcutaneous and muscular fat and less internal fat, owing to which the meat obtains marbleness, high ca-

loricity and perfect flavour properties.

Much attention is given abroad, for instance in Great Britain, during evaluation to the colour of the fat. A yellow colour is considered undesirable. The colour of the fat depends on the accumulation of carotenoid colouring agents (carotene) and is highly unsteady. The breed, fattiness and age the most important factors determining the colour of the fat. The fat of dairy cattle is frequently provided with a very intensive yellowish tint. In case of insufficient nourishing, the animals consume the fat of the organism, the colouring agents remain in the tissue and the colour of the latter becomes more intensive. The accumulation of colouring agents and the darkening of the fat take place also with the elapse of time. Feeding is of certain influence. For instance, green fodder increases the pigmentation of the fat.

Well nourished animals provide a better colour of the meat. Some dependence is observed in the content of iron in the ration. The colour of the meat becomes lighter if their is insufficient iron in the fodder. The colour of the meat darkens during the storage period. There are also some sexual differences, especially in old age animals; the meat of bulls is darker. Gelding reduces the difference. The colour of bullock meat is usually lighter. Intensive activity of the muscular tissue of the animal negatively affects the colour of the meat. However, moderate loads, for instance, movement at pastures do not provide any negative affect to the colour of the meat.

Improvement of meat properties by cross-breeding

According to the principles of Michurin biology, crossing

is considered to be a method of altering the nature of plants and animals, a mean for enriching heredity and shattering it. When crossing, one strives to alter the breed in the required way by utilizing the plastic heredity of crossbreeds. Reproductive cross-breeding is applied in the USSR for the production of new breeds. This method has been applied for producing the Kazakh white-head breed in the south-east regions of the country. The best samples of this breed are not inferior by their meat properties to the English meat breeds. The yield of meat and fat in fattened animals reaches 63% and more, the carcass contains up to 84% of meat and fat and only 14-15% of bones (Galiakberov et al, 1952).

Industrial cross-breeding is applied when the aim is to produce animals with improved meat properties. In the Volgograd Region the crossbreeds produced from purebred Aberdeen Angus oxen had an advantage in live weight as compared with the parent Kalmikh breed (Panyushkin, 1958). In some regions cattle is successfully crossbred with the American meat breed Saint--Hertrude. In the Ukraine ("Askaniya-Nova") the cross-breeds of this breed with the red steppe one gained a positive estimation owing to their powerful growth. The live weight of crossed young stock (18 months) was by 19% higher as compared with their coevals of the red steppe breed(Danilenko, 1960). At "Askaniya-Nova" the crosses of the red steppe breed with shorthorns of 18 months weighed 14% heavier than their coevals of the red steppe breed. Heteroiosis has been observed when cross-breeding the Simmenthaler breed with the Hereford one. The crossbreeds

surpassed the Simmithaler breed by the power of growth and their live weight was by 4-10% higher by the age of 18 months. Fattened crossbreeds were distinguished by a higher percentage, better quality of meat, lower weight of bones in the carcass (Levantin, 1952).

Cattle was crossbred at the Ukraine of the gray Ukrainian breed with the Kostroma one (Rostovtsev, 1954). The crossbreeds surpassed the animals of the gray Ukrainian breed by 7% (25kg) in live weight at the age of 18 months, almost by 9% (36 kg) at the age of 2 years. The yield of meat and fat at the age of 18 months was by 6.4% higher, and by 9.8% at the age of 2 years. The carcasses of the crossbreeds held (absolutely and relatively) more meat and less fat. At the age of 2 years they provided up to 300 kg of meat on bones and 35.2 kg of fat, while the animals of the gray Ukrainian breed provided 265 kg and 40.3 respectively. The average weight of fresh hides of this crossbreed was also somewhat hogher.

We have carried out vast research work on studying the cross-breeding of black-particolour cattle with the red Gorbatov breed. The black-particolour breed, as is known, is of Dutch root and quite close by origin and productive properties to the British-friesian cattle in England, Holstein-friesian - in the USA, black-particolour - in German Democratic Republic, Sweden and other countries. Our research made it possible to obtain high weight gains and high yield of meat from cattle of the black-particolour breed under different zone conditions. The feeding was of greatest importance for influencing the re-

lative development of tissues and chemical composition of the meat.

The red Gorbatov breed is one of the home breeds of the granger's trend and is valued for the high fat content of the milk and well developed meat properties. Studies have indicated that the animals of this breed are inclined to utilizing the nutritive matter of the fodder for the formation of fat and adipopexis. The relative development of the internal organs, linked with blood circulation and processes of exchange(heart, liver, kidneys), point out to the fact that these organs are developed relatively better in the animals of the black-particolour breed, the processes of exchange are performed more intensively and the tendency of forming adipopexis is weaker. Consequently, the utilization of the nutritive matter of the fodder by the animals of these two breeds is different.

Beside the results of cross-breeding, we have also studied also the influence of the degree of feeding and some zonal factors. Graziery was carried out in Moscow Region on water meadows in the bottom land of the Oka River (Rostovtsev, 1949-a,b). Beside the pasture, the cattle was treated also with concentrated feed and during a 3-month period of graziery (July-September) about 137 kg of cotton-seed material was fed to each animal. Graziery was combined with subsequent fattening which continued for 54 days (from 1st October up to 23rd November). The daily ration during the period of fattening consisted of 8 kg of hay, 25 kg of silo (meadow grass and sunflower), 2 kg of combined fodder and 1.5 kg of cake. The nutritiousness of the daily ration equalled to 11.2 feed units. Forty calves have been selec-

ted for the experiment at the age of 13-15 months, which have been bred under such conditions of feeding as to provide an average daily gain of 550-600 g. They were gelded at the age of 3-4 months and weighed on the average 250 kg before the grazing period.

A comparative study was carried out of four groups: black-particolour, red Gorbatov and crossbreeds of the latter two of the first and second generations. The animals were slaughtered at the age of 18-20 months.

As the average daily gain was concerned the crossbreeds of the first generation were the first (1200 g). The second was the group of purebred gelders of the red Gorbatov breed (1179 g). The third and fourth were the crossbreeds of the second generation and the black-particolour breed, the gain of whom was similar (1164 g). The gain was very high in this experiment in all the groups: the primary weight increased by 68-70% and by the time of slaughtering the weight of the gelders reached 422 kg. The crossing of cattle of the black particolour breed with the red Gorbatov breed was intended mainly for improving the fat content of the milk and less for the meat properties of the cattle. However, the results obtained with a large cattle stock in different zones made it possible to draw positive conclusions and recommend crossing of these breeds as a method for improving the fat content of the milk and the properties of the meat of the black-particolour breed.

Interesting results have been received by intensive fattening of crossbreeds of the black-particolour breed with the brown Latvian breed for 103 days (experimental horse-breedin

farm in the Ryazan Region) with a well-balanced ration: the average daily gain reached 900 gr, in which case 8.1 feed units have been consumed per 1 kg of gain. When slaughtered at the age of 15 months, the gelders reached a live weight of 425 kg. The dressing percentage reached 61.2% (including 56.9% of meat on bones). The morphological composition of the carcass was as follows: meat - 72%, fat - 8.1%, bones - 17.7%, trimmings and tendons - -2.2%. More than half of the meat (51.6%) was considered the highest and first grades (Rostovtsev, 1961-b).

The results of our research make it possible to draw the following conclusions: dairy and granger's breeds of horned cattle and their crossbreeds, as well as meat breeds are capable during graziery and fattening to considerably increase their live weight fattiness, yield of meat (on bones) and raw fat, and provide heavy first grade hides. During the period of growing, graziery and fattening it is possible to utilize the great power of growth, increase the economy of growing and provide animals weighing 350-400 kg at the age of 14-16 months, 430-460 kg at the age of 18-20 months. Simultaneously with the increase of the live weight in well fed cattle, the dressing percentage of meat (on bones) increases by 10-12% and fat - by 5-8%. The content of moisture in the meat reduces by 10-12%, the percentage of fat increases 3-4-fold, and the caloricity of the latter doubled. Crossbred stock surpasses the growth energy and live weight of the primary breeds and is characterized by a higher yield of meat and fat, providing also heavier hides. The caloricity of the meat is higher likewise. In case of correct organization

and on bringing the animals to the required conditions 2.5-3 months are required for fattening adult cattle, 3-4 months for 2-3 year old animals, and 6-7 months for one year old cattle.

Investigations of the meat properties of the main dairy and granger's breeds, as well as their crossbreeds in the USSR have testified that they are continuously improving not only by increasing their milk capacity, but also as concerns the properties of the meat. Full-value feeding of the cattle during the period of growing, graziery and fattening provide a vast source for increasing the output of meat, fat, high-quality offal and heavy leather raw material.

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