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BREEDING A NEW POPULATION OF MEAT-BASED SIMMENTAL CATTLE IN THE CARPATHIAN REGION OF UKRAINE

Abstract.

It has been found that the growth rate in this type of repair heifers from birth to 7 months of age in the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is higher; they reliably predominate by 3.4% (P<0.001) their improved peers of the genotype Simmental Combined$^{1}/_{32}$ Simmental Canadian$^{27}/_{32}$ Simmental Austrian$^{1}/_{32}$ Simmental German$^{3}/_{32}$ in the herd of the State Research Farm «Chernivetske». It has been determined that a correlation in repair heifers with the final genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ between the live weight during the period of rearing was low and negative: at birth r=-0.13 (P>0.095); at 7 months of age r=-0.02 and at 12 months of age r=-0.05 (P>0.095). The studies have determined that the linear and mass dimensions of a new population Simmental cattle increase with the raise of their heredity in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$. Their live weight increased by 15.5 kg, the height at withers – by 3.1 cm, the chest circumference – by 4.8 cm, the oblique length of the torso and buttocks – by 1.7 and 2.1, respectively, and the overall dimensions – by 13.5 cm.

It has been found that the growth rate in the repair heifers of meat-based polled Simmental cattle from birth to 7 months of age in a new productive genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is 15.7%; they reliably predominate by 3.4% (P<0.001) their improved peers of the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ in the State Research Farm «Chernivetske».

Keywords: *bulls, tufts, diet, complex preparation, live weight, daily increments*

Setting the problem. In order to provide the population of the country with livestock products, the State Program in the direction of rearing specialized breeds of cattle with high genetic potential of meat productivity was implemented in different regions of Ukraine. In the Western region of Ukraine, in particular in Bukovyna and Halychyna, it has been bred a new population of Bukovyna zonal type meat-based Simmental cattle with productive herds of animals having satisfactory reproductive abilities, the genetic potential of milk and meat productivity, as well as the growth energy in all physiological periods of growing, which is the most relevant for the region [1, 2].

Analysis of recent research and publications. The breeding program for qualitative transformation of local Bukovyna type Simmental breed of the combined direction of productivity using domestic and foreign gene pool of meat-based Simmentals of various breeding and lines in basic and subsidiary farms of Chernivtsi region during 1999-2019 with the formation of new type Bukovyna zonal meat-based Simmental cattle for the Ukrainian Carpathians was developed [3].

The reliable assessment of beef cows in terms of milk productivity is of great importance in the breeding production practice of foreign countries. Based on the generalization of foreign experience using a linear assessment of beef cattle exterior, domestic breeders conduct research on breeding, consolidation and improvement of the new Ukrainian Simmental cattle, which are reared in different regions of Ukraine. When forming the highly productive meat herds, the animal is evaluated by 15 characterstics. The assessment of the first calving cows is carried out during the first lactation in the accepted points according to the instructions [4, 5].

Thus, the efforts of breeders are aimed at assessing the population of mother-stock by phenotype, udder structure, mammary glands and limb strength. The breeding should take into account not only the type and importance of productivity, but also growth, temperament, reproductive abilities and other characteristics. For further cattle breeding, it is necessary to leave for rearing the posterity from the best meat cows-mothers to repair their own herd and sell the breeding young ones to other farms in the regions of Ukraine.

A long-term breeding work allows forming the cattle with high genetic potential of milk and meat productivity provided sufficient feeding during the year (not less than 65 quintals of feed units per beef cow with progeny) according to the norms of feeding beef cattle in the Carpathian region.

In the future, it is necessary to consolidate the achieved genetic potential of productivity, improve the

reproductive functions of animals and provide the appropriate housing conditions that promote good health and prolonged productive use of cows for different climatic zones of the Carpathians [6-14].

Setting the objective. The aim of the research is to breed a new population of meat-based Simmental cattle, in the direction of increasing the genetic meat potential of productivity for cheap beef in the Carpathian region of Ukraine.

In order to obtain the above results, many years of the following breeding work has been carried out:

– breeding the high-value sires evaluated for the quality of posterity;

– the phenotypic assessment of first calving cows;

– the measurement of main physical characteristics of first calving cows;

– the comprehensive assessment of cows, young ones and sires;

– the formation of breeding groups and families, their renewal, breeding the animals for meat-based polled Simmental cattle;

– providing the system of growing meat-based polled repair heifers in accordance with the breed standard of weight and linear growth;

– breeding the repair bull-calves for insemination of mother-stock of Simmental and meat-based Simmental cattle in the area of their breeding;

– the formation of herds of mother-stock of meat-based polled Simmental cattle;

– the determination of the live weight in new genotypes of meat-based Simmental cattle;

– the formation of the herd by age and live weight of animals;

– the determination of average daily gains in all age periods of breeding;

– the determination of the fertility index in the cows of meat-based polled Simmental breed;

– the determination of the insemination rate of mother-stock;

– the exterior assessment of first calving cows;

– the formation of the genealogical composition of cows by productive and reproductive abilities.

Material and methods of research. The herds of a new population of Bukovyna zonal type meat-based Simmental cattle with the use of cows and heifers of different new productive genotypes with different blood for breeding the future posterity in the Carpathian region of Ukraine served as material basis.

Thus, the data of statistical reporting, regulatory materials, the data of own research, literature sources, as well as the annual reports of zootechnicians-breeders in the studied basic and subsidiary breeding farms of the public sector of different forms of ownership in Bukovyna and Pokuttia were the main source for writing the article.

The breeding scientific work to create a population of meat-based Simmental cattle in the direction of increasing the genetic potential of productivity was carried out in the herds of farms of different forms of ownership in Chernivtsi and Ivano-Frankivsk regions with well-arranged zootechnical and breeding records.

The exterior was assessed roughly and by measuring the main body characteristics of the animals. The ones who did not meet the planned parameters were culled from the herd. Zootechnical (determination of live weight, measurements, body composition indices, as well as milk and meat productivity) and biometric (determination of average values, their errors and degree of probability) accepted methods were used.

The study was carried out in basic and subsidiary farms for breeding a new population of meat-based Simmental: the Ukrainian leading and operating State Research Farm «Chernivetske» (151 cows) and the following subsidiaries: Agricultural Production Private Co-operative «Peremoha» (85 cows) of Hertsaivskyi district, SOE «Rokytne», ALLC «Avangard» (65 cows) of Novoselytskyi district, Farm «Ivankivtsi» (45 cows), Agricultural Production Co-operative «Zoria» (30 cows) of Kitsmanskyi district, Chernivtsi region and Private Farm «Potochyshche» (95 cows) of Horodenkivskyi district, LLC «Toro» (45 cows) of Rohatyn district, LLC «Levada» (20 cows) of Kolomyia district, Farm «Zarichchia» (10 cows) and Private Farm «Bohdan» (45 cows) of Kosiv district, Ivano-Frankivsk region. The total number of livestock was 1339 heads, including 590 cows of a new generation in different parts of the Carpathians.

Presentation of the main material of the study. The characteristics of cows of a new generation of Ukrainian meat-based Simmental cattle, which are bred for many years in basic and subsidiary farms of different forms of ownership in Chernivtsi and Ivano-Frankivsk regions, are presented in Table 1.

Table 1

Characteristics of the presented cows in farms

Farm	Amount of cows, heads	Average age of the first calving, months	Live weight, kg	Average milk productivity by lactations, kg		
				lactations		
				first	second	third and older
Chernivtsi region						
Hertsaivskyi district						
State Research Farm «Chernivetske»	165	27	585	214	217	225
Novoselytskyi district						
SOE «Rokytne», ALLC «Avangard»	95	28.5	575	195	210	215
Agricultural Production Private Co-operative «Peremoha»	85	28	545	190	197	205
Private Farm «Kolosok-2»	14	27	565	215	220	227
Farm «Hai»	15	28.0	580	195	–	–
Kitsmanskyi district						
Agricultural Production Co-operative «Zoria»	30	28.1	575	190	215	220
Farm «Ivankivtsi»	45	29.5	565	195	220	225
Total:	444	27.5	561.7	202.5	208.7	217
Ivano-Frankivsk region						
Horodenkivskyi district						
Private Farm «Potochyshche»	85	28.0	563	190	205	211
Rohatyn district						
LLC «Toro»	50	27.5	556	191	197	201
Kosiv district						
Private Farm «Bohdan»	45	27.0	575	195	-	-
Farm «Zarichchia»	10	27.5	545	190	200	225
Total:	190	27.5	565	191	196	200
Total livestock:	634	27.5	563	196.5	202.3	209

It was found that the cows of the State Research Farm «Chernivetske» had the highest milk productivity of 225 kg in the third and older lactation, which was by 14 kg more than in the cows of the Private Farm «Potochyshche».

Analyzing the data (Table 2), it is seen that the daily gains in young animals of Bukovyna zonal type meat-based Simmental cattle in the summer suckling period are 830-950 g, while they are 770-855 g per day for the full cycle of growing.

It was found that the young cattle of meat-based Simmental breed of the State Research Farm «Chernivetske» had the largest daily gains of on average 877 g for a number of years, which was by 5.1-5.4% more than the cattle of other farms breeding that type of animal.

The zonal type of a new generation meat-based Simmental cattle is characterized by a high energy of growth and feed payment, a strong constitution, a rather high reproductive ability, an easy calving of cows and a multifertility of posterity. All these characteristics are also present in the newly created Bukovyna zonal type meat-based polled Simmental cattle, which makes it possible to breed these animals in the conditions of industrial technology (with leashed and grazed keeping in winter and on pastures in summer) without premature loss of health and fertility.

Table 2

Average daily gains of young cattle in the basic farms, g *(summer period)*

Farm	Status	Years								
		2009	2010	2011	2012	2013	2014	2015	2019	on average
Chernivtsi region										
Hertsaivskyi district										
State Research Farm «Chernivetske»	p/e	870	850	820	950	900	870	920	950	877
Private Cooperative «Peremoha»	s/e	750	700	650	750	780	800	800	850	738
Novoselytskyi district										
SOE «Rokytne», ALLC «Avangard»	p/e	850	830	800	870	850	855	875	900	842
Kitsmanskyi district										
Farm «Ivankivtsi»	p/f	-	-	-	-	-	-	-	850	873
Agricultural Production Co-operative «Zoria»	p/f	-	-	815	815	795	800	800	830	810
Ivano-Frankivsk region										
Rohatyn district										
LLC «Toro»	p/f	-	-	-	-	-	-	-	850	850
Horodenkivskyi district										
Private Farm «Potochyshche»	p/f	780	850	800	850	800	850		870	821
Kosiv district										
Private Farm «Bohdan»	p/f	-	-	-	-	850	850	-	865	850
Farm «Zarichchia»	p/f	-	-	-	-	-	-	-	850	850

The newly created population of meat-based polled Simmental cattle is characterized by the following indicators: the live weight of adult cows is 545-650 kg; the milk yield for 210 days is 196-225 kg; the growth rate of young animals for fattening is 950-1150 g; the carcass weight of bulls at the age of 18-24 months is 265-275 kg, as well as the slaughter yield is 60-62%.

Analyzing the data of scientific results of the research having been conducted in the State Research Farm «Chernivetske» on the mother-stock of Bukovyna zonal type meat-based polled Simmental cattle having the well-developed limbs with sufficiently pronounced joints and tendons, the small strong hooves with a shiny horn and a good acclimatization to all climatic zones of the Western region of Ukraine.

The further research on breeding work will be conducted by the scientists of Bukovyna in the State Research Farm «Chernivetske» in order to increase the rearing of this type of beef cattle and the use of existing purebred mother-stock to reproduce the main herd in different climatic zones of the Carpathians.

Therefore, in the State Research Farm «Chernivetske» for breeding heifers of a new population of polled Simmental cattle, the livestock in the amount of 35 heads was evaluated by phenotype, genotype and technological characteristics, taking into account the live weight, which was 215 kg at the age of 7 months, while the average daily gains were 800-850 g in the period from their birth to the first insemination in the foothills of the Bukovyna region.

The studies have shown that in the future the breeding of meat-based Simmental cattle in the herd of the State Research Farm «Chernivetske» will be carried out in the direction of consolidation using the existing purebred mother-stock for the reproduction of animals of a new population Bukovyna zonal type with the following genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{8}$ Simmental German$^{1}/_{8}$ Simmental American$^{1}/_{16}$) for rearing in different climatic zones of the Carpathians. According to the results of the research, it was determined the average live weight of cows of a new generation Simmental cattle in the State Research Farm «Chernivetske», which was on average 652 kg (2019) at the age of 5-7 years (121 heads); it was by 40 kg (6.8%) more than in 2018.

Thus, when creating the new genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{8}$ Simmental German$^{1}/_{8}$ Simmental American$^{1}/_{16}$) a great importance was attached to the formation of the herd structure by age and live weight of animals in the State Research Farm "Chernivetske".

According to the results of the research, it was determined the live weight of the posterity of bulls in the most productive genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{8}$ Simmental German$^{1}/_{8}$ Simmental American$^{1}/_{16}$), which was 225 kg at the age of 210 days ($P<0.001$) (reliability criterion is 2.92). The posterity with the worst genotype with different blood (Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{8}$ + Simmental American$^{1}/_{16}$) had the live weight of less than 67% (td=5.31), while the posterity with an intermediate genotype took the middle position (td=4.1) in the herd of the State Research Farm «Chernivetske» breeding in the foothills of the Carpathian region of Bukovyna.

According to the results of many years of breeding work, it has been determined that the linear and mass

dimensions of Bukovyna zonal type meat-based Simmental cattle of a new population increase with the raise of their heredity in the productively created new genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$). Their live weight increased by 15.5 kg, the height at withers – by 3.1 cm, the chest circumference – by 4.8 cm, the oblique length of the torso and buttocks – by 1.7 and 2.1, respectively, and the overall dimensions – by 13.5 cm.

During the breeding work it has been found that the growth rate in this type of repair heifers from birth to 7 months of age in a new productive genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$) is 15.7%; they reliably predominate by 3.4% ($P<0.001$) their improved peers of the genotype (Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$). The studies have shown that a correlation in repair heifers with the final genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ between the live weight during the period of rearing was low and negative: at birth $r=-0.13$ ($P>0.095$); at 7 months of age $r=-0.02$ and at 12 months of age $r=-0.05$ ($P>0.095$).

In the process of a long-term breeding work it has been found that in the productive meat herd with two created genotypes in the State Research Farm «Chernivetske» there is a tendency to reduce the relative increase in live weight of animals with age. Thus, it was the lowest in the posterity of 12-18 months in the physiological period of animal development, which was (25.3%) in the purebred heifers of the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ and reliably prevailed by 4.5% ($P <0.001$) the improved genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + American$^{1}/_{32}$.

The studies determined the average live weight of bulls in different 5 lines from the date of birth to 7 months of age in the State Research Farm «Chernivetske», where the posterity of the ancestor bull-sire Forest 0899 line Achilles 369, American breeding, had the live weight of 235 kg at weaning, which was by 24.9 kg (12.2%) more than in the peers from the bull-sire Masquit 1822 line Signal 120, Austrian breeding.

Carrying out the breeding work in the herd of the State Research Farm «Chernivetske» indicates that the new created genotypes and their linear genealogical combination of three most outstanding productive lines of meat-based polled Simmental cattle, namely Achilles 369, Apricot 58311 and Signal 120, have high productivity, pass on their natural genes to their posterity and increase the growth energy by 18-21% in the foothills of the Carpathian region of Bukovyna. The heifers in the genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$), having been obtained from bulls-sires of German breeding (Mumbim 9214, Havrosh 9347, Bombay 9212 and Matros 9217), were evaluated. They are characterized by higher maturity and the age of fertilization, which is by 23.5 days shorter than in the daughters from bulls-sires of the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{8}$ + Simmental American$^{1}/_{16}$.

During the breeding period, the insemination rate of cows in the herd of the State Research Farm «Chernivetske» was studied. After the first insemination it was 83.8% in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$, which was by 7.1% more than in the cows of the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{8}$ + Simmental American$^{1}/_{16}$. The studies have determined a clear pattern of the influence of live weight and age of the new generation repair heifers during fertilization on the reproductive abilities of cows of meat-based Simmental cattle in the most productive genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$). An increase in age and live weight of animals during the first insemination leads to a decrease in reproductive abilities of the new generation cows in the Ukrainian Carpathians.

In Chernivtsi and Ivano-Frankivsk regions, the work to create a population of Bukovyna zonal type meat-based Simmental cattle in the direction of increasing the genetic potential of productivity is underway in basic and subsidiary farms of the public sector of different forms of ownership in the Carpathian region of Ukraine (Table 3).

The analysis of the data (Table 3) gives grounds to conclude that the cows of the new generation in the rest of farms are inferior to the animals of the State Research Farm «Chernivetske» in terms of live weight, milk productivity and other biometric indicators.

Thus, the fertility index of the cows of meat-based polled Simmental cattle in the State Research Farm «Chernivetske», having been obtained from the heifers fertilized at the age of 15-18 months at a live weight of 395-420 kg, is 45.3%, while it is 35.5% from those fertilized at the age of 21 months and older at a live weight of 435-450 kg ($P>0.095$). The coefficient of reproductive ability is 0.87 and 0.76, respectively ($P>0.95$).

Certain differences were determined in the new population meat-based Simmental cattle of different promising genotypes in the herd of the State Research Farm «Chernivetske», where the live weight of heifers of meat-based polled Simmental cattle on the date of birth was 31.2 ± 0.45 kg in the genotype (Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$.), while it was 33.5 ± 0.45 kg in the genotype (Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$). These indicators were respectively 89.2 ± 1.25 kg and 91.6 ± 1.37 kg at the age of 3 months old, 185.0 ± 0.78 kg and 195.7 ± 0.80 kg at the age of 6 months old, 270.5 ± 1.15 kg and 277.3 ± 1.18 kg at the age of 9 months old, 303.3 ± 1.24 kg and 310.9 ± 1.78 kg at the age of 12 months old, 325.5 ± 1.35 kg and 350.1 ± 1.91 kg at the age of 15 months old, as well as 389.3 ± 2.34 kg and 405.8 ± 3.03 kg at the age of 18 months old.

Table 3

Live weight and milk productivity of first calving cows

№	Farm	Districts	n	Live weight, kg			Milk productivity, kg (210days)		
				M±m	δ	CV	M±m	δ	CV
Chernivtsi region									
1	State Research Farm «Chernivetske»	Hertsaivskyi	28	552	17.04	4.13	198.5	11.12	4.67
2	SOE «Rokytne», ALLC «Avangard»	Novoselytskyi	14	517	14.12	3.23	185.7	9.35	3.34
3	Farm «Ivankivtsi»	Kitsmanskyi	13	509	13.14	3.03	195.4	8.31	2.95
4	Agricultural Production Cooperative «Zoria»	Kitsmanskyi	8	513	15.04	3.17	191.8	7.34	1.97
5	Agricultural Production Private Cooperative «Peremoha»	Hertsaivskyi	15	495	14.06	3.56	187.6	8.75	2.31
	Total		78	513	14.41	3.51	191.4	8.85	2.95
Ivano-Frankivsk region									
1	LLC «Toro»	Rohatyn	35	515	13.8	3.13	195.7	8.78	2.12
2	Private Farm «Potochyshche»	Horodenkivskyi	18	500	12.3	2.89	195.5	9.12	1.97
3	Farm «Zarichchia»	Kosiv	10	495	15.7	3.15	187.3	8.92	2.45
4	Private Farm «Bohdan»	Kosiv	15	490	14.3	2.87	191.5	8.15	2.56
5	LLC «Levada»	Kolomyiskyi	7	500	11.7	2.31	197.5	8.75	1.97
Total			85	502	13.37	2.87	194.1	8.89	2.12
On average in all farms			163	508	13.89	3.19	192.7	8.87	2.53

A different relative increase in live weight of heifers of different genotypes of the created Bukovyna zonal type meat-based Simmental cattle in different physiological periods of cultivation was determined in the breeding work (Table 4).

Table 4

Relative gain of heifers' live weight, %

Indicator	Period, months					
	0-3	3-6	6-9	12-15	15-18	0-18
Genotype: Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$						
X±Sx	115.2±2.35	108±3.01	32.5±0.65	19.7±0.45	9.8±0.41	795.8±12.31
Cv,%	24.3	26.7	18.6	29.8	41.3	12.8
Genotype: Simmental Canadian $^{3}/_{4}$ + Simmental Austrian $^{1}/_{16}$ + Simmental German $^{1}/_{8}$ + Simmental American $^{1}/_{16}$						
X±Sx	135.6±3.45	101.4±3.35	30.3±0.45	20.5±0.89	11.4±1.06	826.2±15.02
Cv,%	22.6	25.7	15.7	40.7	51.6	11.7

In terms of relative live weight gain, the repair heifers of the most productive genotype (Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$) prevailed the heifers of the genotype (Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$) for the period from birth to 3 months of age by 7.3% (P>0.99), from 9 to 12 months of age – by 1.2% (P<0.95), from 12 to 15 months of age – by 15.4% (P<0.95), from 15 to 18 months of age – by 17.4% (P <0.95) and from birth to 18 months of age – by 29.9% (P>0.99). Only between 9 and 12 months of age the best average indicators were reduced to 1.2% (P>0.99) and 0.9% (P<0.95).

It is noteworthy a very important production indicator for determining the average daily gains in different physiological periods, which were respectively 612.1 ± 0.0234 and 638.2 ± 0.0286 kg from birth to 3 months of age, 1052.7 ± 0.0374 and 1143.9 ± 0.0311 kg from 3 to 6 months of age, 653.6 ± 0.0314 and 0.640 ± 0.0414 kg from 6 to 12 months of age, 985.8 ± 0.0113 and 960.0 ± 0.0241 kg from 9 to 12 months of age, 835.5 ± 0.0132 and 808.1 ± 0.412 kg from 12 to 15 months of age, 708.9 ± 0.0293 and 744.4 ± 0.0552 kg from 15 to 18 months of age, as well as 795.8 ± 0.0049 and 850.0 ± 0.0068 kg from birth to 18 months of age.

It was determined that the coefficient of live weight varied in the range of 3.5-12.2% in the new generation heifers of meat-based Simmental cattle, having different intensity of its growth in certain physiological age periods of rearing. Its indicators increase until 6 months of age, and then decrease, which is consistent with the research of scientists from other institutions. In terms of absolute increase in live weight in some periods, the heifers reliably prevailed their peers of the combined type Simmental cattle, in particular, by 13.7

kg (P>0.999) from birth to 3 months of age, by 8.7 kg (P>0.999) from 12 to 15 months of age, and by 31.3 kg (P>0.999) from birth to 18 months of age. The difference was insignificant in other age periods.

In terms of relative increase in live weight the heifers of the new generation meat-based Simmental cattle prevailed the local Simmental breed by 15.1% (P>0.99) for the period from birth to 3 months of age, by 3.5% (P<0.95) from 9 to 12 months of age, by 11.4% (P<0.95) from 12 to 15 months of age, by 17.4% (P<0.95) from 15 to 18 months of age, and by 48% (P>0.99) from birth to 18 months of age under the conditions of different climatic zones of Bukovyna region.

In the conducted breeding research it was determined the productivity of two adjacent cows' generations (n=18) of mothers-daughters ± mothers, in which the milk productivity was 195.9 kg for the first lactation and 219.8 kg for the third lactation at probability (P>0.001), while the milk productivity of mothers-daughters ± mothers in the herd of the State Research Farm "Chernivetske" was by 19.3 kg more for the first lactation and by 2.4 kg more for the third lactation at probability (P>0.005).

The growth rates of repair heifers of meat-based polled Simmental cattle were studied. At the age of 18 months old, their live weight was 395-405 kg; the height at withers was 125-128 cm and the chest circumference was 180.7-181.0 cm. The live weight of adult cows was 545-650 kg, which exceeded the developed weight and linear standards with an index of legs length, stretching and chest. The indices of stretching and chest were higher by 9.3% (P<0.001), 3.9% (P<0.001) and 0.7% (P<0.05) and 7.6% (P<0.001), 4.3% (P<0.001) and 1.6% (P<0.001), respectively.

It was found that the first calving cows of line Achilles 351, American breeding, having been obtained from different lines, had significant differences in exterior and size of measurements. The first calving cows of line Signal 120, Austrian breeding, exceeded their peers in the height at withers by 5 cm (5.6%), in the chest depth by 8-9 cm (16.6%) and in latitudinal measurements by 3.8%, (6.1%), (16.9%). The similar advantage over the peers of other lines is observed in the first calving cows of line Achilles 351, which are kept in the herd and have, as a rule, a quite large and massive proportional body with the height at withers of 134.8 ± 0.22 cm, the well-developed deep (71.3 ± 0.15 cm) and wide (47.0 ± 0.20 cm) chests with the circumference of 195.4 ± 0.42 cm and the live weight of 675.4 kg.

The analysis of the linear measurements development in the exterior of the daughters of individual bulls-sires of line Achilles 351, American selection, found that the largest first calving cows in the herd of the State Research Farm «Chernivetske» were the daughters of the ancestors of purebred bulls-sires Forest 0899 (height at withers – 128.8 cm, oblique length of the torso – 149.4 cm, chest circumference – 171.9 cm, live weight – 468 kg), Ivora 1001 (height at withers – 17.0 cm, oblique length of the torso – 149.0 cm, chest circumference – 170.1 cm, live weight – 473.3 kg) and Micron 1351 (height at withers –125.7 cm, oblique length of the torso – 146.0 cm, chest circumference – 167.8, live weight – 443.3 kg).

The main economic indicators of the meat industry development demonstrate the stability and growth in the State Research Farm «Chernivetske» as for the breeding the new type meat-based polled Simmental cattle, as shown data in Table 5.

Table 5

Economic efficiency of a new type of meat-based Simmental

Indicator	Units of measurement	2007	2008	2009	2010	2011	2012	2013	2014	2019
Total livestock	heads	378	384	216	246	239	257	279	291	276
Including cows	heads	150	160	160	153	153	153	156	156	151
Production of meat	quintals	514	354	208	435	350	375	380	370	65
Daily gain on pastures	g	917	695	601	685	750	850	930	950	900
Sale of meat	quintals	518	342	02	325	365	355	345	336	345
Sale:										
of breeding young cattle by live weight	heads	43	27	5	1	28	21	22	22	25
	quintals	197	102	269	0.35	37.8	35.6	34.6	35.1	25.3
Cost of 1 quintal of gain	UAH	119.5	496.1	690	750	750	650	925	1100	1110

Since 2012, the State Research Farm «Chernivetske» of Bukovyna State Agricultural Research Station of the National Academy of Agrarian Sciences of Ukraine annually sells the breeding young cattle in live weight in the amount of over 300,000 UAH, which is 30% of profitability. An average monthly growth of 800-950 g for a full cycle of rearing with low feed costs of 7.8-8.5 feed units per 1 kg of gain is achieved.

Thus, the cost of beef production on the pastures of the State Research Farm «Chernivetske» in 2019 was 1,100 UAH, which was by 350 UAH more than in 2011. This affected the reduction in the cost of one feed unit.

The leading breeding plant in the Western region of Ukraine the State Research Farm «Chernivetske» of Bukovyna State Agricultural Research Station of the National Academy of Agrarian Sciences successfully sells more than 25 young cattle each year. In 2017, 50 heads of the first-class and elite breeding heifers were sold to the farms of different forms of ownership in the Carpathian region of Ukraine, which indicated a high demand for breeding cattle of a new type meat-based Simmental.

Thus, ensuring the prerequisites for profitable beef

cattle breeding is possible only on the basis of a rational combination of efficient using the production potential and the region's existing natural and climatic zones under the conditions of using a scientifically sound rational structure of sown areas, zonal specialization, introduction of intensive technologies for breeding, rearing, feeding and keeping animals in order to obtain a profitable meat industry in the Carpathian zone.

The studied economic evaluation of the efficiency of a new breeding achievement, Bukovyna zonal type meat-based polled Simmental cattle, showed that the income from the use of repair young animals at the expense of the breeding effect was 903,300 UAH. The sales revenue per head was 1,358 UAH and it was 4.59 UAH per 1 kg of carcass weight. This is confirmed by the actual results achieved in the farms engaged in the introduction of resource-saving technology for keeping beef cattle of zonal type meat-based polled Simmental.

In the future, in order to improve the economic efficiency of breeding a new type meat-based polled Simmental, it is planned to carry out the work aimed at increasing milk productivity, fertility of beef cows and calving, which will significantly increase meat productivity for the Carpathian region of Bukovyna.

Conclusions: 1. It has been found that the growth rate in this type of repair heifers from birth to 7 months of age in the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is higher; they reliably predominate by 3.4% ($P<0.001$) their improved peers of the genotype Simmental Combined$^{1}/_{32}$ Simmental Canadian$^{27}/_{32}$ Simmental Austrian$^{1}/_{32}$ Simmental German$^{3}/_{32}$ in the herd of the State Research Farm «Chernivetske».

2. It has been determined that a correlation in repair heifers with the final genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ between the live weight during the period of rearing was low and negative: at birth $r=-0.13$ ($P>0.095$); at 7 months of age $r=-0.02$ and at 12 months of age $r=-0.05$ ($P>0.095$).

3. The studies have determined that the linear and mass dimensions of a new population Simmental cattle increase with the raise of their heredity in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$. Their live weight increased by 15.5 kg, the height at withers – by 3.1 cm, the chest circumference – by 4.8 cm, the oblique length of the torso and buttocks – by 1.7 and 2.1, respectively, and the overall dimensions – by 13.5 cm.

4. It has been found that the growth rate in the repair heifers of meat-based polled Simmental cattle from birth to 7 months of age in a new productive genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is 15.7%; they reliably predominate by 3.4% ($P<0.001$) their improved peers of the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ in the State Research Farm «Chernivetske».

5. The studies have proved that in terms of relative live weight gain, the repair heifers of the most productive genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ prevailed the heifers of the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ for the period from birth to 3 months of age by 7.3% ($P>0.99$), from 9 to 12 months of age – by 1.2% ($P<0.95$), from 12 to 15 months of age – by 15.4% ($P<0.95$), from 15 to 18 months of age – by 17.4% ($P<0.95$) and from birth to 18 months of age – by 29.9% ($P>0.99$). Only between 9 and 12 months of age the best average indicators were reduced to 1.2% ($P>0.99$) and 0.9% ($P<0.95$).

6. According to the results of work, it has been determined the average daily gains in the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ and in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$, which were respectively 612.1 kg and 638.2 kg from birth to 3 months of age, 1052.7 kg and 1143.9 kg from 3 to 6 months of age, 653.6 kg and 0.640 kg from 6 to 12 months of age, 985.8 kg and 960.0 kg from 9 to 12 months of age, 835.5 kg and 808.1 kg from 12 to 15 months of age, 708.9 kg and 744.4 kg from 15 to 18 months of age, as well as 795.8 kg and 850.0 kg from birth to 18 months of age in the foothills of the Carpathian region of Bukovyna.

7. The studied economic evaluation of the efficiency of a new breeding achievement, Bukovyna zonal type meat-based polled Simmental, showed that the income from the use of repair young animals at the expense of the breeding effect was 903,300 UAH. The sales revenue per head was 1,358 UAH and it was 4.59 UAH per 1 kg of carcass weighty in the prices of 2019.

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THE STATE OF NATURAL FODDER MEADOWS OF THE EASTERN PODILLYA OF UKRAINE IN MODERN ECOLOGICAL CONDITIONS OF THE ENVIRONMENT

Abstract.
The article presents an analysis of the state of natural fodder meadows of the Eastern Podillya of Ukraine. It was found that in the conditions of dry lowland meadows the safest and most suitable for providing herbivores with plant biodiversity are normal land.

Keywords: *agricultural landscapes, heavy metals, soil, land, natural forage lands, lead, cadmium, zinc, copper.*

In Ukraine, natural forage lands cover an area of about 6.7 million hectares, of which about 4.6 million hectares are pastures, up to 2.3 million hectares - hay and about 0.9 million hectares - swamps. In the Forest-Steppe zone there is about 10% of natural fodder lands from the total area of agricultural lands.

In the Forest-Steppe of Ukraine, natural forage lands cover an area of about 2.1 million hectares, which is 3.4% of the total area of this natural-climatic zone. The forest-steppe zone includes mainland and floodplain meadows.

Natural forage lands are a source of plant food for both domestic and wild ruminants. Although natural plant communities are less nutritious than the vegetation of cultivated pastures, however, its use is costly, which plays an important role in providing food to the population of Ukraine. Modern use of natural lands provides a sufficiently cheaper feed, the possibility of