



UDC 636.2.636.02'033 (477.65)

## BREEDING OF A NEW TYPE OF SIMMENTAL BEEF CATTLE IN THE CARPATHIAN REGION OF UKRAINE

### РОЗВЕДЕННЯ НОВОГО ТИПУ СИМЕНТАЛЬСЬКОЇ М'ЯСНОЇ ХУДОБИ В КАРПАТСЬКОМУ РЕГІОНІ УКРАЇНИ

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*Publons: AAF-5445-2019*

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**Abstract.** For the first time, the article highlights the issue of the efficiency of cattle breeding of a new population Bukovyna zonal type of meat polled Simmental ruminants, which is relevant in the Carpathian region of Ukraine.

The results of research have showed that the growth intensity of repair heifers with the genotype ( $3/4$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American) from birth to 7 months of age prevails by 3.4% ( $P < 0.001$ ) their improved peers with the genotype ( $1/32$ Simmental combined +  $27/32$ Simmental Canadian +  $1/32$ Simmental Austrian +  $3/32$ Simmental German) in the herd of the breeding plant State Research Farm "Chernivetske" of Bukovyna State Agricultural Experimental Station of Institute of Agriculture of the Carpathian region of NAAS.

The difference is that the linear and mass dimensions in cattle of a new population with the genotype ( $3/4$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American) increase with the raise of their heredity. 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.

Studies have shown that in terms of relative live weight gain, the repair heifers of the most productive genotype ( $3/4$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American) prevailed the heifers of the genotype ( $25/32$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/32$ Simmental American) 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% ( $P < 0.95$ ).

**Key words:** cattle breeding, type, beef cattle, productivity, technology, productive characteristics.

### Introduction.

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 is implemented in different regions of Ukraine.

In this regard, in the Western region of Ukraine, in particular in Bukovyna and Prykarpattia, a new population of Bukovyna zonal type meat polled Simmental cattle having satisfactory reproductive abilities, the genetic potential of milk and meat productivity, as well as the growth energy in all physiological periods of growing has been bred for 22 years. It is the most relevant for this controlled region [14-17, 22].

As a result, a regional breeding program for the formation of Bukovyna zonal type meat polled Simmental cattle for the Ukrainian Carpathians on the basis of herds of local Simmental cattle of the combined direction of productivity using domestic and world gene pool of meat Simmental in basic and subsidiary farms of public sector of various forms of ownership in the Carpathian region during 1999-2022 has been developed.

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. [1-2, 18, 20, 21, 23, 24, 26, 27, 28, 31, 32].

When forming the highly productive meat herds, the animal has been evaluated by 15 characteristics. The assessment of the first calving cows has been carried out during the first lactation in the accepted points according to the instructions [3-7].

Thus, the efforts of regional breeders have been 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 [6-13].

A long-term breeding work allows forming the new beef 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 ruminants and provide the appropriate housing conditions that promote good health and prolonged productive use of beef cows. Therefore, the aim of this article is to summarize the materials on breeding the Bukovyna zonal type meat polled Simmental cattle in the direction of increasing the genetic potential of meat productivity to obtain cheap and quality beef in the controlled regions of Ukraine.

In order to obtain the above results, a long-term breeding work has been carried out, namely on the following important selection characteristics: 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 beef cattle; providing the system of growing meat 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 meat Simmental cattle in the area of their rearing; the formation of productive herds of mother-stock of the new type beef cattle; the assessment of the new type beef cattle by live weight indicators; the formation of the herd by age and live weight of ruminants; the determination of average daily gains of meat Simmental cattle in all age and physiological periods of breeding; the determination of the fertility index in the beef Simmental cows; the determination of the insemination rate of Simmental mother-stock; the exterior assessment of first calving cows of meat Simmental and the formation of the genealogical composition of meat polled cows by productive and reproductive abilities.

### **Material and methods of research.**

The meat herds of the newly formed Bukovina zonal type meat polled Simmental cattle with different bloodlines and selection served as the basis for long-term scientific research. The data of statistical reporting, regulatory materials, as well as the data of own research and literature were the main source of writing the article. The annual reports of zoo technicians-breeders in the studied basic and subsidiary breeding farms of the public sector of different forms of ownership with well-arranged zootechnical and breeding records in the regions of Bukovina and Prykarpattia were also used.

The exterior was assessed roughly and by measuring the main body characteristics of the beef ruminants. 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 [25].

The breeding work was carried out in basic and subsidiary farms, namely: the Ukrainian leading and operating State Research Farm «Chernivetske» (151 cows), Agricultural Production Private Cooperative «Peremoha» (85 cows) of Hertsaiivskiyi district, SOE «Rokytn» ALLC «Avangard» (75 cows) of Novoselytskyi district, Farm «Ivankivtsi» (75 cows), Agricultural Production Cooperative «Zoria» (35 cows) of Kitsmanskyyi district, Chernivtsi region and Private Farm «Potochyshe» (115 cows) of Horodenkivskyyi district, LLC «Tor» (45 cows) of Rohatyn 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 604 cows in different parts of the Ukrainian Carpathians.

### **Research results and discussion.**

The characteristics of milk productivity of beef cows of the new population Bukovyna zonal type of ruminants are presented in table 1.

The research 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 analogues of the subsidiary Private Farm «Potochyshe» in Pokuttya region.

The energy of growth in all physiological periods of growing the created new



population of young meat of basic and subsidiary farms in the summer period is determined.

**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
<b>Chernivtsi region</b>						
<i>Hertsaiivskiyi district</i>						
State Research Farm «Chernivetske»	151	27	585	214	217	225
Agricultural Production Private Cooperative «Peremoha»	85	28	545	190	197	205
<i>Novoselytskyi district</i>						
SOE «Rokytno» ALLC «Avangard»	75	28,5	575	195	210	215
<i>Kitsmanskyi district</i>						
Agricultural Production Cooperative «Zoria»	35	28,1	575	190	215	220
Farm «Ivankivtsi»	45	29,5	565	195	220	225
Total:	391	27,5	561.7	202.5	209	217
<b>Ivano-Frankivsk region</b>						
<i>Horodenkivskiyi district</i>						
Private Farm «Potochyshe»	115	28,0	563	190	205	211
<i>Rohatyn district</i>						
LLC «Toro»	45	27,5	556	191	197	201
<i>Kosiv district</i>						
Private Farm «Bohdan»	45	27,0	575	195	-	-
Farm «Zarichchia»	10	27,5	545	190	200	225
Total:	215	27,5	565	191	196	200
Total livestock:	604	27,5	563	196.5	202.3	209

Analyzing the production data, we can conclude that the daily gains in young animals of Bukovyna zonal type meat polled 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 in the foothills of Carpathian region.

It was found that the young cattle 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 their analogues of other subsidiary farms breeding that type of beef cattle in the Carpathians.

Thus, the newly created population of beef 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%.

The newly formed Bukovyna zonal type meat polled 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. It makes 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, g (summer period)**

Farm	Status	Years								
		2009	2010	2011	2012	2013	2014	2015	2019	on average
<b>Chernivtsi region</b>										
<i>Hertsaiivskiyi district</i>										
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
<i>Novoselytskyi district</i>										
SOE «Rokytn» ALLC «Avangard»	p/e	850	830	800	870	850	855	875	900	842
<i>Kitsmanskyyi district</i>										
Farm «Ivankivtsi»	p/f	-	-	-	-	-	-	-	850	873
Agricultural Production Cooperative «Zoria»	p/f	-	-	815	815	795	800	800	830	810
<b>Ivano-Frankivsk region</b>										
<i>Rohatyn district</i>										
LLC «Toro»	p/f	-	-	-	-	-	-	-	850	850
<i>Horodenkivskyyi district</i>										
Private Farm «Potochyshe»	p/f	780	850	800	850	800	850		870	821
<i>Kosiv district</i>										
Private Farm «Bohdan»	p/f	-	-	-	-	850	850	-	865	850
Farm «Zarichchia»	p/f	-	-	-	-	-	-	-	850	850

Thus, the studies having been conducted in the State Research Farm «Chernivetske» conclude that the beef mother-stock of Bukovyna zonal type meat polled Simmental cattle have 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 breeding work will be carried out to increase the consolidation and improve the herds of meat polled Simmental ruminants in the Carpathian region.

In the conditions of the breeding plant, 35 heads of repair heifers of the newly created meat type were 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.

Therefore, the further selection in the meat herd of the State Research Farm «Chernivetske» will be aimed at consolidation and improvement using the existing purebred mother-stock for the reproduction of cattle of a new population Bukovyna zonal type with the genotype ( $3/4$ Simmental Canadian  $1/8$ Simmental Austrian





$1/8$ Simmental German  $1/16$ Simmental American) 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, 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 ( $3/4$ Simmental Canadian  $1/8$ Simmental Austrian  $1/8$ Simmental German  $1/16$ Simmental American) a great importance was attached to the formation of the herd structure by age and live weight.

According to the results of the research, it was determined the live weight of the posterity of bulls with the genotype ( $3/4$ Simmental Canadian  $1/8$ Simmental Austrian  $1/8$ Simmental German  $1/16$ Simmental American), which was the highest and amounted to 225 kg at the age of 210 days ( $P < 0,001$ ) (reliability criterion is 2,92). The bulls with blood ( $3/4$ Simmental Canadian +  $1/8$ Simmental Austrian +  $1/16$ Simmental American) were the worst and had the live weight of less than 67% ( $td=5.31$ ), while the posterity with an intermediate genotype took the middle position ( $td=4,1$ ).

The further research has determined that the linear and mass dimensions of Bukovyna zonal type meat polled Simmental cattle of a new population increase with the raise of their heredity in the productively created new genotype ( $3/4$ Simmental Canadian  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American). 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 repair heifers of this meat polled type from birth to 7 months of age with the genotype ( $3/4$ Simmental Canadian  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American) is 15,7%; they reliably predominate by 3,4% ( $P < 0,001$ ) their improved peers of the genotype ( $25/32$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/32$ Simmental American).

The studies have determined a correlation in repair heifers with the final genotype ( $3/4$ Simmental Canadian  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American), which was low and negative between the live weight during the period of rearing both at birth  $r=-0,13$  ( $P > 0,095$ ), 7 months of age  $r=-0,02$  and 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 meat herd of the State Research Farm «Chernivetske» there is a tendency to reduce the relative live weight gains in young cattle with age. Thus, at the age of 12-18 months they were the lowest (25.3%) in the purebred heifers with the genotype ( $3/4$ Simmental Canadian  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American) and reliably prevailed by 4.5% ( $P < 0,001$ ) the heifers with the genotype ( $25/32$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/32$ Simmental American).

The study of 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» was an important area of research in that period. 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.

The breeding work in the meat herd of the State Research Farm «Chernivetske» indicates that the most effective is the linear genealogical combination of three most outstanding productive lines of meat polled Simmental cattle, namely Achilles 369 Apricot 58311 and Signal 120. They have high productivity and pass on their natural genes to their productive meat posterity.

Analysis of the data shows that the repair heifers with the genotype ( $\frac{3}{4}$ Simmental Canadian  $\frac{1}{16}$  Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{16}$ Simmental American) have been evaluated in the studies. They have been obtained from bulls-sires of German breeding (Mumbim 9214, Havrosh 9347, Bombay 9212 and Matros 9217 and 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 ( $\frac{3}{4}$ Simmental Canadian +  $\frac{1}{8}$ Simmental Austrian +  $\frac{1}{16}$ Simmental American).

During the breeding period, the insemination rate of cows in the productive beef herd of the State Research Farm «Chernivetske» was studied. After the first insemination it was 83,8% in the genotype ( $\frac{3}{4}$ Simmental Canadian  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{16}$  Simmental American), which was by 7,1% more than in the cows of the genotype ( $\frac{3}{4}$ Simmental Canadian +  $\frac{1}{8}$ Simmental Austrian +  $\frac{1}{16}$ Simmental American).

The studies have determined a clear pattern of the influence of live weight and age of repair heifers during fertilization on the reproductive abilities of cows with the most productive genotype ( $\frac{3}{4}$ Simmental Canadian  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{16}$  Simmental American). An increase in age and live weight of cows during the first insemination leads to a decrease in reproductive abilities of the new generation ruminants.

In Chernivtsi and Ivano-Frankivsk regions, the work to create a new population of Bukovyna zonal type meat polled 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 gives grounds to conclude that the cows of the new generation in subsidiary 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 in the cows of the State Research Farm «Chernivetske», having been 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 ( $P > 0,95$ ).

On the date of birth the live weight of meat heifers with the genotype ( $\frac{25}{32}$ Simmental Canadian +  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{32}$ Simmental American) was  $31,2 \pm 0,45$  kg, while it was  $33,5 \pm 0,45$  kg in those with the genotype ( $\frac{3}{4}$ Simmental Canadian +  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{16}$ Simmental American). These indicators were respectively  $89,2 \pm 1,25$



kg and  $91,6 \pm 1,37$  kg at the age of 3 months old,  $185,0 \pm 0,78$  kg and  $195,7 \pm 0,80$  kg at the age of 6 months old,  $270,5 \pm 1,15$  kg and  $277,3 \pm 1,18$  kg at the age of 9 months old,  $303,3 \pm 1,24$  kg and  $310,9 \pm 1,78$  kg at the age of 12 months old,  $325,5 \pm 1,35$  kg and  $350,1 \pm 1,91$  kg at the age of 15 months old, as well as  $389,3 \pm 2,34$  kg and  $405,8 \pm 3,03$  kg at the age of 18 months old.

The long-term breeding work has determined a different relative live weight gain in the heifers of different genotypes of these created beef cattle during different physiological periods of rearing in the foothills of the Carpathian region of Bukovyna.

In terms of relative live weight gain, the repair heifers of the most productive genotype ( $3/4$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American) prevailed the heifers of the genotype ( $25/32$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/32$ Simmental American) 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% ( $P < 0,95$ ).

**Table 3 - Relative gain of heifers' live weight, %**

Indicator	Period, months					
	0-3	3-6	6-9	12-15	15-18	0-18
Genotype: $25/32$ Simmental Canadian $1/16$ Simmental Austrian $1/8$ Simmental German $1/32$ Simmental American						
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: $3/4$ Simmental Canadian $1/16$ Simmental Austrian $1/8$ Simmental German $1/16$ Simmental American						
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

The average daily gains in different physiological periods were  $612,1 \pm 0,0234$  and  $638,2 \pm 0,0286$  kg from birth to 3 months of age,  $1052,7 \pm 0,0374$  and  $1143,9 \pm 0,0311$  kg from 3 to 6 months of age,  $653,6 \pm 0,0314$  and  $0.640 \pm 0,0414$  kg from 6 to 12 months of age,  $985,8 \pm 0,0113$  and  $960,0 \pm 0,0241$  kg from 9 to 12 months of age,  $835,5 \pm 0,0132$  and  $808,1 \pm 0,412$  kg from 12 to 15 months of age,  $708,9 \pm 0,0293$  and  $744,4 \pm 0,0552$  kg from 15 to 18 months of age, as well as  $795,8 \pm 0,0049$  and  $850,0 \pm 0,0068$  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 and had a different intensity of its growth in certain physiological age periods of rearing. It increased until 6 months of age, and then decreased, which was consistent with the research of scientists-breeders from other institutions of NAAS of Ukraine. In terms of absolute live weight gain 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 live weight gain the repair heifers of Bukovyna zonal type prevailed their analogues of 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 in the conditions of Bukovina region.

In our research, we studied the comparison of two adjacent generations of meat polled Simmental cows at the breeding plant of the State Research Farm «Chernivetske».

**Table 4 - Productivity of two adjacent generations**

Daughters		Mothers		±, to mothers	
Genotype: $\frac{3}{4}$ Simmental Canadian $\frac{1}{16}$ Simmental Austrian $\frac{1}{8}$ Simmental German $\frac{1}{16}$ Simmental American					
Milk productivity		Milk productivity		By milk productivity	
I lactation	III lactation	I lactation	III lactation	I lactation	III lactation
X ±m	X ±m	X ±m	X ±m	X ±m	X ±m
Line Achilles 369					
197,1 ±2,1	235,3 ±1,8	201,2 ±1,9	245,2 ±2,4	38,1 ±1,6	10,3 ±1,9
Line Apricot 58311					
195,3 ±2,5	215,5 ±1,5	200,6 ±1,9	225,4 ±2,4	29,9 ±1,7	9,9 ±1,7
Line Signal 120					
185,5 ±1,8	210,2 ±1,3	197,8 ±1,9	212,7 ±2,4	11,9 ±1,2	1,9 ±1,5
German breeding					
205,7 ±2,6	218,4 ±1,7	215,4 ±1,9	222,5 ±2,4	9,5 ±1,6	3,9 ±1,3
On average					
195,9 ±1,7	219,8 ±1,2	215,2 ±1,9	222,2 ±2,4	19,3 ±1,3	2,4 ±1,2

The studies showed that the milk productivity in daughters of first calving cows for the first lactation was 197,1 kg, while it was 201,2 kg in their mothers, whose predominance was +4,1 kg for the first lactation and +9,9 kg for the third.

According to the results of productivity of two adjacent cows' generations ( $n=18$ ) of Mothers-Daughters ± to mothers, their milk productivity was 195,9 kg for the first lactation and 219,8 kg for the third lactation at probability ( $P>0,001$ ). Such high and average values of the coefficient of heredity of productivity indicators allowed us to conduct an effective breeding, because the higher that coefficient was, the more its phenotype due to genotype was. It was proved in the studies conducted in the foothills of Bukovyna region.

Thus, the breeding studies determined the comparative characteristics of mothers' and their daughters' productivity, which indicated a greater impact of fathers compared to mothers on their daughters' productivity. The so-called heredity coefficient was used to determine the breeding effect in the next generation in the herd of meat polled Simmental ruminants. According to the results of studies, the live weight of repair heifers, heifers and first calving cows of meat polled Simmental cattle at the breeding plant of the State Research Farm "Chernivetske" was determined.

It was determined that the first calving cows of the newly created more productive genotype of meat polled Simmental cattle  $\frac{3}{4}$  Simmental Canadian  $\frac{1}{16}$  Simmental Austrian  $\frac{1}{8}$  Simmental German  $\frac{1}{16}$  Simmental American dominated their



peers of the previous improved genotype  $^{25}/_{32}$  Simmental Canadian  $^{1}/_{16}$  Simmental Austrian  $^{1}/_{8}$  Simmental German  $^{1}/_{32}$  Simmental American by 30 kg (7,8%), which indicated the manifestation of the level of live weight productivity by physiological periods of development in certain groups of ruminants with a newly created productive genotype at the controlled breeding plant of the State Research Farm «Chernivetske».

**Table 5 - Live weight of repair heifers, heifers and first calving cows, kg**

Indicator, months	New created genotypes					
	$^{25}/_{32}$ Simmental Canadian $^{1}/_{16}$ Simmental Austrian $^{1}/_{8}$ Simmental German $^{1}/_{32}$ Simmental American.			$^{3}/_{4}$ Simmental Canadian $^{1}/_{16}$ Simmental Austrian $^{1}/_{8}$ Simmental German $^{1}/_{16}$ Simmental American		
	amount, heads	live weight, kg	standard, ±	amount, heads	live weight, kg	standard, ±
New born	22	31±1,1	35	23	32±1,2	35
At the age of 210 days	18	191±1,3	-9	16	210±1,5	+9
At the age of 8 months	17	200±1,2	-20	16	205±1,3	-6
At the age of 12 months	17	285±1,4	-10	15	315±1,4	0
At the age of 18 months	15	385±1,3	0	12	415±1,3	+25
Heifers	11	455±1,6	-	11	460±1,5	-
First calving cows	15	485±1,7	10	6	500±1,6	+5

In the research, we evaluated the heifers' body measurements corresponding to the parameters of the new population Bukovyna zonal type of meat polled Simmental cattle.

**Table 6 - Heifers' body measurements, cm**

Indicator	height at withers	height at sacrum	chest depth	width at the buttocks	oblique length of the buttocks	chest circumference	metacarpus circumference	On average by all characteristics
n	32	32	32	32	32	32	32	32
M	130,5	132,7	64,5	43,5	47,1	169,7	20,2	86,9
b	4,87	4,35	3,85	3,93	5,95	11,35	2,75	5,29
m	0,51	0,52	0,59	0,51	1,2	2,47	0,65	0,92
C <sub>y</sub>	3,93	3,95	6,87	5,93	4,65	5,24	15,65	6,60
On average by all characteristics	34,9	35,4	18,9	3,68	14,7	47,2	15,7	-

It has been found that only the height at withers and the metacarpus circumference in heifers slightly exceed the norm. The largest deviation from the breed standard is observed in the measurement of the chest width. As a result of the breeding work, a clear pattern of the influence of heifers' live weight and age during fertilization on the reproductive qualities of meat polled Simmental cows in the genotype  $^{3}/_{4}$ Simmental Canadian  $^{1}/_{16}$ Simmental Austrian  $^{1}/_{8}$ Simmental German  $^{1}/_{16}$ Simmental American has been revealed. Thus, a significant increase in the age and live weight of repair heifers of meat polled Simmental cattle during fertilization leads



to a decrease in the reproductive qualities of the new generation beef cows in the Carpathian region.

Therefore, the fertility index in the meat polled Simmental cows obtained from the heifers, having been 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, which have been 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 ( $P>0,95$ ) in the herd of the State Research Farm «Chernivetske».

The research has determined the development of heifers and the milk productivity of meat polled cows in the farms of Chernivtsi and Ivano-Frankivsk regions in 2021.

It has been determined that at the first calving the breeding repair heifers of the State Research Farm «Chernivetske» have a live weight by 8,7% more than their peers of the Agricultural Production Private Cooperative «Peremoha» and by 11,5% more than the cattle of the Private Farm «Bohdan».

It has been defined that after the third calving the live weight in the cows of meat polled Simmental cattle in the State Research Farm «Chernivetske» is 525-655 kg, which is by 75 kg (12,9%) more than in the cattle of SOE «Rokytne» ALLC «Avangard». The studies have shown that the live weight in the heifers of meat polled Simmental cattle in the State Research Farm «Chernivetske» is higher.

The average live weight of bulls in different 5 productive lines from the date of birth to 7 months of age in the State Research Farm «Chernivetske» was studied. 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 (122%) more than in the peers from the bull-sire Masquit 1822 line Signal 120, Austrian breeding, in the foothills of Bukovyna.

It was determined that the control of genetic meat productivity was the main and obligatory element within genealogical formations to create a new population of meat polled Simmental cattle and define the genotypes and leading productive lines located in basic and subsidiary farms in the region of Bukovyna.

The breeding work for this period in each specific controlled meat herd in basic and subsidiary farms for the mother-stock of meat polled Simmental cattle has identified the promising new lines using the method of linear breeding “in itself” for different herds of this type animals of the Carpathian region.

The results of the breeding work in the State Research Farm «Chernivetske» indicate that the new created genotypes and their linear genealogical combination of three most outstanding productive lines of meat polled Simmental cattle have high productivity, pass on their natural genes to their posterity and increase the growth energy by 18-21% in the foothills of Bukovyna. The studies have determined the biochemical blood parameters of repair heifers of meat polled Simmental cattle in two lines of Achilles 369 and Apricot 58311.

As a result of studies, it was found that the total blood protein before feeding was increased in the heifers of line Apricot 58311, Canadian breeding, (89.0) compared to their peers of line Achilles 369. The blood glucose level in the heifers of line Apricot 58311 before feeding was increased and did not significantly differ from



line Achilles 369, American breeding. The blood cholesterol in the heifers of line Apricot 58311 was 3,8 mmol/l and tended to increase compared to line Achilles 369, in which it was 3,2 mmol/l. The concentration of triglycerides in the heifers of line

Apricot 58311 was 0,09 mmol/l; it was observed its decrease. The blood creatinine level in two groups of animals was slightly increased (140,1-154,32 mmol/l).

**Table 7 - Biochemical blood parameters of repair heifers**

Parameter	Line Achilles 369	Line Apricot 58311
Cholesterol mmol/l	3,2±0,4	3,8±0,2
Glucose mmol/l	3,5±0,5	3,9±0,005
Protein g/l	70±7,6	89,3±3,9
AST, IU/L	58,3±2,7	113,3±3,6
G-GTP, IU/L	20,0±0,6	29,6±1,4
CPK, IU/L	174,3±11,6	362,2±36,2
LDH, IU/L	1405±69,5	1085,0±467,6
Amylase Амілаза, IU/L	120,2±46,5	342,6±116,3
Triglycerides, mmol/l	0,13±0,06	0,09±0,07
Urea, mmol/l	15,3±11,3	57,3±2,0
Alkaline Phosphatase, IU/L	129,0±39,4	-
ALT, IU/L	4,6±3,7	24,3±3,6
Creatinine, mmol/l	140,1±20,1	154,3±17,7
Bilirubin, mmol/l	18,8±6,1	119,0±0,9

Thus, the concentration of bilirubin in the serum of repair heifers of line Apricot 58311 was 34,3 mmol/l, while that parameter was reduced to 18,8 and 11,9 mmol/l, respectively, in line Achilles 369. An important factor in the liver is to determine the activity of organ-specific enzymes in the heifers' serum. Thus, the activity of Alanine Aminotransferase (ALT) in the cattle of line Achilles 369 before feeding was 4,6 IU/L.

That parameter in the heifers of line Apricot 58311 was significantly increased and amounted to 24,0 IU/L ( $P < 0,05$ ). The activity of Gamma-glutamate peptidases (G-GTP) in line Achilles 369 before feeding was 20 IU/L. Its activity in line Apricot 58311 was increased and amounted to 29.6 IU/L. The activity of Alkaline Phosphatase in the heifers of line Achilles 369 was 174,3 IU/L, which was by 187,9 IU/L (2,2%) less than in their peers of line Apricot 58311. 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 polled Simmental ruminants in this region. Thus, the cost of production of cheap and high quality beef on the pastures 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. Since 2012, the State Research Farm «Chernivetske» annually sells the breeding young cattle in the amount of over 300,000 UAH, which is 30% of profitability. An average monthly growth is 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.

The leading breeding plant in the Western region of Ukraine, the State Research Farm «Chernivetske», successfully sells more than 25 young cattle each year. In 2020, 59 heads of breeding heifers and the first-class and elite bulls 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.

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 polled Simmental cattle, has showed that the income from the use of repair young animals at the expense of the breeding effect is 903,300 UAH. The sales revenue per head is 1,358 UAH and it is 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 in this region.

The results of breeding work presented in the article will allow to carry out an effective selection in the herds of meat polled Simmentals, aimed at consolidation, improvement and formation of the desired economic and useful characteristics of Bukovyna zonal type meat polled Simmental cattle in the region of Bukovyna Carpathians.

### Conclusions

It has been found that the growth rate in this type of repair heifers from birth to 7 months of age with the genotype ( $\frac{3}{4}$ Simmental Canadian +  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{16}$ Simmental American) is higher; they reliably predominate by 3,4% ( $P < 0,001$ ) their peers with the genotype ( $\frac{1}{32}$ Simmental Combined  $\frac{27}{32}$ Simmental Canadian  $\frac{1}{32}$ Simmental Austrian  $\frac{3}{32}$ Simmental German) in the herd of the State Research Farm «Chernivetske».

It has been determined that a correlation in repair heifers with the final genotype ( $\frac{3}{4}$ Simmental Canadian  $\frac{1}{16}$ Simmental Austrian  $\frac{1}{8}$ Simmental German  $\frac{1}{16}$ Simmental American) 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 in the cattle with the genotype ( $\frac{3}{4}$ Simmental Canadian +  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{16}$ Simmental American) increase with the raise of their heredity. 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 polled Simmental cattle from birth to 7 months of age with the genotype ( $\frac{3}{4}$ Simmental Canadian +  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{16}$ Simmental American) is 115.7%; they reliably predominate by 3.4% ( $P < 0.001$ ) their peers with the genotype ( $\frac{25}{32}$ Simmental Canadian +  $\frac{1}{16}$ Simmental Austrian +  $\frac{1}{8}$ Simmental German +  $\frac{1}{32}$ Simmental American) in the State Research Farm «Chernivetske».

The studies have proved that in terms of relative live weight gain, the repair





heifers of the most productive genotype ( $3/4$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American) prevailed the heifers of the genotype ( $25/32$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/32$ Simmental American) 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% ( $P<0,95$ ).

According to the results of work, it has been determined the average daily gains in the heifers with the genotype ( $25/32$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/32$ Simmental American) and in those with the genotype ( $3/4$ Simmental Canadian +  $1/16$ Simmental Austrian +  $1/8$ Simmental German +  $1/16$ Simmental American), 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 region of Bukovyna.

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**Анотація.** У статті вперше висвітлено питання щодо ефективності розведення худоби нової популяції створеного буковинського зонального типу м'ясного комолого сименталу жуйних, що є актуальним в Карпатському регіоні України.

Результатами досліджень встановлено, що за інтенсивністю росту ремонтні телиці з генотипом ( $3/4$ симентал канадський +  $1/16$ симентал австрійський +  $1/8$ симентал німецький +  $1/16$ симентал американський) від народження до 7-місячного віку переважають на 3,4% ( $P < 0,001$ ) своїх поліпшених ровесниць з генотипом ( $1/32$ симентал комбінований  $27/32$ симентал канадський  $1/32$ симентал австрійський  $3/32$ симентал німецький) у стаді племінного заводу ДП ДГ «Чернівецьке» Буковинської ДСГДС ПСГ КР НААН.

Наведено різницю, що з підвищенням спадковості у худоби нової популяції з генотипом ( $3/4$ симентал канадський +  $1/16$ симентал австрійський +  $1/8$ симентал німецький +  $1/16$ симентал американський) збільшуються їх лінійні і масові габарити, так жива маса зростає на 15,5 кг, висота в холці – 3,1 см, обхват грудей – 4,8 см, коса довжина тулуба і заду відповідно на 1,7 і 2,1, габаритні розміри – 13,5 см.

Дослідженнями доведено, що за визначенням відносного приросту живої маси ремонтні телиці з найбільш продуктивним генотипом ( $3/4$ симентал канадський +



$1/16$ симентал австрійський +  $1/8$ симентал німецький +  $1/16$ симентал американський), переважали телиць з генотипом ( $2^5/32$  симентал канадський +  $1/16$ симентал австрійський +  $1/8$ симентал німецький +  $1/32$ симентал американський) в період від народження до 3-місячного віку на 7,3% ( $P>0,99$ ), від 9- до 12-місячного на 1,2% ( $P<0,95$ ), від 12- до 15-місячного – 15,4% ( $P<0,95$ ), від 15- до 18-міс. – 17,4% ( $P<0,95$ ) та від народження до 18-місячного віку – 29,9% ( $P>0,99$ ), лише в проміжках від 9- до 12-міс. віку кращі середні показники були зменшені і становили 1,2% ( $P>0,99$ ) та 0,9% ( $P<0,95$ ).

**Ключові слова:** скотарство, тип, м'ясна худоба, продуктивність, технологія, продуктивні ознаки.