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Adapting Australian Hereford Cattle To The Conditions Of The Southern Urals.

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ABSTRACT

The article discusses the results of breeding Hereford cattle imported from Australia and their several progeny generations in conditions of the Southern Urals. Within three years there was a comprehensive study of clinical medical, hematological, exterior, productive and reproductive indicators of the imported animals in terms of their naturalization to the sharp continental climate. The body temperature, respiratory frequency and heart rate were found to be within reference limits of the physiological standards. An adaptation index was lower. Coefficient and rate of animal adaptability to high and low temperatures demonstrated no sharp stress reactions of animals to the changing living conditions. The received results of morphological and biochemical blood composition of the imported cattle were within the physiological standards. Reproduction quality indicators of the female cattle increased by the third year of acclimatization that proves certain livestock adaptation flexibility. Young cattle of the the first, second and third Russian generation growth and development indicates common adaptation processes of the cattle imported from Australia.

Keywords: Hereford breed, cows, bulls, acclimatization, adaptation, clinical indicators, productivity

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INTRODUCTION

Russian and foreign scholars claim that acclimatization issues require studies of the whole set of factors having impact on adaptation of animals being moved to new habitats. These are the very factors to determine a way of animals' life as well as to affect their productivity for a long period of time, for several generations. Ability of animal organisms to adapt to different climatic zones provides their further geographic settlement [1-3,9-13,20,26,27].

The Hereford breed history, being one of the oldest British cattle, goes back to the middle of the XVIII century. Currently, it is one of the most common breeds in the world. Hereford cattle was imported to Australia from England. They have been living on the Australian continent for a long time and proven their ability to survive in different climatic zones: from cold mountainous regions to the hot plains of Central Australia. The cattle of this breed have been noted numerous times to handle cold and snowy winter in open areas and be characterized by a high feed conversion ratio [8,11,12,14,17,19].

Stepanov D. V. and his co-authours (2015) [22] argue that farm animals have a certain conventionality in terms of natural and climatic conditions of their habitat. Correspondently, every breed has its own climatic optimum and the sum of inborn and behaviour reflexes resulted from the environment they were created. For example, the animals show elevated physiological functions when are moved to conditions with higher or lower average temperatures.

Thus, being in a new habitat different from the usual one an animal organism experiences stress and its natural response to changing environmental conditions is a change in clinical medical characteristics: respiratory frequency and depth, heart rate and body temperature.

Numerous studies have found that interior indicators, in particular hematological ones, can demonstrate animal adaptability to certain conditions. As the result of several environmental factors there is change in blood composition and its redistribution in the bloodstream. Haematopoietic organs are very sensitive to various effects on the body and, thus, the cellular and biochemical composition of blood reflects all the quantitative and qualitative changes taking place in the course of the continuous change of the physiological processes in the body [2-7,10,16,18,20,23,24].

The acclimatization process takes more than a year, the animal body is adjusted on harmonious existence with the new factors of the external environment, regulating the physiological, hormonal, biochemical, immunological factors being a part of metabolic processes and protective reactions, reproductive and other functions, in accordance with the new climate and feed conditions.

The adaptation process has often an effect on reproductive qualities of animals. When animal acclimatization is improper, there can be a sharp decline in the heard reproduction intensity. Its main indicator is calf crop per 100 cows and heifers available at the beginning of the year. Legoshin G. P. (2014) suggests that high reproduction rate can be achieved by a number of measures. Their aim is to grow healthy calves by the time of their weaning based on the principle: the number of calves equals the number of cows per year. Productive longevity is not less than 7 calvings a year. Calving time is different in different regions depending on natural and climatic conditions, available housing, pastures and bulky feed [15].

Important acclimatization indicators for imported cattle are health and safety of offspring, as well as its growth and development. They result in sound and highly productive animals [4,5,9,12,15].

The purpose and objectives of the study: The aim is to evaluate the results of breeding Hereford cattle of Australian origin and its progeny in conditions of the Southern Urals. There are following tasks to be solved: to study clinical, physiological and hematological indices in different seasons during three years after the animals are brought to new breeding conditions; to analyze adaptability rate in winter stall-feeding and summer-grazing periods, to evaluate reproductive qualities of cows and performance of the young cattle.

MATERIALS AND METHODS

Object of study: Hereford bulls and cows of the Australian selection (F_0) and descendants of the first (F_1), second (F_2) and third (F_3) generations. Parents were delivered to farms in December 2009. The studies were conducted in three departments of state farms "Tsentralnaia" and "Sawa-Agro-Usen", located in the Ural steppe and forest-steppe zones of the Southern Urals. The farms have a status of bred livestock farms [19].

Characteristics of territories, natural and climatic conditions: Climatic conditions and feeding habits of bulls and cows in the Australian continent and on the Cis-Ural as well as the steppe and forest-steppe zones of the Southern Urals were studied according to the web-based data on climatic conditions of countries (Weather and climate, Climate statistics for Australian locations available at: http://www.bom.gov.au/climate/averages/tables/cw_066062_All.shtml) and bred livestock accounting.

The experimental scheme: Acclimatization of the imported animals was studied by a method of full assessment of clinical evidence and animal adaptability coefficients in July and October, 2010, January, April, July, October 2011, 2012 [1, 10, 16]. Temperature and relative humidity were determined by a psychrometer. Clinical evidence was examined by simultaneous (parallel) taking weather and clinical readings. Animal body temperature was taken per anum by an electronic thermometer, respiratory frequency (RF) was inspected visually on chest excursion, heart rate (HR) was measured by the precordial region auscultation. The above mentioned indicators were recorded three times a day at 7.00-8.00, 14.00-15.00 and 20.00-21.00 on two adjacent days per every season of the year. According to the received research results adaptation flexiblity was identified (adaptation rate, tolerance, thermal stability, heat and cold resistance).

Livestock adaptation rate (AR) was calculated with the R. Banzer equation (1970):

$$AR = (BT/38,33) + (BR/23,0)$$

Where BT stands for body temperature;

BR means breathing rate;
38,33 is body temperature in ºC in conditions favorable for animals;
23,0 is a breathing rate per 1 minute in conditions favorable for animals.

Tolerance rate (TR) was determined on a bright sunny day at temperature of 30 degrees Centigrade. The animal body temperature was measured twice at 10.00 and 15.00 and estimated with the equation of Roud's "Iberian overheating assessment" (1944):

$$TR= 100-[10-(t-101)]$$

where t stands for the average body temperature of an animal, °F;

101 is a normal body temperature, °F;
10 denotes a body temperature deviation rate for different species;
100 demonstrates total heat efficiency in terms of body temperature conservation at 101 °F;

Converting temperature from Fahrenheit to Celsius:

$$t^{\circ}C= 0,55\ (t^{\circ}F-32)$$

Converting temperature from Celsius to Fahrenheit:

$$t^{\circ}F=1,8^{\circ}C+32$$

Heat resistance rate (HRR) was calculated according to the formula:

$$HRR=(BTa/BTm)+(BRa/BRm)$$

where BTa is a body temperature in the afternoon;
BTm is a body temperature in the morning:

BRa is a breathing rate in the afternoon;
BRm is a breathing rate in the morning.

Heat resistance index (HRI) was defined according to the Raushenbach method (1975) when body temperature being measured twice a day in the morning and in the afternoon at the hottest time with the formula:

$$HRI = 2(0,6t_2-10dt+26)$$

where t_2 is an air temperature in the afternoon at the time of monitoring;

dt is difference in body temperature of animals in the afternoon at t_2 and in the morning;
0,6 is a body temperature regression rate to the air temperature for livestock.

Cold resistance index was calculated with the O. Raushenbach formula (1975). It is based on additional energy loss to preserve temperature homeostasis when the air temperature decreases. The formula to determine cold resistance index is as follows:

$$CRI = 60 - ((H_2-H_1)/H_2 \times 100) + R(t_2+10)$$

where H is heat production, kcal per kg of live weight;
H_1 is the air temperature within thermal comfort;
H_2 is the lower temperature (t_2) after two hours of exposure;
R is regression rate for heat production change (%). This rate for livestock equals to 0,6.

Body temperature regulation is directly dependent on animal coat. Coat structure characteristics (weight, length, density, diameter and composition) were studied in January and July according to the Russian State standard GOST 17514-93 "Sherst naturalnaia. Metody opredeleniia ee toniny" [Natural wool. Methods to determine its fineness]. Hair samples were taken from the right side of the neck, in the middle of the last rib and the thigh with an area of 1 cm^2.

Blood samples were drawn from the jugular vein in the middle third of the neck in the morning before feeding animals in winter stall-feeding and summer-pasturing periods: in the first year of acclimatization - July, 2010 and in January and July, 2011-2012. Whole blood an serum were used to conduct studies.

Haematological studies were performed under the clinical diagnostic laboratory. Morphological composition of blood was determined with the Beckman Coulter LH-500 Hematology analyzer (USA) by the Coulter method (flow cytometry) to take into account the number of erythrocytes, hemoglobin and leukocytes. Total protein was determined by the end point method based on the biuret reaction as well as with "total protein" reagent on the biochemistry analyzer Synchron CX4 PRO by Coulter Bechman (USA). Protein fraction content was identified using the capillary electrophoresis automated solution MINICAP by Sebia (France).

Cattle was weighted by scale VSP-4 twice a year before the beginning of pasturing as well as a winter stall-feeding period. Breeding records were used to analyze reproductive ability of cows and their offspring.

Reproductive qualities were recorded according to the calving interval length (CIL), a service period (SP), newborn calf crop and their liveweight (kg), reproduction ability and averade milk yield ratio (kg), calculated according to the liveweight of calves at the age of 205 days. Indicators were calculated according to the common methods [4,10,23,26].

Cow fertility was determined by the Dohi index (1961):

$$T = 100 - (K+2i),$$

where *T* — cow fertility index;
i — average calving interval in months;

К — cow age at first calving in months.

Then cows were classified according to the index rate: if$T \geq 48$ - fertility is considered to be good, at T = 41-47, fertility is average, at $T \leq 40$ - fertility is poor.

Reproduction ability rate (RAR) was calculated by the formula:

$$RAR=365/CIL,$$

where *CIL* is a calving interval in days.

Growth and development of calves of generations F_1, F_2 и F_3 were evaluated according to the absolute (A_g), average daily (Av_g) liveweight gain and relative growth rate (K)

Absolute gain in body weight for the time of growing:

$$A_g=W_t-W_0$$

where A_g is absolute gain in live weight;
W_0 - initial mass of the animal, (kg);
W_t*is* live weight of the animal at the end of the period, (kg).

The average daily gain in live weight over a certain period:

$$Av_g = (W_1-W_0)/t$$

where Av_g*is* the average daily live weight gain, (g);
W_0 - initial mass of the animal, (kg);
W_1 *is* live weight of the animal at the end of the period, (kg).
t is the time.

Relative growth rate (K) is calculated by S. Brody:

$$K = \frac{W_1 - W_0}{0.5 \times (W_1 + W_0)} \times 100\%$$

where K is the relative growth rate (%);
W_0 - initial mass of the animal, (kg);
W_1 *is* live weight of the animal at the end of the period.

Statistical analysis was performed with Excel (Microsoft) software.

RESULTS AND DISCUSSIONS

Given the fact that Australia lies in the southern hemisphere, its seasons are opposite of those in the northern hemispere. Climate analysis gives an idea of different conditions in which animals were bred in the South-East of the Australian continent (New South Wales) and the Republic of Bashkortostan where the animals were imported. On the whole it is pointed out that there are no freezing temperatures and the climate is much warmer on the plain of South-East Australia. Thus average annual temperature maximum and minimum in the state (Sydney) is 22,3 ºC and 13,8 ºC while in the Republic of Bashkortostan it is 8.6 ° C and -1.6 ° C (Ufa), the difference between average annual minimum temperature between considered territories is 15.4 ° C and a maximum of 13.5 º. The average annual precipitation differs more than two times (the difference is 667,9 mm) and is 1214,7 mm in the state of New South Wales and 546,8 mm in Bashkortostan. Significant rainfall in the first case is due to the abundant rain in winter and spring resulted from the low pressure zone passing over the territory of South-Eastern Australia[25].

Change in air temperature and average rainfall at the mean for the months of the year in the state of New South Wales and the Republic of Bashkortostan is shown in figure 1.

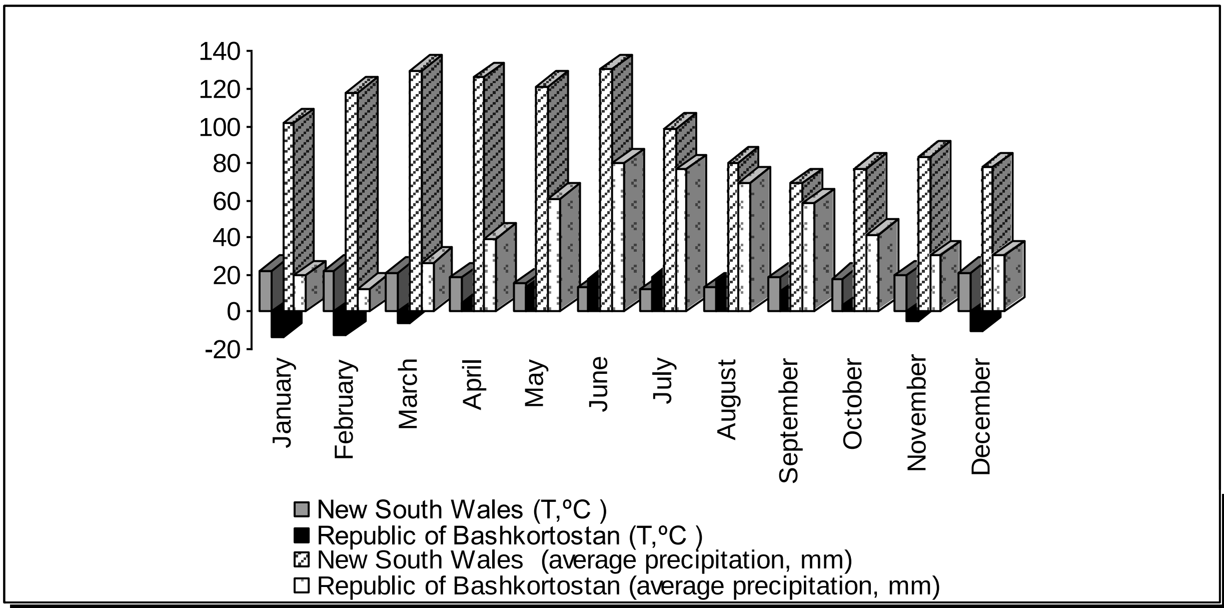

Fig 1: Air temperature change at the mean for the months of the year and average rainfall in the state of New South Wales and the Republic of Bashkortostan

The main difference between the studied territories in the average ambient temperature comes for the periods from January to March and from October to December. Dynamics of the average rainfall by months is different and depends on the season of the year. A significant difference in rainfall in the state of New South Wales and Bashkiria is from January to March (81,8-105,7 mm). From April to June the difference in the values is smaller (86.9- 50.6 mm). From July to September the amount of precipitation differs slightly (9,9-21,7 mm) and in the subsequent three months the difference increases again (35,8-53,5 mm). Cattle is kept on Australian pastures all the year round. Animals are watered from natural sources.

Since beef cattle in Australia are also bred in mountainous pastures, where there is snow and subzero temperatures, Hereford cattle was adapted to breeding in low temperatures [12-15].

Wolfe ET (2009) and Moore RM (1970) [17,25] claim that there are mostly local perennial grasses on natural pastures of South-Eastern Australia: *Dactylis glomerata, Austrodanthonia spp*., *Arundinacea, Themeda triandra*, *Poa labillarderi*, *Austrostipa aristiglumis and Heteropogon contortus*, *Bothriochloa macra, Dichanthium sericeum, Chloris truncata, Microlaena stipoides*.

In conditions of the Bashkortostan Republic, especially in the steppe, forest and steppe as well as mountain areas the most popular breeding technology is pasture-stall. The farms conducting a scientific-economic experience practice winter-spring rounded calving. After calving cows are kept together with calves within 10-14 days. Further they are moved to ground runs and return to calves at feeding time. Summer keeping is carried out according to the system "cow-calf". Weaning of calves is at the age of 6-8 months. Bulls are kept on open feedlots all the year round.

Diets for cows are prepared according to the nutritional value of fodders. Winter stall period diets include high quality hay of cereals and legumes, haylage and concentrated fodder. Winter stall period diets of bulls include high quality hay of cereals and legumes, haylage, root crops and concentrated fodder in the form of a mixture: barley, millet, mill offals and mixed fodders. When animals are in heat their diets include fodder of animal origin: blood, fish flour, skimmed milk, grass cutting, concentrates of vitamins A, D, E and microelement salts in composition of premixes. Bulls are kept on pastures in summer. Farms use mainly floodplain meadows as pasture lands. Plant species diversity on the floodplain reaches 30-40 species. Livestock is also grazed at typical steppe grassland with dominated mixed fescue-feather stand, in hollows there is mostly narrow-leaved feather grass. Species diversity in pastures is approximately 20 species. Steppe stands include 60-70% of graminaeous grasses, 5-8% of legumous grasses, 25-30% of different grasses.

The studies found that indicators of body temperature, respiratory frequency and heart rate are within the physiological standards. Moreover, there were no obvious differences between the studied indicators of acclimatization for different years. However, there is tendency of increased body temperature within 38,7-39,4 °C in July. It was especially in 2010 when average daytime temperature according to two measurements was 31,61 ° C. There was higher respiratory frequency to an average 31,74 in the daytime that proves good adaptation of animals to higher temperatures. Slightly larger than the optimum body temperature of animals (38,33) was observed in January (air temperature – 20 ° C) in the first year of adaptation. It was 39,21-39,25 ºC. There was rapid breathing at maximum 30 breaths per minute that consequently reduced in winters of 2011 and 2012. This is due to the compensatory processes in animal bodies on cold atmospheric exposure. Dynamics of clinical indicators for bulls is the same as that for cows. However, respiratory frequency and heart rate are somewhat lower.

Our results are also consistent with the results of Arakcha C.A. and others (2015) [3], who point out increased respiratory frequency during the summer time and higher heart rate in spring.

In our studies heartbeat quickens in April on average for the two adjacent days from 60 to 68 beats per minute, and also with higher relative air humidity.

Indicators of adaptation flexiblity of cows to high temperatures are tolerance rate (TR); heat resistance (HR) and index of thermal stability (HRI). They are identified in summer when the ambient temperature is over 30 ° C (table 1).

Table 1: Indicators of cattle adaptation to the environmental conditions (*X±Sx*)

Year of acclimatization	A month	AR	TR*	HR*	HRI*	CRI
		cows				
First	July	2,01±0,12	85,12±4,15	2,68±0,21	74,55±3,31	-
	October	2,20±0,08	-	-	-	53,95±3,09
The second	January	2,23±0,14	-	-	-	49,58±3,11
	April	2,01±0,09	-	-	-	54,86±3,22
	July	1,98±0,11	86,68±3,89	2,51±0,18	76,61±3,87	-
	October	2,00±0,08	-	-	-	56,17±3,15
The third	January	2,00±0,12	-	-	-	54,09±2,88
	April	1,97±0,08	-	-	-	57,22±3,24
	July	1,97±0,10	87,34±4,38	2,49±0,20	77,81±3,61	-
	October	1,98±0,09	-	-	-	57,39±2,97
		bulls				
First	July	2,00±0,11	85,54±4,56	2,56±0,12	75,84±3,51	-
	October	2,12±0,08	-	-	-	55,50±2,13
The second	January	2,13±0,12	-	-	-	49,99±2,22
	April	2,01±0,12	-	-	-	55,41±2,74
	July	1,99±0,11	85,78±6,01	2,49±0,10	76,83±3,48	-
	October	2,00±0,8	-	-	-	56,52±3,11
The third	January	2,00±0,11	-	-	-	54,13±3,15
	April	1,97±0,08	-	-		57,48±2,89
	July	1,98±0,09	87,94±5,15	2,48±0,13	77,95±3,75	-
	October	1,98±0,08	-	-	-	57,65±3,20

*are defined only in summer when the ambient temperature is over 30 ºC.

The data obtained indicate that the values of all investigated parameters are optimal in terms of acclimatization processes of imported cattle.

The studies noted the positive dynamics of the adaptation rate for cows as well as for bulls. There was decrease of the adaptation rate in July. For cows it was 2.01 in the first year, 1.99 in the second year and 1,98 in the third year. For bulls it was 2,00 →1,99 →1,98. In October these indicators were as follows: 2,2→2,0→1,98 and 2,12-2,00-1,98; in January – 2.23 (the second year) and 2.0 (the third year) and 2.13→2,0, respectively; in April both cows and bulls have values of 2.01 to 1.97 in the third year of acclimatization. Low values of adaptation rate are explained by the fact that animals were imported from lowland areas of warm climate with high humidity and low temperatures of mountain pastures. Conditions of sharp continental climate do not cause strong stress response on change of living conditions. When there is good adaptive capacity, its value should decrease from 2. For example, in similar research of Sharafutdinova E.B. and others (2016), where cows of Canadian selection were studied, the adaptation index in July during the three years of the investigation decreased from of 2.91 to 2.49 [10,11,22].

The index of tolerance for cows increases from 85,12 to 87,34 from the first year of acclimatization to the third one. Heat resistance index is slightly above the desired figure (2) but tends to decrease from 2.68 to 2.48; index of thermal stability increases from 74,55 to 77,81 that demonstrates developed resistance of animal bodies to higher air temperatures (30 ° C). A similar tendency is observed for bulls.

The cold resistance index is calculated based on animal heat production. Similar studies carried out by Rauschenbach Y. O. (1975) in Siberia showed that at air temperature drop to minus 20 - 22 °C (in % of the value plus 10-12°C) heat production of Jersey cows increased by almost 2 times, of black-and-white cows it was higher by 46%, while it decreased by 10%d for Yakut cattle as well as their cold resistance coefficient [22].

The cold resistance index is an indicator of adaptation to low ambient temperatures. The lowest cold resistance index for cows and bulls was established in January of the second year of adaptation. It was 49,58 and 49,99. For comparison it is 75 for Yakut cattle, 59 for black-and-white animals according to Stepanov D.V. and others (2015). However it increased to 54,09 for cows and 54,13 for bulls (it is higher by 0.04 for the latter) in the third year of acclimatization. The index tends to increase in autumn: first year – 53,95 and 55,50 (↑1.55 V), the second year – 56,18 and 56,52 (↑0,34), the third year – 57.39 and 57,65 (↑to 0.26). It indicates a better adaptation of bulls to low temperatures.

Thermoregulation processes of the animal body depend on quality and the optimal composition of coat (table 2).

Table 2: Coat characteristics (*X±Sx*)

Year of acclimatization	A month	Indicator		
		density, units per 1 cm^2	weight, mg	length, mg
cows				
First	July	830,11±25,64	16,81±0,84	13,70±1,05
The second	January	1297,62±62,02	47,06±2,98	28,56±2,04
	July	841,15±31,07	17,05±1,10	14,31±1,12
The third	January	1415,67±67,17	51,51±3,06	32,83±2,88
	July	852,92±25,89	17,23±0,93	14,61±1,25
bulls				
First	July	846,17±21,45	18,26±0,69	14,93±0,54
The second	January	1312,72±74,11	48,92±2,15	31,97±0,81
	July	852,55±23,12	18,61±1,01	15,22±0,25
The third	January	1415,47±68,84	53,13±2,53	34,13±0,73
	July	862,92±*21,98	19,31±0,36	15,74±0,19

The data in tables indicate that from the first to the second year of acclimatization, cows increase the performance of thick fur in summer by 1.33% and from the second to the third at 1.40% from January 2011 to January 2012 by 9.09%. Weight and wool length during the period of acclimatization in summer is more by 2.50 % and 6.64 %, in winter it is higher by 9.46% and 14.9%. Bulls have generally the same trend. Significant differences between indicators of acclimatization are not marked.

Thus, in the course of acclimatization in summer coat of cows varies slightly, but in winter coat density, weight and length become higher that denotes adaptability of the animal to low ambient temperatures.

Morphological composition of blood of cows and bulls in the process of adaptation are presented in table 3.

Table 3: Morphological composition of blood (*X±Sx*)

Year of acclimatization	A month	Indicator		
		erythrocytes, 10^{12}/l	leukocytes, 10^{9} /l	hemoglobin, g/l
cows				
First	July	5,34±0,11	7,83±0,35	101,14±5,23
The second	January	5,39±0,22	8,93±0,41	108,49±9,51
	July	7,17±0,41	7,13±0,52	119,91±4,75
The third	January	6,18±0,21	8,63±0,73	115,56±6,11
	July	7,18±0,09*	7,29±0,61	123,7±4,77*
bulls				
First	July	5,68±0,22	6,94±0,43	104,64±6,22
The second	January	5,72±0,31	7,98±0,37	109,11±7,31
	July	7,18±0,42	7,05±0,40	123,15±5,28
The third	January	6,24±0,18	8,27±0,65	120,83±5,47
	July	7,21±0,26*	7,12±0,57	125,12±3,99*

Note: *P<0.05

The obtained results of morphological blood composition of cows were within the physiological standards. However, in the first year of adaptation in summer, the content of red blood cells and hemoglobin were within the lower limit of normal (5,34 10^{12}/l and 106,14 g/l), in the next two years they significantly (P<0.05) increased by 34.46% and 22,31%, in winter they rose by 14.6% and 10.74%, respectively. There were the same changes in morphological composition of blood of bull calves. However, the content of erythrocytes and hemoglobin of male animals was higher on average by 4-6%. There was a significant (P<0.05) increase in red blood cells by 26.94%, hemoglobin by 19.57% in summer by the third year of acclimatization. In winter these indicators were higher by 9.09% and 10.74%, respectively.

Increased number of erythrocytes and hemoglobin is a positive physiological indicator of high level of metabolic processes in the animal organism [1,10,13].

Protein content in the serum and protein fractions are presented in Table 4.

Table 4: Protein fractions of blood serum (*X±Sx*)

Year of acclimatization	A month	Common protein, g/l	Fractions, %			
			Albumins	α-globulins	β-globulins	γ-globulins
cows						
First	July	73,68±4,16	46,51±2,13	15,60±0,85	15,74±0,56	22,15±1,54
The second	January	75,29±5,27	45,82±1,97	13,29±0,79	14,71±0,93	26,18±1,68
	July	78,15±1,98	44,99±2,04	12,05±1,21	13,34±0,53	29,62±3,68
The third	January	81,67±2,23*	45,78±2,11	11,89±1,11	12,78±0,49	29,55±2,45
	July	79,93±3,45*	44,34±1,86	12,05±0,75*	12,49±0,71*	31,12±1,85*
bulls						
First	July	74,25±4,16	47,39±2,45	13,34±0,85	15,84±0,56	23,43±1,54
The second	January	75,37±5,21	45,95±2,53	13,19±1,54	14,98±1,28	25,88±2,03
	July	78,09±3,77	44,29±2,19	12,18±1,64	13,39±0,57	29,14±1,69
The third	January	80,47±4,41*	45,28±3,11	11,47±0,97	12,02±0,94*	30,23±1,11
	July	79,88±4,62*	44,50±3,05	12,61±0,76*	12,18±0,81**	31,71±1,07*

Note: * P<0.05, ** P<0.01

It should be noted that the values of total protein, protein fractions of blood serum are within reference limits of the physiological standards.

In the third year of acclimatization when compared to the first one there is a significant increase in total protein in the blood serum by 8.48 % in summer, by 8.47% in winter for cows and 7.58% and 6.77% respectively for bulls. There is also a certain dynamics regarding protein fractions. If in summer of the first year of acclimatization of cows and bulls content of albumins (46,51% and 47.39 %) and β-globulines (15,74% and 15.84%) were within the upper limit of the physiological standards while content of γ-globulins (22,15% and 23,43%) was within the lower limit of normal. By the third year of acclimatization these indicators averaged out. The difference in winter indicators for cows and bulls between the third and second year of acclimatization amounted to 0,04% and 0,67% of albumins, 1.93 % and 2,96% of β-globulins; 3.37% and 4.35 % of γ-globulins respectively. In the summer-grazing period there was slight decline in the number of albumins and increased number of γ-globulins in the blood serum of animals.

Reproductive qualities of cows in the first, second and third year of acclimatization to conditions of the sharp continental climate is presented in table 5.

Table 5: Reproductive qualities of cows (*X±Sx*)

Indicator	Year of acclimatization		
	first	the second	the third
Livestock number, an.	503	496	480
Disposal, an.	7	16	11
%	1.40	3.20	2.3
Average live weight, kg	498,55±5,61	532,75±7,25	557,10±4,11*
Calving interval length	-	361,02±4,12	354,04±5,20
Service period length, days	-	76,22±1,41	68,31±1,55
Calf crop, %	80.00	82.51	90.24
Live weight of calves at birth, kg	31,3±0,89	33,8±0,91	34,1±1,11*
Reproduction rate	-	56.4	56.8
Reproductive ability coefficient	-	1.01	1.03
Average milk yield of mother cows, kg (live weight of calves at the age of 205 days)	199,45±2,3	204,01±2,7	220,0±3,1*

* P<0,05

Analyzing the data in the table it is possible to note a rather high viability of imported breeding stock. For three years of acclimatization 34 cows were culled (6,75% of the total livestock population) where 12 cows were culled for difficult delivery, 9 animals for being poor milkers, 8 animals for limb injuries (for the whole period), 5 animals for mastitis in the fresh period.

The average live weight in the third year of acclimatization (third calving) significantly ($P<0.05$) increased by 10.51%, calving interval (CIL) of the studied livestock decreased by 7 days, service period (SP) reduced by 8 days. Calf crop in the second year of acclimatization increased by 2.51% and by 7.73% in the third year.

The third lactation showed a significant ($P<0.05$) increase in milk yield of mother cows by 10,30%. Characteristics of milk production of cows according to live weight of calves at weaning in terms of 205 days proves that this indicator being 220 kg is on the level of 2008. It meets requirements of the elite-record and the elite classes.

By the third year of acclimatization the studied breeding stock demonstates some increase in fertility index (by 0.4) and coefficient of reproductive ability (by 0.02). Reproductive ability is considered to be good if the fertility index (FI) is more than 0.48, and the coefficient of reproductive ability (RAR) is more than 1.0.

On the whole the received data is compatible with the results Rostovtseva N.M. and others (2014), where milking capacity averaged 244 kg. It provided high energy growth of calves in the suckling period. The results obtained for Limousin cattle by Bakharev A.A. (2013) are slightly lower. However, reproduction of Limousin cattle was carried out according to the technology proposed by the French animal breeders. It relies on servicing heifers at the age of 24 months having 400-420 kg of live weight. It increases the age of the first service and, therefore, reduces the values of the studied factors (SP – 32-41,2; RAR – 0,82-0,90) [4,18].

Thus, based on the investigated indices, we can make a conclusion on good reproductive ability of breeding stock during acclimatization in conditions of the Southern Urals.

Indicators of liveweight gain and viability of young cattle of three generations, bull calves and heifers born from Hereford cattle imported into the territory of Bashkortostan are presented in Table 6.

Table 6: Liveweight gain of young cattle (*X±Sx*)

Indicator	Generation		
	the first (F_1)	the second (F_2)	the third (F_3)
heifers			
The number of animals at the beginning of rearing (newborn), an.	200	108	58
The number of animals at the end of rearing (age of 17 months), an.	184	100	54
Safety, %	92.0	92.59	93.10
Weight of newborn calves, kg	31,83±0,47	32,14±0,85	32,26±0,71
Weight at the age of 17 months, kg	417,75±7,52	423,15±8,11	429,69±6,15
Absolute gain during rearing, kg	385,92±7,99	391,01±7,98	397,43±6,31
Average daily gain during rearing, g	746,46±11,59	756,29±12,08	768,72±11,73
Relative growth rate, %	173.62	174.90	175.32
bull calves			
The number of animals at the beginning of rearring (newborn), an.	202	90	49
The number of animals at the end of rearing (age of 18 months), an.	184	84	46
Safety, %	91.09	93.33	93.88
Weight of newborn calves, kg	32,12±0,47	32,72±0,85	32,88±0,71
Weight at the age of 18 months, kg	530,64±7,52	541,35±8,11	550,47±6,15
Absolute gain during rearing, kg	498,52±6,95	508,63±7,98	517,59±6,31
Average daily gain during rearing, g	911,37±12,03	927,85±11,78	946,23±11,85
Relative growth rate, %	175.18	175.80	176.22

Analysis of the data in the tables indicates rather high safety indicators of young cattle having been risen at 1.1% for heifers and at 2.79% for bull calves. There is some increase in live weight of newborn calves. Thus the weight of a calf of the third generation exceeds the first one by 0.43-0.76 kg. There are increased indicators. Thus weight of 17-month-aged heifers is higher by 2.86%, the weight of 18-month steers is more by 3.74%; absolute gain is higher by 2.98% and 3,83%; average daily weight gain is more by 2.98% and 3.82%; relative growth rate is higher by 1.7% and 1.04%, respectively.

It should be noted that indicators of live weight and liveweight gain of bull calves are higher than those of heifers.

As the final weights at different ages were studied, it is natural to compare the average daily liveweight gain and relative growth rate. Thus the average daily gain of heifers was slightly lower than that of bull calves by 164,91 g for the first generation , by 171,56 g for the second generation, by 177,51 g for the third generation.

Thus, growth and development indicators for young cattle of the first, second and third Russian generations show the usual processes of adaptation of Hereford cattle populations imported from Australia.

CONCLUSION

1. The studies found that indicators of body temperature, respiratory frequency and heart rate are within physiological norms. During animal acclimatization there is a decrease in the adaptation index, optimization of ratios and indices characterizing an adaptive power of animals to high and low temperatures. This proves that conditions of sharp continental climate don't cause strong stress response to changes in living conditions.

2. The received results of morphological and biochemical blood composition of the imported cattle were within the physiological standards.

3. The studied reproductive qualities of Hereford cows of foreign selection in conditions of the Southern Urals during the first three years of keeping are within the physiological standards. They increase a little by the third year of acclimatization that proves certain adaptation flexiblity of livestock.

4. Growth indicators of young cattle of the first, second and third Russian generations indicate common adaptation processes of the cattle imported from Australia.

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