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Meat cattle breeding in Ukraine (climate impact, breeding features, efficiency improvement strategies)

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Abstract. Ten breeds of meat and combined productivity are bred in Ukraine, of which six are cross-border breeds and four are Ukrainian breeds developed through combination crossbreeding of local breeds with cross-border breeds. These breeds are located in different natural and climatic and agricultural zones, so it is important to investigate the indicators of meat productivity of breeds

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and the factors that influence them. The purpose of the study was to determine the influence of the breed, agricultural climate zone (zone) and calendar year (year) on the studied characteristics of meat cattle and to evaluate statistical indicators of relationships between them. To achieve this goal, the study applied the methods of multivariate analysis of variance, correlation and regression analysis. The indicators of efficiency of beef cattle production are: 1) live weight of cows after the third calving and older; 2) milk yield of cows after the first calving, which is defined as the live weight of a calf at day 210 after birth; 3) milk yield of cows after the third calving and older. It has been established that the flat landscape of Ukraine has a moderately continental climate, with five agricultural climatic zones: 1) severely arid; 2) moderately arid; 3) insufficient moisture; 4) sufficient moisture; 5) excessive moisture. These zones differ in the amount of precipitation, reserves of productive moisture in the soil, temperature fluctuations over the periods of the year, and have a certain potential to provide livestock with feed resources, especially in summer. The perspective is considered to be the keeping of animals in compost barns in winter, which meets the requirements of animal welfare and ensures high growth rates for fattening beef cattle. The practical significance of the results obtained lies in the possibility of taking into consideration the influence of the breed, agricultural climate zone, and calendar year on the meat cattle characteristics under study, as well as the possibility of predicting the values of some indicators of meat productivity based on the values of others

Keywords: meat cattle; red meat; milk yield; agricultural climatic zones; degree of influence; efficiency assessment; technology of maintenance

Introduction

According to S.Y. Ruban *et al.* (2021) and P.L. Greenwood (2021), declining pastures and environmental constraints continue to put pressure on beef producers worldwide, leading to a search for more efficient production systems. Chicken is gradually replacing other types of meat due to the low price, which is conditioned by the lower cost of industrial production. The average level of meat consumption per capita in North America is 78.6 kg, up to 52.1 kg in Europe and 9.6 kg in the African continent (Statista, n.d.). Beef remains an important source in the human diet for providing macro- and micro-elements in an easily accessible form, which includes haem iron, zinc, selenium, and vitamins D and B. In countries with a high standard of living, according to S. Hongbing & C.M. Weaver (2021), there is a prevalence of Fe-deficient anaemia, which leads to poor health, especially among women and children. Thus, an increase in the level of iron deficiency anaemia in the United States over the past almost 20 years is associated with a decrease in the concentration of Fe in food and a change in the diet itself. It is noted that beef consumption has recently decreased by 15.3% (the main source of haem iron), and chicken meat consumption has increased by 21.5%, which has negatively affected people's health. In recent years, in the meat balance of an ordinary resident of Ukraine, 27 kg is occupied by poultry meat, 19.8 kg – pork, 7.4 kg – beef, 1.5 kg – meat of other types, which with a total consumption of 55.7 kg is not enough for a medically valid norm of 80 kg, where beef should occupy 39% or 31.3 kg of physical weight (Ruban *et al.*, 2021).

The only way to achieve the above indicators is the development of a specialised branch of beef cattle breeding, which is based on the seasonal use of pastures in various agricultural and climatic zones of Ukraine, and education of potential consumers about the importance of consuming "red meat", which primarily includes beef.

Beef cattle breeding is popular in most regions of Ukraine with the possibility of using pastures and especially in areas with sufficient moisture. Most breeding farms plan to breed a new generation of calves in the shortest possible time (seasonally), which falls at the end of the first and beginning of the second quarter of the calendar year, which allows using cheap natural forage land in the summer. Thus, the mating season usually falls on August-October, when 83% of females use natural mating, and about 17% are artificially inseminated, as noted by O.M. Jukorskiy *et al.* (2023). A low level of artificial insemination occurs in farms of Dnipropetrovsk, Odesa, Rivne, and Chernivtsi oblasts. In natural mating, the average load per bull is 32 of breeding cows. Most calves are born in the spring, which are weaned from their mothers at 5-7 months. According to the researcher, pasture keeping of livestock in most climatic zones of Ukraine is used from April to November and is stopped under appropriate conditions when the height of basal plant remains averages from 5 to 8 cm. The duration of grazing in breeding farms ranges from 150 to 270 days, and the shortest duration is observed in farms of severely and moderately arid zones of Donetsk (150 days), Odesa (170-210 days), and Kherson (180-200 days) oblasts. The longest grazing time (235-270 days) is carried out in farms of the Lviv Oblast, which belongs to the agroclimatic zone of sufficient moisture (Pankeev & Liashevska, 2020).

According to J.B. Glaze (2019), 38% of U.S. farmers who breed beef cattle use crossbreeding with other breeds. Thus, R. Favero *et al.* (2019) indicate that the use of crossbreeding in beef cattle breeding can significantly increase the productivity characteristics and quality of carcasses. The more advanced beef industries in the United States and Australia maintain a high level of flexibility in production options, especially in the face of constant climate change. The selection of breeds and use of various crossbreeding options for cattle, including feed supply, allow adapting cattle breeding to economic and environmental challenges (Greenwood, 2021).

According to S.A. Berça *et al.* (2021), successful pasture management and feed waste management practices minimise environmental, social impacts, and guarantee resource savings. S.A. Terry *et al.* (2021) note that diet modification and genetic selection have led to better results of beef cattle breeding, although flexible management methods, considering the unique ability of ruminants to use pasture in different environmental conditions, and the simultaneous production of high-quality protein, are the main advantage of this industry. Recently, considerable attention in beef cattle breeding has been paid to indicators of feed efficiency. According to P.V.B. Ramos *et al.* (2024), feed efficiency plays an important role in the overall profitability and sustainability of the cattle breeding industry, as it is directly related to reducing animals' need for input resources and reducing methane emissions. The use of new technological approaches and an efficient feeding system in the beef cattle breeding of Ukraine, especially in winter, is partially "borrowed" from farms that are engaged in breeding dairy cattle. Thus, keeping animals on long-term litter, or compost cowsheds with feeding in the middle of the room, is becoming very popular among farmers. In addition, global experience of regional genetic improvement programmes, grazing systems depending on landscape characteristics, and housing is considered (Greenwood, 2021).

Thus, the analysis of the state of meat cattle breeding in Ukraine with an assessment of the impact of the main natural and human-organised factors on the efficiency of the industry is of constant interest with options for finding effective approaches to stable production of highly valuable food products. The purpose of the study was to determine the influence of the breed, agricultural climate zone (zone) and calendar year (year) on the studied traits of beef cattle and to evaluate statistics of relationships between them.

Materials and Methods

The research material was based on the data from the State register of breeding subjects in animal husbandry for 2019-2022 (State register of breeding subjects..., n.d.). Zonally, the enterprises included in the State register of breeding subjects in animal husbandry were located in different agricultural and climatic zones. In total, in the conditions of the sharp continental climate of Ukraine, there are five agricultural and climatic zones, each of which is characterised by its own characteristics (Table 1).

Table 1. *Main characteristics of agricultural and climatic zones of Ukraine*

Agroclimatic characteristics	Agroclimatic zones				
	severely arid	**moderately arid**	**insufficient moisture**	**sufficient moisture**	**excessive moisture**
Agroclimatic resources for the growing season of plants					
Sum of active temperatures °C	3,000 – 3,700	2,800 – 3,200	2,400 – 3,000	2,400 – 2,800	2,400 – 2,600
Precipitation during the warm period (mm)	200 – 280	250 – 300	260 – 320	300 – 380	360 – 430
Duration of the active growing season (days)	175 – 190	170 – 185	160 – 180	160 – 175	150 – 170
Duration of the frost-free period on the soil surface (days)	155 – 210	135 – 180	135 – 160	140 – 170	135 – 160
Agro-hydrological resources					
Productive moisture reserves in a metre layer of soil (mm)	110 – 160	120 – 160	140 – 200	160 – 220	180 – 260
Adverse and natural meteorological events					
Repeatability of atmospheric drought,%	40 – 55	35 – 45	20 – 40	10 – 30	8 – 12
Number of days with dry weather	1 – 20	16 – 20	9 – 15	1 – 10	0 – 4
Number of days with a thaw in winter	50 – 70	30 – 60	30 – 55	40 – 55	40 – 50

Source: developed by the authors based on Maps of Ukraine (n.d.); APK Inform (n.d.); The National Centre for Biotechnology Information (n.d.)

Depending on the region of location, farms were assigned to the five specified agricultural and climatic zones, with breed and livestock productivity data recorded (Table 2).

Table 2. *General data on the distribution of farms and the corresponding number of cows of different breeds depending on agricultural and climatic zones*

Agricultural and climatic zones	Region (oblast) that is part of the agroclimatic zone	Number of farms*	Main breeds
Severely* arid	Kherson, Zaporizhzhia, Autonomous Republic of Crimea	2	Southern Meat, Ukrainian Grey
Moderate	Kharkiv, Luhansk, Odesa, Dnipropetrovsk, Donetsk, Mykolayiv,	6	Southern Meat, Ukrainian Grey, Blonde d'Aquitaine, Ukrainian Meat

Table 2. Continued

Agricultural and climatic zones	Region (oblast) that is part of the agroclimatic zone	Number of farms*	Main breeds
Insufficiently moistened	Sumy, Vinnytsia, Cherkasy, Poltava, Kirovohrad,	4	Aberdeen-Angus
Sufficient moisture	Volyn, Rivne, Zhytomyr, Kyiv, Chernihiv, Lviv, Ternopil, Khmelnytskyi,	36	Aberdeen-Angus, Volynian Meat, Polissian Meat, Limousin, Charolais, Simmental
Excessive moisture	Ivano-Frankivsk, Chernivtsi,	3	Simmental, Aberdeen-Angus, Polissian Meat

Note: Farm data was considered for the last four years (2019-2022)
Source: developed by the authors

For the analysis, traits characterising the efficiency of beef cattle breeding (main productive traits) over the past four years were taken, namely: 1) live weight of cows after the third calving and older; 2) milk yield of cows after the first calving, which was defined as the live weight of a calf at 210 days of life after birth; 3) milk yield of cows after the third calving and older.

Analysis of variance of the influence of the breed, agricultural climate zone of breeding, and calendar year on the main productive characteristics was carried out using a linear model:

$$y_{ij} = a_i + b_j + c_k + e_{ij}, \quad (1)$$

where y_{ij} – alternate by year values based on: 1) live weight of cows after the third calving and older; 2) milk yield of cows after the first calving; 3) milk yield of cows after the third calving and older, belonging to the i-th breed in the j-th breeding zone, c_k- certain year; a_i – effect of the i-th breed; b_j – effect of the j-th climate zone; c_k – effect of the k-th year; e_{ij} – residue.

The degree of influence of factors on the studied traits of beef cattle was calculated by the equation:

$$\eta 2 = \left(\frac{SSA}{SSD}\right) \cdot 100\%, \quad (2)$$

where *SSA* – sum of the squares of deviations due to the influence of the factor; *SSD* – total sum of the squares of deviations.

Statistical analysis (descriptive statistics, analysis of variance, correlation and regression analysis) was performed using RStudio software.

Results

The most popular breeds in Ukraine are Aberdeen-Angus, Polissian Meat, Volynian Meat, and Limousin (Table 4), which indicates the high adaptability of these breeds to different agro-climatic zones. According to the average live weight of cows after the third calving and older, high rates were observed for such breeds as Charolais, Simmental, Hereford, and Volynian Meat (Table 4).

At of the beginning of 2023, there were 1.32 million cows in Ukraine, and according to the State register of breeding subjects in animal husbandry for a number of years (State register of breeding subjects…, n.d.), the breeding stock of beef cattle is concentrated in more than 70 farms, where four domestic breeds created by crossbreeding are kept (Table 3, Fig. 1), and four cross-border beef breeds and one of dual-purpose productivity (Fig. 2).

Table 3. List of beef breeds bred by combination crossing in Ukraine in recent years

Breed	Breeds involved in the crossbreeding		Region of breeding
	Local	Cross-border	
Volynian Meat	Black-and-White, Polish Red	Aberdeen-Angus, Hereford, Limousin	West of Ukraine, Polissia
Southern Meat	Red Steppe	Hereford, Charolais, Santa Gertrudis, Siboney de Cuba	East and South of Ukraine
Polissian Meat	Simmental, Ukrainian Grey	Charolais, Chianina, Angus	West of Ukraine Polissia
Polissian Meat (Znamiankaintrabreed group)	Red Steppe	Simmental, Aberdeen-Angus, Charolais	Chernihiv Oblast
Ukrainian Meat	Ukrainian Grey	Charolais, Chianina, Simmental	Central regions of Ukraine

Source: developed by the authors

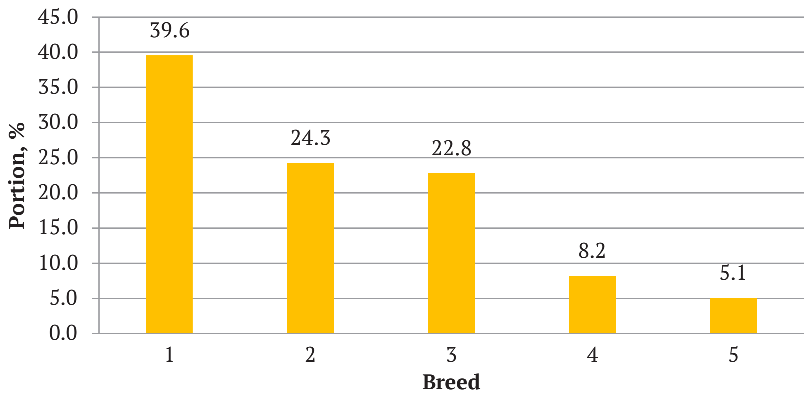

Figure 1. Share of breeding cows of domestic beef and native breeds in Ukraine

Note: 1 – Polissia Meat breed; 2 – Volynian Meat; 3 – Southern Meat; 4 – Ukrainian Grey (native breed); 5 – Ukrainian Meat, (total number of cows is 3,258 units)

Source: (State register of breeding subjects..., n.d.)

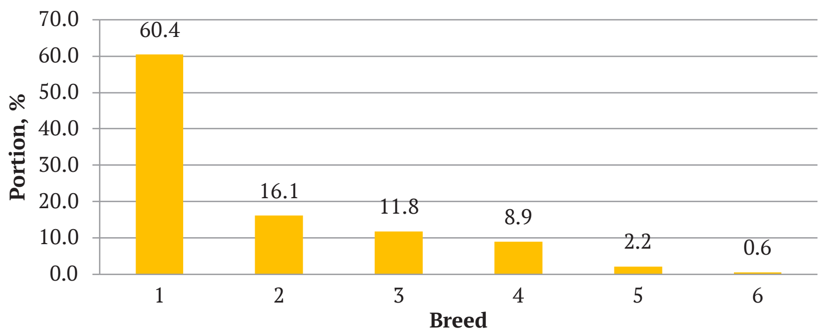

Figure 2. Share of breeding cows of cross-border meat and combined breeds in Ukraine

Note: 1 – Aberdeen-Angus; 2 – Limousin; 3 – Charolais; 4 – Simmental (combined breed); 5 – Hereford; 6 – Blonde d'Aquitaine (total number of cows is 6,650 units)

Source: (State register of breeding subjects..., n.d.)

Such cross-border breeds as Aberdeen-Angus, Hereford, Limousin, Blonde d'Aquitaine, Charolais, and Simmental are generally recognised in the world, exceeding Ukrainian breeds in terms of total number and productivity due to more intensive breeding and a larger total number not only in farms of Ukraine, but also abroad. The general descriptive statistics are presented in Table 5 and indicate the influence of a wide range of genetic, environmental and organisational factors (keeping conditions) on the dynamics of variability of productive traits. The average milk yield after the third calving and older slightly exceeded the average milk yield after the first calving, but the latter value was characterised by greater variability (Table 5).

Table 4. *Main productivity traits of breedingood cows by breed*

Breed	Indicators				
	number of cows, head	**number of farms**	**average milk yield of cows, after the first calving, kg**	**average milk yield of cows, after the third calving and older, kg**	**average live weight of cows after the third calving and older, kg**
Aberdeen-Angus	4,017	16	197.5	212	548.5
Volynian Meat	793	3	216.5	222.5	581
Hereford	145	1	225	228	587
Limousin	1,065	5	220	235.5	562.5
Southern Meat	743	4	200.5	230	515
Polissian Meat	1,290	7	215	224	570.5
Grey Ukrainian	266	2	166	176	538
Blonde d'Aquitaine	43	1	206	216	550
Simmental	594	4	218	224	610
Ukrainian Meat	166	1	208	216	566
Charolais	786	4	235	251	628
Total by breed:					
– cross-border	6,650	31	217.0	227.8	581.0
– Ukrainian	3,258	17	201.2	213.7	554.1

Source: developed by the authors

Table 5. *Descriptive statistics of the traits under study (total sample size – 9.908 animals)*

Indicator	N*	M ± m	σ^2	σ	Cv, %
Average live weight of cows after the third calving and older, kg	46	571.04±6.67	2,046.66	45.24	7.9
Average milk yield after the first calving, kg	43	210.21±2.55	280.69	16.75	8.0
Average milk yield after the third calving and older, kg	46	223.67±2.40	265.56	16.30	7.3

Note: N – number of farms in the total sample, M – mean, m – standard error of the mean, σ^2 – variance, σ – standard deviation, Cv – coefficient of variability
Source: developed by the authors

The general results of the influence of such fixed factors as "Breed", "Agricultural climate zone", and "Year" on the studied indicators of meat cattle are given in Table 6.

Table 6. *Influence of the breed, agricultural climate zone (zone), and calendar year (year) on the beef cattle traits under study*

Factor, trait	Sum of squares of deviations	Number of degrees of freedom	Average square of deviations	Fischer's F-test	η^2, %
Average live weight of cows after the third calving and older					
Breed	37,050	11	3,368	8.44***	35.0
Zone	5,600	4	1,400	3.51**	5.3
Year	3,876	3	1,292	3.24**	3.7
Residue	57,020	143	399		
Average milk yield after the first calving					
Breed	6,791	11	617	19.90***	56.6
Zone	432	4	108	3.48**	3.6
Year	321	3	107	3.45**	2.7
Residue	4,446	142	31		
Average milk yield of cows for the third calving and older					
Breed	6,911	11	628	27.30***	58.7
Zone	756	4	189	8.22**	14.7
Year	345	3	115	5.0**	3.1
Residue	3,178	141	23	11,190	

Note: *** – P>0.999, ** – P>0.99

Source: developed by the authors

It was found that all the studied factors significantly affect the productivity traits, with the greatest effect of the "Breed" factor: the degree of influence ranged from 35% (average live weight of cows after the third calving and older) to 58% (average milk yield of cows after the third calving and older). The "Zone" factor is less influential: from 3.6% (average milk yield after the first calving) to 14.7% (average milk yield for cows after the third calving and older). The least influential factor was "year" or fluctuations by year, with the degree of influence from 2.7% (average milk yield after the first calving) to 3.7% (average live weight of cows after the third calving and older). Thus, the correct choice of breed mainly determines the success of beef cattle breeding ahead of natural fluctuations, which is caused by the creation of more comfortable conditions for housing both young and adult cattle.

In recent years, farms that raise livestock use the technology of housing on straw bedding (Fig. 3) when, regardless of weather conditions and time of year, it is possible to reduce the negative impact of weather on the growing process, with stable productivity traits. Such a system involves combining a pasture system and a system of loose housing in comfortable premises with ensuring the comfort of animals during the summer heat or winter cold.

Additionally, the relationship between the average live weight of cows after the third calving and older, the average milk yield after the first calving, and the average milk yield after the third calving and older were estimated (Table 7).

Figure 3. Fragment of a room for housing young animals on fattening with the use of straw bedding in the recreation area and a feed table for feeding (Terezine agricultural enterprise)
Source: photo taken by the authors

Table 7. *Coefficients of correlation between the traits under study*

Indicators		Average live weight of cows after the third calving and older, kg	Average milk yield after the first calving, kg
Average milk yield after the first calving, kg	n	43	
	r	0.5225	
	m_r	0.1332	
	t	3.9241***	
Average milk yield after the third calving and older, kg	n	46	43
	r	0.3965	0.8164
	m_r	0.1384	0.0902
	t	2.8653**	9.0529***

Note: n – number of observations, r – correlation coefficient, mr – standard error of the correlation coefficient, t – probability criterion of the correlation coefficient, ** – P > 0.99, *** – P > 0.999
Source: developed by the authors

The values of the coefficients of correlation were significant, since the closest positive relationship was between the average milk yield after the first calving and the average milk yield after the third calving and older. This indicates a high repeatability of the milk production of cows with a larger live weight, which is what the selection system in breeding farms is aimed at. The lowest coefficient of correlation was between the average live weight of cows after the third calving and the average milk yield after the third calving and older. Coefficients of regression between the studied traits were calculated, which reflect the rate of change of one trait when another changes (Table 8).

Table 8. *Coefficients of regression between the traits*

Influencing indicator	Dependent indicator	$b \pm m_b$
Average milk yield after the first calving, kg	Average live weight of cows after the third calving and older, kg	$1.41095 \pm 0.3719^{***}$
Average milk yield after the first calving, kg	Average milk yield after the third calving and older, kg	$0.79411 \pm 0.0907^{***}$
Average milk yield after the third calving and older, kg	Average live weight of cows after the third calving and older, kg	$1.10088 \pm 0.3842^{**}$

Note: b – regression coefficient, mb – standard error of the regression coefficient, ** – P > 0.99, *** – P > 0.999
Source: developed by the authors

All coefficients of regression are significant. The obtained coefficients of regression allow simulating changes in the main productive traits over time according to the following trends:

- an increase in the average milk yield of cows after first calving by 1 kg leads to an increase in the average live weight of cows after calving and older by 1.41095 kg;
- an increase in the average milk yield of cows after first calving by 1 kg leads to an increase in the average milk yield after the third calving and older by 0.79411 kg;
- an increase in the average milk yield of cows after the third calving and older by 1 kg leads to an increase in the average live weight of cows after the third calving and older by 1.10088 kg.

The assessment helped to identify the degree of influence of environmental factors (agricultural climate zone, fluctuations by year) and genetic factors (breed) on the efficiency of cattle breeding, which affects the overall dynamics and number of breeds. The perspective is considered to be the housing animals in premises that meet the requirements of animal welfare and provide high growth rates for fattening. The results of the conducted research indicate that the traits of meat productivity (the average live weight of cows after the third calving and older), and the maternal qualities of cows of beef breeds (the average milk yield after the first calving and after the third calving and older) depend on both genetic factors (breed) and environmental factors (agricultural climate zone and calendar year). This conclusion is in line with the findings of A.E.O. Malau-Aduli *et al.* (2022), who, based on beef cattle data from Northern Australia, found that both feeding conditions and genetics influence meat quality, and manipulating these factors can contribute to achieving the desired properties of beef, including softness, taste, juiciness, meat yield, and marbling.

Correlation and regression analysis showed the presence of probable phenotypic relationships both between traits of milk yield of cows at different ages and between indicators of milk yield and live weight. According to J.B. Mulliniks *et al.* (2020) selection for increased dairy productivity in cattle increases calf weight at weaning, however, the response to selection varies greatly under different environmental conditions. The researchers note that constant selection for milk synthesis in beef cows is aimed at increasing calf weight during weaning, but increases food stress during critical physiological periods such as early lactation (the period of early suckling), and ultimately negatively affects the level of reproduction, which increases the productive costs of both maintaining productivity and the level of reproduction. In addition, selection for high milk yield can have a long-term negative impact on the feed efficiency after weaning.

According to S.Y. Ruban *et al.* (2021), in recent years, the system of housing cattle on straw bedding has gained popularity in a number of countries. The cows are provided with free space for movement in the recreation area, rather than being kept tethered. In the recreation area, the surface mixture of organic bedding and bovine excrement is mixed 1-3 times a day, absorbing fresh manure, which contributes to the aerobic composting process, as confirmed by L. Leso *et al.* (2020), D.T. Eberl *et al.* (2024). Such a system functions well when the optimal density of animals in the zone of free movement ranges from 7.4 to 15 m^2/cow depending on several climatic zones, litter type, herd management, and cow breed. The data by S.Y. Ruban *et al.* (2021) proved that compost litter, compared with conventional systems, has the potential to improve the well-being of cows, improve rest comfort and feet health, and promote the production of high-quality organic fertilisers.

According to F.A. Damasceno *et al.* (2022) the compost cowshed management system is relatively simple but "tied" to a specific climate zone and provides thermal comfort, especially in winter, and better hygiene conditions for animals. Wood waste was the most optimal material for bedding, and the level of contamination with *E. coli,Bacillus* and *Streptococcus* were observed in bedding with a lower moisture content. According to research by B. Yameogo *et al.* (2021) conducted during the wet winter season in Brazil, when one compost cowshed (A) was closed using ventilation of horizontal aerodynamic shafts that created negative pressure, and the second (B) with open natural ventilation, without curtains but with fans in the recreation area, which proved the advantage of the first cowshed (A).

According to P.R.F. Adkins *et al.* (2022), the relationship of the housing conditions with the level of bacteria on the teats of animals and bedding proved that long-unchanged bedding with its aeration mode provides less bacterial contamination compared to other housing technologies. According to U. Emanuelson *et al.* (2022), analysis of 32 dairy herds in different climatic zones of Europe, found that herds with a housing system on compost had fewer veterinary problems.

As stated by C. McManus *et al.* (2021), the possibility of creating a gene bank for cattle of beef breeds based on their adaptability to specific environmental conditions (ambient temperature, humidity, precipitation, altitude, and feed production) is of great importance, because it helps to increase the adaptation of beef cattle to certain climatic zones and climate changes in general. Considering the supply of a sufficiently large amount of crop residues (straw) in Ukraine in the production of grain, the combination of housing cattle on compost litter in winter with grazing in summer, allows producing meat cattle products at a fairly low cost, providing fairly comfortable conditions for animals in terms of their well-being and health.

According to G. Di Vita *et al.* (2024), despite the significant role of beef in the European agri-food industry, its intensification is changing environmental sustainability, which is the goal of general agricultural policy in the near future. Balancing the importance of the industry and its sustainability is crucial. The goal is to identify environmentally friendly practices that are consistent with the best efforts to protect the environment in agricultural settings in the European Union and Ukraine.

The results showed that the best models, regardless of climate zones, show significant differences in terms of agricultural intensity, geographical distribution, and economic profitability, highlighting a certain polarisation between economic and environmental sustainability.

Conclusions

The analysis of live weight and milk yield traits of cows of the main meat breeds of Ukraine, whose livestock is concentrated in breeding farms, was carried out. The average milk yield after the third calving and older slightly exceeded the average milk yield after the first calving. The most popular breeds in Ukraine are Aberdeen-Angus, Polissian Meat, Volynian Meat, and Limousin, which indicates the high adaptive capabilities of these breeds.

The analysis of variance showed the significant influence of all the studied factors (breed, climate zone and year) on the signs of productivity of beef cattle, all the studied factors significantly affect the productivity traits, so the most influential factor is the breed: its degree ranges from 35% (average live weight of cows after the third calving and older) to 58% (average milk yield of cows after the third calving and older). The climate zone is less affected: from 3.6% (average milk yield after the first calving) to 14.7% (average milk yield for cows after the third calving and older). The least influential factor was "year" or fluctuations by year, with the degree of influence from 2.7% (average milk yield after the first calving) to 3.7% (average live weight of cows after the third calving and older).

Statistically significant estimates of coefficients of correlation between all the traits under study are established. The closest positive relationship was between the average milk yield after the first calving and the average milk yield after the third calving and older. A less close positive relationship is observed between the average live weight of cows after the third calving and older and the average milk yield after the first calving. The lowest correlation coefficient is found between the average live weight of cows after the third calving and the average milk yield after the third calving and older.

Regression analysis showed that the highest coefficient of regression was found between the average live weight of cows after the third calving and older and the average milk yield after the first calving. The coefficient of regression between the average live weight of cows after the third calving and older and the average milk yield for the third calving and older has a slightly lower value. All coefficients of regression are significant.

Further research may be related to the investigation of breed factors, climate zone, climatic features of the year on an expanded set of traits of the beef cattle industry where the technology of housing in compost cowsheds, especially in winter, will provide a compromise between economic and environmental sustainability.

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Conflict of Interest

The authors declare no conflict of interest.

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Анотація. В Україні розводять десять порід м'ясного та комбінованого напрямів продуктивності, з яких шість відносяться до транскордонних та чотири – українські породи, виведені на основі комбінаційного схрещування місцевих порід з транскордонними. Зазначені породи розміщені в різних природньо-кліматичних та аграрних зонах, таким чином вивчення показників м`ясної продуктивності порід та факторів, які на них впливають є актуальною темою досліджень. Метою дослідження було визначення впливу породи, аграрної кліматичної зони (зона) і календарного року (рік) на досліджувані ознаки м`ясної худоби, а також оцінка статистичних показників зв’язків між ними. Для досягнення поставленої мети використовували методи багатофакторного дисперсійного аналізу, а також кореляційний та регресійний аналізи. За показники ефективності ведення м’ясного скотарства взято: 1) живу масу корів після третього отелення і старше; 2) молочність корів за першим отеленням, яка визначається як жива маса теляти на 210 день життя після народження; 3) молочність корів за третім отеленням і старше. Встановлено, що в рівнинному ландшафті України визначають помірно континентальний клімат, з п’ятьма аграрними кліматичними зонами: 1) суворо посушлива; 2) помірно посушлива; 3) недостатнього зволоження; 4) достатнього зволоження; 5) надмірного зволоження. Ці зони відрізняються кількістю опадів, запасами продуктивної вологи в ґрунті, температурними коливаннями по періодах року, і мають певний потенціал забезпечення кормовими ресурсами худоби і особливо в літній період. Як перспектива розглядається утримання тварин в компостних корівниках в зимовий період, що відповідає вимогам добробуту тварин та забезпечує високі показники приросту на відгодівлі м’ясної худоби. Практична значимість отриманих результатів досліджень полягає в можливості врахуваннявпливу породи, аграрної кліматичної зони і календарного року на досліджувані ознаки м`ясної худоби, а також можливості прогнозування значень одних показників м`ясної продуктивності на основі значень інших

Ключові слова: м`ясна худоба; червоне м'ясо;молочність; аграрні кліматичні зони; ступінь впливу; оцінка ефективності; технологія утримання