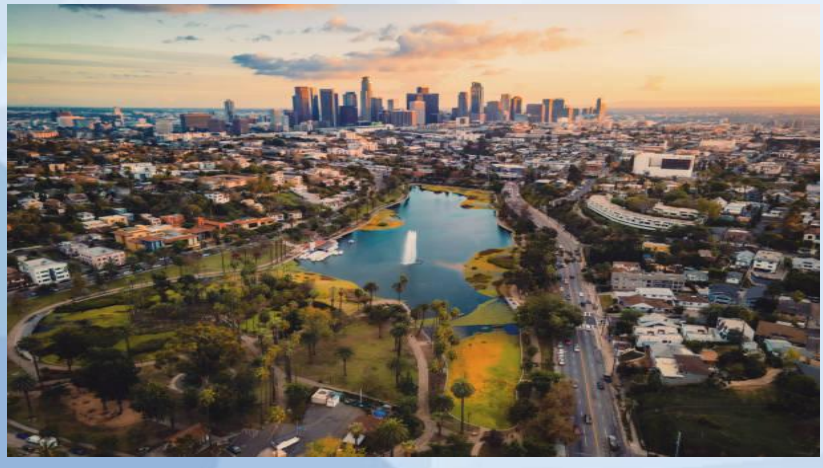
INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE

GLOBAL CHALLENGES AND INNOVATIVE SOLUTIONS IN THE DEVELOPMENT OF SCIENCE, EDUCATION, ECONOMY, AND SOCIETY: AN INTERDISCIPLINARY APPROACH

Book of abstracts



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SECTION 5

BIOLOGY AND BIOCHEMISTRY

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INFLUENCE OF CONSTITUTION TYPE ON ECONOMICALLY USEFUL TRAITS OF BROWN SWISS COWS

The body conformation traits of animals are primarily influenced by heredity, as well as by the way the organism responds to environmental conditions in which this heredity is expressed. Since constitution traits are inherited, they are of genetic and breeding significance in the selection and mating of animals [1, p. 16]. The exterior (type) traits of cattle are characterized by moderate to moderately high heritability, which in most cases ranges within $h^2 = 0.35–0.45$, ensuring the effectiveness of selection for these traits [2, p. 9; 3, p. 1; 5, p. 10]. The development of appropriate

methods and approaches that would yield practical results remains a promising direction with significant production value [4, p. 261].

The aim of the study was to determine selection parameters for the selection of cows according to constitution types defined by the volumetric-weight coefficient.

Materials and methods of research. The study was conducted at LLC MVK "Yekaterinoslavskyi" in the Dnipropetrovsk region. Animals were grouped taking into account breed, age, physiological condition, and number of lactations. The total experimental population consisted of 77 animals, which were analogues in terms of age and physiological status. The method of differentiating cows into constitution types using the volumetric-weight coefficient was developed by Professor Chernenko O.M. Cows were classified based on a deviation of 0.67σ from the mean value of the VWC in the studied group into large-, medium-, and small-volume constitution types. Body measurements were taken using a measuring stick in Brown Swiss cows at 2–4 months of lactation after the second calving: chest width behind the shoulder blades; chest depth behind the shoulder blades; chest width at the level of the last rib; chest depth at the level of the last rib; and thoracic region length.

The volumetric-weight coefficient (VWC) provides an indication of the ratio between the chest volume (in liters) and the live body weight of the animal and is calculated using formula (1):

$$VWC = \frac{h \times (S_1 + \sqrt{S_1 S_2} + S_2)}{BV \times 3000} \quad (1)$$

where VWC – volumetric weight coefficient, L/kg; *h* – chest length, cm; S_1, S_2 – cross-sectional areas of the chest at the shoulder blades and at the last rib, respectively, cm². $S = \pi \times r_1 \times r_2$, where π is the π constant; r_1 and r_2 are half of the chest depth and chest width, respectively; BW is body weight, kg.

The volume of the thoracic region is calculated using formula (2) for the volume of a truncated cone: $V = \frac{h}{3} \times (S_1 + \sqrt{S_1 S_2} + S_2)$ (2)

where V is the volume of the thoracic region (cm³) or (L) when divided by 1000; h is the chest length, cm; S_1 is the cross-sectional area of the chest behind the shoulder blades, cm²; S_2 is the cross-sectional area of the chest at the level of the last rib, cm².

The obtained research results were statistically processed, and the significance of differences between indicators was evaluated using Student's t-test.

Results of the study. It was established that the conditional volume of the thoracic region was higher in animals of the large-volume and medium-volume constitution types compared to the small-volume type by 119 L and 72.1 L, respectively, with $p < 0.001$ in both cases. Due to the fact that live body weight differed within 3%, no statistically significant intergroup differences were found, while the volumetric-weight coefficient was higher in the large-volume and medium-volume types compared to the small-volume type by 0.18 L/kg and 0.11 L/kg, respectively, with $p < 0.001$ in both cases (Table 1).

1. Chest measurements and live body weight in Brown Swiss cows

Thoracic measurements	Types of constitution in cows					
	large-volume type, *n*=18		medium-volume type, *n*=42		small-volume type, *n*=17	
	X ± SE	*Cv,%*	*X ± SE*	*Cv,%*	*X ± SE*	*Cv,%*
Chest depth behind the shoulder blades, cm	75.5 ± 0.77***	4.3	73.4± 0.62***	5.2	68.2± 0.88	5.9
Chest width behind the shoulder blades, cm	48.7 ± 0.74**	6.5	48.1± 0.39**	5.4	43.6± 0.88	7.5
Chest depth at the level of the last rib, cm	82.7 ± 0.88***	5.2	79.9± 0.95***	7.3	67.2± 0.98	7.8
Chest width at the level of the last rib, cm	65.2 ± 0.91***	6.5	59.5± 0.77*	8.4	55.4± 0.85	6.1
Chest length, cm	109.7 ± 1.03***	4.1	105.3± 0.73***	4.7	99.8± 1.05	4.5
Cross-sectional area of the chest behind the shoulder blades, cm^2	2886.4 ± 57.31***	8.5	2771.5± 32.64**	7.7	2478.8± 92.27	10.2
Cross-sectional area of the chest at the level of the last rib, cm^2	4232.8 ± 80.31***	8.3	3731.9± 64.11***	9.1	2922.5± 52.12	8.1
Conditional volume of the chest section, L	388.5 ± 7.35***	9.4	341.2± 6.41***	8.7	269.1± 7.37	10.1
Live weight, kg	630.4 ± 17.22	11.3	637.7± 11.31	8.9	625.5± 13.15	8.6
Volume-to-weight coefficient, L/kg	0.61 ± 0.007***	5.2	0.54± 0.006***	4.9	0.43± 0.009	6.8

Note: * – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$ compared to the low-volume group.

The large-volume and medium-volume constitution types of cows exceeded the small-volume type in milk yield by 2,113 kg and 1,367 kg, respectively ($p < 0.01$ and $p < 0.01$, respectively). These constitution types also demonstrated a higher milk fat yield compared to the small-volume type by 82.8 kg and 51.1 kg ($p < 0.001$ and $p < 0.01$, respectively), as well as a higher milk protein yield by 68.5 kg and 43.3 kg, respectively (Table 2).

2. Milk productivity of Brown Swiss cows (second lactation)

Trait	Types of constitution in cows					
	large-volume type, *n*=18		medium-volume type, *n*=42		small-volume type, *n*=17	
	$\overline{X} \pm S_{\overline{X}}$	*Cv,%*	$\overline{X} \pm S_{\overline{X}}$	*Cv,%*	$\overline{X} \pm S_{\overline{X}}$	*Cv,%*
Milk yield for 305 days of lactation, kg	10218 ± 218.7***	11.3	9472 ± 208.1**	10.5	8105 ± 258.6	12.8
Milk fat content, %	3.88 ± 0.017	3.8	3.85 ± 0.012	3.9	3.87 ± 0.019	4.1
Milk fat yield, kg	396.4 ± 8.43***	10.7	364.7 ± 7.82**	8.9	313.6 ± 13.46	11.3
Milk protein content, %	3.24 ± 0.019	3.5	3.23 ± 0.013	3.8	3.24 ± 0.022	3.7
Milk protein yield, kg	331.1 ± 8.60***	9.9	305.9 ± 7.17**	8.3	262.6 ± 12.05	10.4
Milk production coefficient, kg	1623.7 ± 49.28***	11.6	1485.3 ± 33.29***	10.5	1295.7 ± 44.72	12.4

The milk production coefficient was higher in large-volume and medium-volume animals compared to small-volume animals by 328 kg and 189.6 kg, respectively ($p < 0.001$). Analysis of reproductive performance data (age at first insemination, age at first calving, service period length, dry period length, and calving interval) showed that there were no statistically significant differences between constitution types. Thus, the constitution type determined by the volumetric-weight coefficient does not have a significant effect on reproductive performance traits.

Conclusion:

For the intensification of milk production and the effective realization of the genetic potential of Brown Swiss cattle, it is recommended to use the

volumetric-weight coefficient (VWC) as a selection parameter for cows at a level not lower than 0.46 L/kg. This ensures an increase in milk yield by more than 1,300–2,100 kg during the second lactation compared to small-volume contemporaries, as well as an increase in the total yield of milk fat and protein without deterioration of reproductive performance indicators. It also complements the visual assessment of constitution with a tool based on morpho-functional characteristics of animals.

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