The inbreeding pattern by generation and its effect on milk yield, growth, and reproductive traits in Guzerá cattle

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Mating among individuals who share at least one common ancestor raises on the inbreeding rate, consequently increasing the loss of genetic variability and the likelihood of homozygosity for deleterious recessive alleles in the population. Thus, the control of inbreeding levels is important to minimize unfavorable effects on fitness and traits of economic interest. This study aimed at evaluating the progress of inbreeding coefficients (F) and their effects on the milk, growth, and reproductive phenotypes of Guzerá cattle over time. Wright's F is defined as the probability that an individual has two identical alleles by descent. Information from 172,825 animals from 17 generations, born between 1956 and 2019, was used. The traits studied were: 305-day milk yield at first lactation (MY305, kg); age at first calving (AFC, days); body weight in kg at the ages of 210 (W210); 365 (W365); and 450 (W450) days; scrotal perimeter at the ages of 365 (SP365, cm); and 450 (SP450, cm) days. The inbreeding trend over generations and the inbreeding effects on the phenotypes were obtained by linear regression, with a significance level of 5%. Additionally, animals were classified into three groups, according to the phenotype data available: beef (growth traits), dairy (milk traits), and dual-purpose (both traits), as an assumption about the production system to which they belonged. The F effects were evaluated within these groups. The percentage of animals within beef, dairy, and dual-purpose groups was 96.68%, 1.70%, and 1.62%, respectively. A total of 74.1% of the animals were inbred. The mean F in relation to the established base population was 0.02 ± 0.04, ranging from 0 to 0.43. Only 3.84% of them had an F above 0.10. All the groups had a mean F equal to 0.02 ± 0.03. Dairy and dual-purpose herds originally came from beef herds, from where they continue to introduce animals into their herds, standardizing, therefore, the F. The mean F by generation ranged from 0.01 to 0.05. The equation that described the inbreeding coefficients trend over generations was $y = 0.0007 + 0.0022x$, i.e., there was a 0.2% increase in F per generation. For MY305 and AFC, the inbreeding effect was not significant ($p\text{-value}>0.05$). There was a significant effect ($p\text{-value}<0.0001$) of inbreeding on W210, W365, W450, SP365, and SP450. However, the effect was positive, indicating an increase in phenotypic values as F increased. The increase in phenotypic values can be attributed to the selection applied in the herds against undesired phenotypes as well as to the mating planning. Anyway, the population mean F was low and even with an increasing trend it might not yet have a negative effect on the phenotypic performance of animals for the analyzed traits. However, it should be emphasized that the increase in inbreeding could be higher than that obtained in this study and it should not be neglected in a breeding program.

Keywords: inbreeding coefficient, genetic variability, dual purpose, Zebu

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