

Genetic and phenotypic parameters for feed and water efficiency in Senepol cattle

The sustainability of beef production in the world demands the identification and selection of efficient animals that can produce more products with fewer inputs. Feed accounts for around 50-70% of variable costs of beef cattle systems, depending on the level of intensification adopted. Water has been traditionally considered an inexpensive, readily available, and renewable natural resource. However, growing concerns about the availability of drinkable water have increasingly pushed pressure on livestock production, especially cattle. Thus, we estimated genetic and phenotypic parameters for feed and water efficiency in Senepol cattle in order to evaluate their use as selection criteria. Records on 587 Senepol heifers, involved in performance tests, were used. Traits studied included residual feed intake (RFI), residual water intake (RWI), average daily feed intake (ADFI), average daily water intake (ADWI) and average daily gain (ADG). Individual daily feed and water intake records were collected over a 70-day period, using electronic feed and water bunks developed by Intergado Ltd. The ADG was calculated dividing the total weight gained during the test by its duration. A linear regression model of ADFI on metabolic weight (mean weight^{0.75}) and ADG was fitted. RFI was calculated as ADFI minus that predicted using the regression equation. The same was performed for calculating RWI by using ADWI instead of ADFI in the linear regression model. Genetic (co)variances were estimated using two-trait animal models and software AIREMLF90. Direct heritability estimates for RFI, RWI, ADFI, ADWI and ADG were 0.12 ± 0.10 , 0.39 ± 0.12 , 0.23 ± 0.11 , 0.47 ± 0.12 and 0.15 ± 0.09 (averaged across all analyses), respectively. RFI was genetically ($r_g = 0.50 \pm 0.65$) and phenotypically ($r_p = 0.37 \pm 0.04$) correlated with RWI. Both RFI and RWI presented phenotypic correlations near to zero with ADG ($r_p = -0.11 \pm 0.05$ and -0.09 ± 0.05 , respectively). Genetically, RFI was not correlated ($r_g = 0.06 \pm 1.12$) with ADG, whereas RWI was ($r_g = 0.45 \pm 0.79$). The correlations between the pairs RFI-ADFI and RWI-ADWI were all positive ($r_g = 0.68 \pm 0.91$, $r_p = 0.78 \pm 0.02$; and $r_g = 0.90 \pm 0.11$, $r_p = 0.84 \pm 0.01$, respectively). ADFI was positive correlated with ADWI ($r_g = 0.75 \pm 0.41$, $r_p = 0.57 \pm 0.03$), and both traits presented similar correlations with ADG ($r_g = 0.61 \pm 0.77$, $r_p = 0.28 \pm 0.04$; and $r_g = 0.70 \pm 0.69$, $r_p = 0.29 \pm 0.04$, respectively). Genetic improvement for feed and water efficiency in Senepol cattle can be achieved through selection. Genetic progress for water efficiency is expected to be superior to the one for feed efficiency due to the former being 2-fold more heritable than the latter. Water intake and efficiency can be genetically improved by selecting animals for feed intake and efficiency.

Keywords: beef, correlation, heritability, residual feed intake, residual water intake, selection