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Design of selection strategies for cattle tick resistance using genomic information

Plotzki, PR[1,2]; Yokoo, MJ[4]; Boligon, AA[3]; Cardoso, FF[4,5]

[1]Mestranda do Programa de Pós- Graduação em Zootecnia – UFPel, Brasil; [2]Bolsista CNPq; [3]Professora adjunta – UFPel; [4]Pesquisador A - Embrapa Pecuária Sul; [5]Bolsista de Produtividade Nível [2] CNPq.

andrea.plotzki@hotmail.com

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The objective of this study was to compare different selection strategies to include resistance to ticks (RES) in the Delta G Hereford and Braford breeding program, using selection index (SI) theory. Besides RES, traits already considered in Delta G Index (IDG) were evaluated: pre-weaning gain (PWG), weaning conformation (WC), weaning precocity (WP), weaning muscling (WM), post-weaning gain (PWG), yearling conformation (YC), yearling precocity (YP), yearling muscling (YM) and scrotal circumference (SC). Genetic gain per generation (GG) was evaluated using seven different SI, the current IDG and six alternatives that included RES in the IDG with 10% or 53% relative weight, using traditional (EBV) or genomic (GEBV) breeding values. Accuracy of GEBV (r_{MG}) ranged from 0.1 to 0.9. The SI were: 1) Traditional IDG (EBV) (SI1); 2) 10% weight for RES (EBV) + IDG (EBV) (SI2); 3) 53% weight for RES (EBV) + IDG (EBV) (SI3); 4) 10% weight for RES using GEBV + IDG (EBV) (SI4); 5) 53% weight for RES (GEBV) + IDG (EBV) (SI5); 6) 10% weight for RES (GEBV) + IDG (GEBV) (SI6); 7) 53% weight for RES (GEBV) + IDG (GEBV) (SI7). The accuracy of the SI (r_{IH}) increased with increasing with r_{MG} for all strategies where GEBV were included in the index (SI4, SI5, SI6 and SI7). Changes in r_{IH} when altering r_{MG} were substantially large for SI6 and SI7 (from 0.12 to 0.96), which included genomic information for all traits in the index, compared with SI4 and SI5 (from 0.30 to 0.80), where GEBV was only considered for RES. In SI1, SI2 and SI3, where RES was selected based on EBV, lower r_{IH} (0.47) was observed as the weight on RES increased to 53%. Counting ticks and using EBV to select for RES would result in the same GG of a GEBV with r_{MG}=0.44, but animal would have to be exposed to parasite to obtain the phenotypic information. On the other hand, use of GEBV for RES with $r_{MG} \geq 0.5$ would result in higher values for r_{IH} ranging from 0.50 to 0.96, without the risks of parasitism. Nonetheless, when the weight of RES was only 10%, minimal genetic progress was obtained in standard deviations (SD) for this trait per generation (up to 0.12 and 0.07 when r_{MG}=0.90 for SI4 and SI6, respectively). Due to low correlation with other traits in IDG, substantial genetic progress for RES would only be achieved when this trait is the main focus of selection as in SI5 (GG=0.63 SD/generation, when r_{MG}=0.90) or SI7 (GG=0.57 SD/generation, when r_{MG}=0.90). In the study, focusing on selection for RES, the SI7 and SI5 are respectively the best scenarios of selection to develop resistant lines of cattle to tick parasitism.

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