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Economic values for sustainable dairy cattle breeding in the tropics: A focus on climate change responsive traits

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Abstract

The goal of this study was to estimate economic values for feed efficiency (FE), resilience (RE), adaptability (AD), and disease resistance (DR). The indicator traits that were used to measure; FE, RE, AD and DR were residual feed intake (RFI), variance deviations in milk yield, heat stress using milk reduction due to an increase in temperature humidity index (THI) by 1 and brucellosis disease resistance, respectively. A bio-economic model was developed in python using both simple profit functions and risk-rated profit models and was used to compute economic values for FE, RE, AD, and revise economic values for traits in the existing breeding goal, which included milk yield (MY), fat yield (FY), protein yield (PY), age at first calving (AFC), calving interval (CI), pre-weaning daily gain (DG), post-weaning daily gain (PDG), mature live weight (LW), pre-weaning survival rate (PSR), post-weaning survival rate (PWR), and productive lifetime (PLT). The economic value for brucellosis disease resistance was derived using selection index methodology. The risk-rated economic values for the climate change responsive traits were; KES -15.54, KES 47.37, KES 175.48, and KES -58.71 for FE, RE, AD, and DR respectively. The revised risk-rated economic values for the other traits were; KES 47.6, KES 132.8, KES 136.1, KES -334.9, KES -171.9, 8.3 g/day, 3.4 g/day, KES -30.8, 7.49%, 7.66%, and KES 63.9 for MY, PY, FY, AFC, CI, DG, PDG, LW, SR, PSR, and PLT respectively. The profits realised per year were; KES 705.71, and 77,473.70 for the current breeding goal (CBG) and climate change responsive breeding goal (CCRBG) respectively. These economic values indicate that inclusion of climate change responsive traits in breeding goal would increase response to selection of dairy cattle in the tropics.

Keywords: Bio-economic model, resilience, feed efficiency, disease resistance, adaptability