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“Bridging the gap between increasing knowledge and decreasing resources”

Genomics for Improved Productivity Within Developing Country Livestock Production Systems

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Abstract

The productivity of developing country livestock production systems lags well behind that of the developed world. Addressing this issue is one important route to poverty alleviation, improved food security and environmental sustainability (because, generally, the lower the productivity of livestock systems the higher the environmental impact per unit of product). Low productivity can be attributed to a number of inter-related factors including (depending on the system) high disease burdens and weak animal health-care systems, poor quality and insufficient animal feed, use of breed-types that are not optimal, and other social and economic constraints.

This paper describes how the rapidly developing field of genomics can contribute to improved productivity in developing country livestock production systems. Rather than attempt an exhaustive review, the paper focuses on selected promising applications, and it is understood that to achieve impact at scale any resultant intervention would need to be applied within a systems context.

In relation to improving animal health, two key applications of genomics stand-out: the use of genomics to identify genes or gene networks conferring disease resistance with the subsequent creation of new resistant breed-types by transgenic or genome editing approaches; and the use of genomics to better understand host-pathogen interactions and mechanisms of immunity, contributing to the development of new vaccines and therapeutics. On the ruminant feeding side, genomic approaches can and are being used to improve the nutritive value of crop stovers (a common feed source in developing countries) and rumen microbial genomics may improve rumen function for better utilisation of low quality feed. In regard to breed-use, genome based assays for breed composition have facilitated *in-situ* comparisons of breed-types which were previously difficult in the absence of pedigree data, breeds developed with the input of genomic approaches (typically in developed countries) are increasingly used as inputs into cross-breeding systems, and genomic approaches can help ensure breeds are fit for future changed climates. Finally, in relation to economic barriers arising from food safety concerns, the use of genomics to trace or authenticate livestock products may open new markets or remove trade restrictions.

Keywords: Environmental sustainability, genomics, livestock, productivity