

## ABSTRACT

The goat industry plays a key role in provision of economic and social benefits to a significant population in Kenya. Therefore improving their performances would contribute to food security, poverty reduction and economic empowerment of resource poor rural households. Reproductive performances and estimation of response to selection are considered among the essential pillars of economic viability of dairy operations. This thesis evaluated reproductive performance and response to selection of dairy goats using reproductive technologies, genomic selection and different mating designs in Kenya. The specific objectives of the thesis were: (1) to determine the effect of breed and age on testicular and semen characteristics of dairy goat bucks, (2) to determine the effect of oestrous synchronisation protocols and type of service on reproductive performance of dairy goats, (3) to estimate response to selection in conventional and alternative dairy goat breeding programme incorporating reproductive technology and genomic selection and (4) to estimate rates of genetic gain and inbreeding in alternative dairy goats breeding programme utilising reproductive technology, genomic selection and different mating designs. The study was conducted using Toggenburg and Saanen bucks where body weight, scrotal circumference and scrotal length were measured and semen characteristics were evaluated. The does were synchronised using short (7 days) and long-term (12 days) protocols and mated using natural and artificial insemination methods. The onset and duration of oestrus, response to oestrus and conception, kidding and twinning rates were evaluated. The data for testicular, semen characteristics, onset and duration of oestrus were analysed using ANOVA, while response to oestrus, conception rate and kidding rate were analysed using Chi-Square test. Deterministic and stochastic simulation models were used to evaluate response to selection under both conventional (CS) and genomic (GS) schemes utilising reproductive technologies. Breed of the bucks affected semen consistency and sperms concentration while age affected scrotal circumference and length, semen consistency, sperms concentration and motility. Synchronisation protocols and mating methods had no effect on reproductive performance parameters measured. It was found that AI-liquid semen was superior compared to AI-Frozen semen, and natural mating strategies in terms of response to selection in both conventional and genomic selection schemes. Genomic scheme outperformed conventional scheme in all the parameters measured. The mating designs significantly influenced level of inbreeding. It is concluded that short-term protocol following single fixed-time AI could be an alternative

to long-term oestrous synchronisation, while adoption of artificial insemination and genomic selection optimizes response to selection in dairy goat breeding programme.