SUMMARY

A deterministic approach was used to evaluate open nucleus schemes for the Holstein-Friesian cattle population in Uganda. The superiority of the breed in terms of milk production has made it popular among zero grazing and fenced-dairying production systems, which are characterised by commercial modes of production. Though the breed fits well in some agro-ecological zones of Uganda, its adaptability still poses problems. Selecting this breed under conditions in which it is intended to perform instead of relying on imported germplasm would improve on its performance in terms of adaptation to the available local resources. The National Animal Genetic Resources Centre and Databank (NAGRC), a body corporate with the mandate of overseeing all animal breeding work in the country, has, therefore, earmarked one of its farms, Njeru Stock Farm, to serve as a central nucleus for this breed. The study covered the Lake Victoria Crescent region of Uganda with an on-going herd/milk recording scheme which provided much of the data that was used. The specific objectives of the study were to estimate biological coefficients and evaluate a range of open nucleus schemes (genetic) for the breed.

The biological coefficients were estimated using SAS. The means and standard deviations (in brackets) got are: Total lactation Milk Yield (MY), 3266 (969) kg; Calving Interval (CI), 444 (92) days; Lactation Length (LL), 322 (61) days; Age First Calving (AFC), 968 (207) days; Productive life of cows, 4 years; Bull age when first offspring is born (BAFC), 2.37 (0.19) years; services per conception using artificial insemination (INS), 2.4 (1.41); services per conception using both a bull and AI, 1.54 (0.88); services per conception using only a bull, 1.45 (0.93); services per conception with all types of services weighted together, 1.7 (1.09). The results were within estimates or comparable with other studies done on the breed in the tropics and revealed the need to pay more attention to fertility management.

ZPLAN, a deterministic computer simulator programme, was used to model the breeding schemes. In view of the market conditions, available information, and resources, only two traits, MY as a production trait and CI as a fertility trait, were considered in the aggregate genotype and in the selection criteria. The economic weights, in Ugandan currency points (Ugcp), for the two traits were derived from profit functions using the partial budgeting method and standardized on the basis of genetic standard deviations. Their relative economic importance in the selection index was 98.25% for MY and 2.63% for CI. In order to curb deterioration in CI as MY improves, a restriction in genetic gain was imposed on CI and their importance in the index was then 74.28% for MY and 25.72% for CI.

The population structure (two-tier) was made up of a nucleus and a base population and had 7 selection groups. The nucleus consists of two units: the central unit to be based at Njeru stock farm and the dispersed unit which will consist of farmers in the fenced dairying production system. It is envisaged that farmers who will be part of the dispersed unit should have enough cows, at least twenty, for contemporary testing of daughters of different bulls, use exclusively AI, and carry out intensive recording of their herds. This unit makes it possible to increase on the nucleus size and minimizes the risks associated with concentrating stock in one place. The two units were modelled as one and differences between them will be during the operationalisation of the programme. During modelling, we assumed that the basic situation, which forms the basis for varying parameters in other strategies, is the the optimal scheme. Its population size of 100,000 animals depended on the number of animals which could be serviced by AI, the nucleus size of 700 animals depended on the capacity of Njeru stock farm and the number of farms in the dispersed unit which could adequately be supervised. For establishing the optimal number of 10 young bulls (YB) and the 0.6 proportion of cows in the nucleus mated to young bulls (PCYB), YB was simultaneously varied with PCYB. The optimal 6 inseminations needed per daughter record (Ins/DR) were established by varying Ins/DR around 10 YB + 0.6 PCYB and putting into consideration the INS coefficient. From this basic situation, the population size and the nucleus size were varied and a restricted index modelled. The criteria for evaluating the schemes was based on annual monetary genetic gain (AMGG), discounted returns (R) and discounted profit (P).

The scheme which was finally regarded as the optimal one had the following features:

- i. a population of 100,000 animals of which 700 are in the nucleus
- ii. 10 YB or test bulls from which 4 proven bulls (PB) are selected
- iii. 0.6 PCYB
- iv. 6 inseminations per daughter record (Ins/DR)
- v. progeny testing takes place in only the nucleus
- vii. exclusive use of AI in the nucleus
- viii. genetic gain disseminated to the base population via PB
- ix. a restricted selection index in regard to CI
- x AMGG of 1.00 Ugcp R of 1.34 Ugcp and P of 1.26 Ugcp is got.

The higher PCYB is, the less realisation of genetic superiority from PB, but there is a lowering in the mean generation interval. Ins/DR is greatly influenced by INS which is dependent on management. The higher the population and nucleus size are, the better it is for the programme. All the genetic gain is achieved in the nucleus, but 95% of all returns are realised in the base population. This implies that a scheme has nation-wide benefits. Its total economic approach is demonstrated by a lot of farmers in the base population with one or two cows, who do not invest in the programme being the major beneficiaries of improved genetics.