Summary only

POPULATION STRUCTURE AND BREEDING FOR GENETIC IMPROVEMENT

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PREDICTIONS of likely genetic change following selection have their most useful role in the solution of problems of choice of breeding plan. By using simple formulae based on current theory and a range of values for each of the several parameters involved it is possible to compare various plans and thereby guide breeders and research workers. A multiplicity of plans arising from variations in two aspects of population structure have been considered in relation to selection for a single criterion with a given accuracy of identification of genotypic merit. The two aspects of structure considered are the age composition and the size of the male population in a closed breeding group of restricted size.

The longer animals are kept as reproducing units, the longer is the generation interval, but the replacement rate is lower and the potential selection differential greater. In terms of genetic progress per unit of time, there are therefore two opposing forces and presumably an optimum balance. The influence of the size of the population becomes important in small, closed populations and is dependent upon the magnitude of the adverse effect of inbreeding upon production. The higher the permissible level of inbreeding with a given female population size, the smaller can be the proportion of males to females, and the greater can be the selection intensity for males.

Some results of calculations for a small (200 ewe) sheep flock were used to illustrate the work. Evidence was presented that under certain conditions it might pay to use rams for two consecutive matings rather than once only, and that, although the optimal number of males may be in the range of 4 to 6, genetic gains are not affected much by using as many as 10 rams, thus reducing the effects of inbreeding and genetic drift on characters other than that under selection.

Verification of some of the theoretical calculations can be attempted using flour beetle (*Tribolium castaneum*) populations to simulate domestic livestock populations. A preliminary investigation involving the comparison of three populations, each with a different generation length for males, is currently in the sixth generation at Ruakura Agricultural Research Centre.