Chapter 12.4: Breeding programs with an (open) nucleus

Nucleus programs are characterized by a limited number of female animals with a genetic superiority. In potential, these are the dams to breed sires. They are owned by a breeding organization or a limited number of breeders and called a nucleus (breeding farm(s) or breeding unit(s)). They deliver the next generation of sires to breed sires and sires to breed dams. They are recorded for a large number of traits. The breeding organization takes the decisions on selection and mating in the nucleus and in the contracts. As a consequence breeding goals are used steadily, recording of traits and pedigree is complete, selection and mating in the nucleus is under full control. This results in a high genetic improvement rate over generations. Nucleus programs can be closed, as is the case in commercial pig and poultry breeding. Once the breeding animals for the nucleus are chosen at the start, no animals from outside the nucleus are added to the nucleus population. It is called a closed nucleus breeding program.

In cattle breeding artificial reproduction techniques, in particular artificial insemination techniques and in vitro fertilization in combination with embryo implantation are well developed and heavily used in the open nucleus. This gives the opportunity to produce high numbers of offspring from superior sires and from dams and disseminating the genes of these superior animals widely in the production population. In the disseminated part of the population (mainly used for production purposes = production population) the offspring of the sires is tested for important traits. When the estimated breeding value of females in the production population is comparable with (or higher than) the breeding value in the nucleus population they can enter the nucleus. In that case they can be bought by the breeding company or contracted by the breeding organization. This is called an open nucleus breeding program.

Open nucleus breeding programs can be considered in species where the present breeding programs have a flat structure: horses, dogs, sheep and goats. Then genetic improvement can be generated in a controlled situation and males from the nucleus can be used widely by individual private breeders. In dogs open nucleus breeding programs are developed for breeding working dogs and for eye-seeing dogs even closed nucleus programs are set up.