

SELECTION OF BREEDING STOCK



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Genetic improvement in livestock performance (growth rate, reproductive rate, resistance to disease, etc) is achieved through selection of superior animals within a herd. Genetic progress relies on selection based on accurate, objective, assessment of the variation in performance of individuals and the heritability of characters used as the basis of selection. Selection may be based on individual animal performance, lifetime performance, pedigree performance, progeny performance and performance of near relatives.

Breeders should limit the number of characteristics they select for at any time as there is a general rule that as the number of characteristics selected for increases, there is a corresponding decrease in the progress made in each characteristic (trait). Selection can be undertaken as:

- Single trait selection, i.e. having one clear objective
- Tandem selection, i.e. improve one trait then the next
- Independent culling levels, i.e. acceptable performance levels are set for a range of characteristics. If an animal fails in one then it is removed from the breeding population no matter how good its results in the others may have been
- Index selections, i.e. all characteristics are balanced into an overall index that gives animals a rank

However, selection can only improve genetic merit if:

- The producer has clear objectives for the breeding program
- The breeding program focuses on only a few characteristics
- The breeding program maintains a high level of selection pressure
- The producer uses production records
- The selected characters are heritable

These rules are important as there is a tendency to try and link what we see (the animal's phenotype) with the true genetic merit of the animal (the animal's genotype) when these links are difficult to establish. There are many factors that influence the appearance of an animal and environmental factors (nutrition, health, sex, production status etc) contribute 60-80% of an animal's appearance. Frequently selected traits in commercial deer farming include live weight at different ages, antler size and shape, temperament, disease resistance and carcase leanness (quality). Commercially important traits may change with time as market requirements change.

The degree of genetic gain a breeder can expect to see in their herd depends on many factors including:

- **Heritability** (how strongly a character is passed to successive generations)
- **Selection differential** (the superiority of the animals being joined over the average for the population)
- **Generation interval** (the rate of turnover in the population or the average age of parents when offspring are born)
- **Correlation between characters** (any positive or negative correlation between characters. For example if two characters are negatively correlated an increase in one character will mean a decrease in the other character)

It is important to remember that a comparison of the relative genetic merit of animals in different herds is extremely difficult. Environmental influences often have a greater influence on animal performance than genetic influences. A 'rule of thumb' is to only compare animals within herds and compare genetic improvement programs (breeding goals, selection pressure and record keeping) between herds.

Objective comparisons of animals can only be made when they are of the same sex, the same age, the same production status and they are managed in the same environment.

Not all characteristics have the same heritability. Some (qualitative characters) are determined entirely by genetics and the character will be present or absent (eg coat colour). Others (quantitative characters) are largely influenced by environment factors (body weight, growth rate, reproductive rate, etc) and the genetic merit of these characters may be masked by environmental influences (nutrition, disease, etc).

While heritability estimates are not widely available for deer, Table 31 [71] details some 'guesstimates' of heritability for various production traits in Fallow deer. Note that a heritability factor of 1.0 indicates high heritability and factors close to 0 indicate low heritability.

The heritability of velvet weight is about 35%, which makes velvet weight a moderately heritable trait [46].

Characteristic	Heritability estimate	Heritability level
Coat Colour	1.0	high
Growth	0.2 to 0.4	moderate
Antler size	0.3 to 0.4	moderate
Carcass fatness	0.3 to 0.4	moderate
Ovulation rate	?	low
Fawn survival	0.1 to 0.2	low
Temperament	?	low
Disease resistance	?	low

Table 2: Heritability 'guesstimates' for Fallow deer

Recording Programs

Maintenance of records is an integral part of programs to maximise productivity. Any females that do not produce an offspring should be culled. Wet and drying hinds pre-weaning is a method commonly used to detect non-lactating animals. Dry females along with females of bad temperament should be culled.

Any recording program should start with the tagging and weighing of offspring, and preferably the identification of their sire and dam. This is only possible if single sire mating is practised, and if some time is devoted to "matching up" dams with offspring (can be done at weaning, but is more accurate if done at birth).

In addition, it is desirable to record the following:

- Weaning weight, taking into account date of birth
- Live weight at 6, 12, 15 and 25 to 27 months
- Carcase weight when appropriate
- Velvet weight and quality (including 2 year olds)
- Casting and harvest date of antlers

When evaluating weaning weights and growth rate to weaning, it must be remembered that male calves are heavier than female calves, and two-year old females will always wean lighter calves than older females.

Comparisons are only valid *within herds* - differences in environment have a profound effect on comparisons between herds.

Calculation of Growth Rates

To determine accurate growth rates for stock they should be weighed regularly and ideally at weaning, 6 months and 12 months.

As animals are not born on the same day but groups of animals are usually weaned on the same day, animals born later in the calving/fawning season are usually lighter than those born early in the season.

If initial selection of stock is made on weaning weight, those born later in the season will be disadvantaged - they will be lightweight.

Taking the birth weight from the weaning weight and dividing by the number of days from birth to weaning can make a more accurate estimation of their early growth.

For example:

Birth weight (A)	10kg
Weaning weight (B)	65kg
Days from birth to weaning (C)	100
Growth rate, ie $\frac{B-A}{C}$	0.550kg/day

Late Calvers/Fawners

Female offspring that are born late in the season will often get pregnant late in the season and so give birth late in the season when they begin breeding.

If the goal of deer farming is venison production from animals processed at 12 to 15 months of age, these animals may need to be culled from the herd (see the chapter on reproduction).