LWCC

LIVESTOCK WELFARE

COORDINATING COMMITTEE

Established 1978

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POSITION STATEMENT

LIVESTOCK BREEDING AND ANIMAL WELFARE

Animal breeding has always been an important issue, but there are concerns that animals are bred to suit only human needs at the cost of their welfare. However, animal welfare plays an increasingly important role in breeding goals for livestock today.

Most production traits that are of economic importance in livestock, like fertility, body weight, carcass, milk and wool traits are partly controlled by quantitative genes. These traits are in turn affected by many genes, each with a small effect, and most of these genes influence other traits as well (Falconer and Mackay, 1996). As the same genes may influence many traits, this result in what is known as genetic correlations between traits: changing one of these economic traits by selection will inevitably change other traits as well, resulting in sometimes unforeseen consequences and unfavourable outcomes.

Quantitative gene action is also affected by the environment (Falconer and Mackay, 1996) – the genetic potential of the animal can only be reached in a suitable environment. An example of this is selecting dairy cows for high milk production. This is a high output system that requires a high input system – these cows need a very specialized feeding system to realize their genetic potential (Rauw, et al. 1998). Approaches where we adapt the animals by genetic selection should always be combined with balanced approaches to also optimize the environment of the animals (Rodenburg and Turner, 2012).

It is widely known in livestock breeding that selecting animals on just one trait – for example maximum production - will inevitably cause changes in other traits due to genetic correlations between traits (Bourdon and Brinks, 1982; Rauw, *et al.* 1998; Oltenacu and Broom, 2010). The obvious solution is to not to select for single traits, because problems down the line are guaranteed, but rather to combine traits into a selection index and select for many important traits at the same time (Ochsner, 2016). These traits are combined according to economic importance and heritability in a selection index.

Selection is then on the aggregate genotype, rather than single (output) traits. For many species, welfare traits are already part of the breeding index (e.g., lameness in dairy cows and faecal egg count in sheep) (Rodenburg and Turner, 2012). It is more important for animals to be physiologically in balance with the environment than to select only for high outputs (Rauw, *et al.* 1998). It is possible to change animals genetically to fit criteria set by humans, for example to select them for maximum production traits, but this nearly always impairs essential biological functions (and therefore welfare) in the process. The key is to select for optimum production rather than maximum production.

Milk yield per cow on average has more than doubled in the previous 40 years and many cows now produce more than 20,000 kg of milk per lactation (Oltenacu and Broom, 2010). The genetic improvement of dairy cattle is an example of selection for maximum production that resulted in many unforseen outcomes (Rauw, et al. 1998), as well as a complete turn-around in selection goals to correct the problem, leading to a different type of dairy cow in production today (Oltenacu and Broom, 2010). Milk production is easy to measure, is moderately heritable and economically important as it is the product which is sold. Consequently, strong selection for production or maximum output led to a phenomenal increase in milk production per cow. However, farmers had to cull most of these high producing cows during or shortly after their first lactation, mainly because of health-, fertility- and udder problems, which were also animal welfare concerns (Rauw, et al. 1998; Oltenacu and Broom, 2010). Dairy cows produce more milk in their second and third lactations and it is expensive to raise heifers until they start to produce an income. A complete turnaround in selection goals of dairy bulls was made by placing emphasis on body conformation traits (e.g. udder, feet and legs, size, etc), health traits (somatic cell counts indicating mastitis), fertility and longevity, also known as productive herd life (Oltenacu and Broom, 2010). Currently, selection for milk production traits (output) comprises a small proportion of breeding objectives in dairy cattle. Around 30% of emphasis is placed on longevity and health traits, 30% on conformation traits, which also improve longevity, and only 40% on production traits. Milk production of the modern dairy cow is still high, but she is more balanced and her body is able to produce high volumes of milk.

The intensity of selection has differed between different livestock species or types, thus the amount of genetic progress that has been achieved in improving the species from its original state differs between species. One of the reasons is the challenge of phenotyping traits for selection under extensive conditions. While there have been some welfare consequences of past selection decisions in the extensively managed breeds, such as an increased lambing rate, which is likely to have contributed to a reduction in lamb survival and an increased frequency of dystocia in some breeds or crosses of beef cattle, breeding-related welfare challenges are more commonly associated with the highly selected dairy and pig sectors (Rodenburg and Turner, 2012).

Beef cattle and sheep farming in South Africa are mainly extensive in nature. Selection of animals relies on the identification of the most efficient and productive animals. Beef cattle breeding also have a strong emphasis on adaptability, where adaptability is defined as an animal that is in complete harmony with its environment. Animals will genetically shut down growth and especially reproduction if the environment is too harsh and there is not enough energy available in the system. If a beef cow is for example not adapted to a hot environment, she will lose energy to heat dissipation, while staying close to water or in the shade, making her more susceptible to ticks and lowering her resistance to disease. This will also happen if her body size is too large for the environment, as her energy requirements for body maintenance will be higher. Negative emphasis is thus currently placed on mature body weight in the South African beef selection index, the Cow Value, therefore favouring smaller sized cows. Indigenous breeds, which have been selected for many years under local environmental conditions, are also some of the more popular choices for South African beef cattle breeders. An adapted beef cow can therefore be easily identified – she will be able to calve regularly for many years and reach a greater age. Most countries, including South Africa, therefore measure and estimate breeding values for longevity, also known as herd life or productive herd life. An animal that is capable of reaching old age, while calving regularly, is adapted to that specific environment. When estimating breeding values for longevity, pedigree information is also taken into account. It therefore makes more sense to adapt the animal genetically to its environment by using indigenous types of beef cattle and sheep under extensive conditions (Rauw, et al. 1998). Another welfare problem facing breeds with unpigmented eyelids, like Hereford, Simmentaler and Holstein, is eye cancer caused by increased ultraviolet radiation, which is thought to predispose poorly adjusted cattle to cancer eye (Bailey, 2015). Selection for pigmented eyelids is most effective and is an important selection criterion for these breeds in South Africa.

Behaviour and welfare traits increasingly play a more important role in breeding programs in general. This is related to the fact that an increasing proportion of farm animals are kept in group housing systems, where behaviour of purely individual animals has an impact on the performance of the whole group. For such systems to be successful, genetic selection should focus on successful groups as well as successful individuals. Mixing pigs into new social groups is a routine procedure experienced several times during the life of most commercial pigs. This triggers aggression that can result in the accumulation of large numbers of superficial skin lesions. Furthermore, aggressive behaviour compromises the rate and efficiency of weight gain, meat quality, and carcass grading. Tail biting in pigs has also been shown to be correlated with genetic selection for lean meat, an example of where selection for increased production may also have led to an increase in undesirable behaviour. Selection on social effects may ultimately avoid the need for routine phenotyping of aggressiveness, making it more feasible to reduce the expression of this behaviour through selection (Rodenburg and Turner, 2012).

Breeding and genetics has played and will continue to play an important role in the welfare of domestic animals. Sustainability of genetic improvement can be assured by defining breeding objectives with biological efficiency goals instead of economic efficiency goals (Dickerson, 1982). A multi-trait selection programme in which improving health, fertility and other welfare traits are included in the breeding objective, and appropriately weighted relative to production traits (Oltenacu, et al., 2010), are currently adopted by most breeding organisations in the world and in South Africa as well. Currently, we are at the start of the genomics era, where specific traits can be mapped to the genetic code of individual animals. This could offer opportunities to collect more precise information on the biological impact of certain breeding decisions. Genomic tools could also facilitate selection for complex behavioural and welfare traits, which are frequently impossible to measure on a large number of animals. Once the genetic fingerprint for such complex phenotypes is available, these welfare issues could be addressed by targeted genomic selection approaches (Rodenburg and Turner, 2012).

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