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TECHNOLOGY IS NOT A CURSE

By WA LOMBARD

Traditional livestock breeding has always been based on the selection of animals based on the physical appearance. These traits are used to determine breeding values for the animals. However the process isn't always accurate or effective and can be quite time – consuming, as many of the traits can only be detected once an animal has reached maturity.

Genomics is one of the latest technologies used for genetic progress in cattle breeding. We asked Dr. Anton Smit of Taurus Evolution to tell us about this ground breaking technology.

Genomics and the cattle farmer

Genomics allow for the identification of animals carrying economically important traits, at every early age. The used of genomic bulls, especially in the dairy industry, has therefore increased significantly over the past number of years.

'' In the beef industry the technology is still in a developmental stage. '' says Dr. Smit. ''Genomics entail the study of an organism's complete DNA genome. When DNA is investigated. Gene variants are identified through variation in DNA markers in or near the genes. A series of these DNA markers then represent a genomic profile, which is a powerful aid in selecting animals accurately at an early age "

Genomics assist in accelerating genetic progress in a herd, because I can identify economically important traits at an early stage. It also enables breeders to monitor genetic progress in their herds.

A few companies currently offer similar genomics analysis services. When it comes to the analyses of breed cattle, each of the following aspects are investigated and scored:

-Carcass traits: Back- fat thickness meat tenderness, red meat yield, marbling and eye-muscle area.

-Mothering and reproduction traits:

Maternal calving ease – a score is given for the percentage of births without assistance/help.

Heifer gestation rate – represents a heifer's chances of coming into calf during the normal breeding season. Compared to other heifers. A higher score indicates that a higher percentage of heifers should become pregnant during the breeding season.

Longevity –represents the ability of a female to remain in the herd for longer than six years. The higher the score out of ten, the better the longevity of the animal.

-Feed efficiency traits:

Average daily gain ADG – predicts how quickly an animal will gain weight. The higher the score out of ten, the better.

Residual feed intake RFI – describes the difference between the animal's actual feed intake and its expected feed intake, based on the maintenance and growth requirements. A low RFI is better, because such an animal will either eat less for the same weight gain, or gain more weight for the same feed intake. Independent results for two interdependent feed efficiency and growth factors, assists producers in making more accurate management decisions.

Temperament:

A calm temperament is preferred as it ensumes the safety of the handler, but also because calm animals eat more, react better to immunization and their meat is more tender. A higher score indicates calmer behavior.

Other information which is also taken into account included colour inheritance, polled or horned, determination of paternity, etc.

Genomic test options

There currently are two genomic test options breeders can use to test their animals. The first is a low density test that can be used to identify some of the traits. The test is cheaper and does not test the DNA detail.

The other option is a high density test which is a full test that can identify more traits, but approximately three times more than the low density test.

Normally the low density test is used for females and to identify males with high potential. Male animals with high potential identified by the low density test, can be tested with the high density for a more thorough examination of identified traits.

" Genomics cannot be determined separately from normal breeding values, as they remain the point of reference. "

The accuracy of these tests depend on the size of the genetic database of the specific breed. Before any meaningful tests can be conducted in a breed, the data bases should contain the genetic profiles of at least 1000 of the breed's bulls. These bulls should have highly reliable breeding values which the DNA profiles can be linked to.

‘’Genomics cannot be calculated separately from normal breeding values as it remains the reference point. ‘’ Dr. Smit explains. ‘’ Genomics accelerate the time interval needed to obtain more reliable breeding values. The Holstein breed is the current leader when it comes to their database and cattle from this breed can already be tested 80 % accuracy for production traits. ‘’

Sexed Semen

Over the past number of years sexed bull semen has been receiving more attention. Research in this regard started in the 1980”s with the production of sexed semen from freshly produced (unfrozen) bull semen.

‘’The original semen, however, resulted in a very low gestation rate. It led to more research in the field and the first sexed semen calf produced from frozen semen, was born in 1999. Since then sexed semen has become more commercialized. It has been widely available in the USA since 2004 and now also in South Africa.”

A flow spectrophotometer is used to distinguish between the male and female sperm, Dr. Smit explains. ‘’The principle of the separation process rests on the fact that female sperm contain 3.8% more DNA male sperm. Before the sperm is sorted, it is dyed with a fluorescent dye and flows through the flow spectrophotometer in the form of drops of liquid, each containing a single sperm.

‘’ because female sperm contain more DNA than male sperm, they appear brighter than the male sperm when exposed to light. This creates the opportunity for the laser and detector of the flow spectrophotometer to distinguish between the male and female sperm. ‘’

‘’As the dyed drops pass through the flow spectrophotometer, they receive a positive or negative change. Positive drops move in one direction, negative drops in another and unchanged drops move straight ahead. The uncharged drops usually contain more than one sperm or damaged tissue such as dead sperm. ‘’

PROS AND CONS

The cons of sexed seed is that semen processing takes three to four times longer than traditional semen. It means that a premium will have to be paid for the semen and that fewer straws can be produced per ejaculation. Sexed semen straws contain fewer sperms each than traditional straws, but on the positive side the straws contain almost no defective sperms.

Because the straws contain fewer sperms, the conception rate is approximately 70 to 90 % of traditional straws. There also is a smaller variety of bulls with sexed semen, because not all bull semen is suitable for the process.

The greatest advantage of sexed semen, he emphasizes , is that the opportunity of breeding an animal of the desired gender, increased to more than 90% (compared to 50 % in the case of traditional semen) This can be of great advantage to farmers who attach great importance to a specific gender. Dairy farmers don’t have to take a 50 % chance in the breeding of replacement heifers anymore, and they can now opt to use sexed semen to produce replacement heifers from their top cows.

The producer can also inseminate cows that are not being used to breed replacement heifers, with the semen off a beef bull so as to earn more of his calves. Stud farmers in the beef industry can use sexed semen to produce enough bulls from their best female animals in a bid to maximize their income.

Use the opportunity

Both types of technology are already available in South Africa and although the dairy industry is making good use of it. It has not yet taken off in the beef industry. However, it should receive more attention as more breeds build the genetic databases necessary for meaningful economic analyses.
