Key index figures
E-45
BWB-index

Introduction
Over the years, the breeding goal for the Belgian Blue breed has shifted from a primary focus on muscularity to a greater emphasis on growth, fertility, and reduced calf mortality. The ideal cow that serves as the basis for this breeding goal is one with good muscularity, strong feet & legs, which performs well in functional characteristics at birth, grows quickly, has a short calving interval, and has a young age at the time of the first insemination. Growth and fertility are essential for the breeding goal, as is calf mortality, which together ultimately determines the profitability for the beef industry.
These success factors are translated into practice through the Flemish Belgian Blue Index (BWB Index). The BWB Index can determine the breeding value of an animal in relation to the population, aligned with the breeding goal of the herd book. In this way, the breeding goal is pursued, and beef farmers are provided with the necessary tools when choosing a bull, as the BWB Index describes the breeding goal and thus enables a simple ranking of bulls. Beef farmers who consistently choose animals with the highest overall index will evolve most effectively toward the set breeding goal.

Breeding Goal
The Flemish Belgian Blue herd book describes the breeding goal as an animal that undergoes easy rearing, achieves high daily growth, gives birth to its first calf at 24 months, and becomes pregnant again quickly. Furthermore, maintaining muscularity and proper feet & legs remains a focus. This leads to the following important characteristics for pursuing the breeding goal: calf mortality, fertility, growth potential, feet & legs and muscularity.
Every five years, this breeding goal is evaluated and, if necessary, adjusted by the member-beef farmers of CRV.

Composition of the BWB Index
The BWB Index is constructed based on the established breeding goal, by utilizing available breeding values. Breeding values from both the Walloon and Flemish Belgian Blue breed registries were used in the development of the index. Weighting factors were calculated to achieve the desired outcome. In total, seven traits are included in the BWB Index: age at first insemination, carcass weight of the cow, feet & legs, calf mortality, mortality at 14 months, muscularity, and overall score. The breeding values for these traits come from the Cooperation CRV and the BWB herd book Wallonia (Elevéo). Each trait is assigned a specific weight in the composition of the index. Carcass weight does not represent the heaviest cows but provides an indication of growth potential, taking into account the age at which the cow is slaughtered. Table 1 describes which organization calculates each breeding value and the respective proportions for the traits in relation to the desired breeding goal. This table also displays the average breeding value for each trait along with its corresponding range.

Table 1: Origin of breeding values used within the BWB Index.

Characteristic	Source	Ratio	Average Breeding value	Standard deviation
Age at 1st insemination	Cooperation CRV	20	100	4
Carcass Weight Cow	Cooperation CRV	30	100	4
Feet & Legs	Elevéo	10	100	10
Calf Mortality	Elevéo	-10	100	10
Mortality at 14 Months	Elevéo	-5	100	10
Muscularity	Elevéo	10	100	10
Overall Score	Elevéo	15	100	10

Selection Response

The BWB Index is the number used to rank the bulls and aims to place the bull that produces strong daughters that most closely approach the breeding goal at the top. The BWB Index is based on achieving a desired selection response. To determine this, the correlations between the traits that need improvement are taken into account. Selection for a specific trait will, in most cases, also lead to changes in another trait, known as correlated response. Table 2 shows the correlations between the breeding values of the different traits. For the breeding values of calf mortality and mortality at 14 months, a lower breeding value is desirable as it is associated with lower mortality. For the other breeding values, a higher value is desirable. For age at first insemination, a higher breeding value means a lower age at first insemination. The correlation of -0.35 between the breeding values of muscularity and age at first insemination means that a higher breeding value for muscularity is associated with a lower breeding value for age at first insemination. In other words, more muscle development leads to a higher age at first insemination. The breeding values for mortality at 14 months and age at first insemination have a correlation of -0.12. This means that a lower breeding value for mortality at 14 months is somewhat more likely to result in a higher breeding value for age at first insemination. In other words, lower mortality at 14 months is associated with a lower age at first insemination.

Table 2: Correlations between breeding values for traits of the BWB Index.

Correlations breeding values	*Age at 1st insemination*	Carcass Weight Cow	Feet & Legs	Calf Mortality	Mortality at 14 Months	Muscularity	Overall Score
Age at 1st insemination	-						
Carcass Weight Cow	-0,11	-					
Feet & Legs	-0,03	-0,35	-				
Calf Mortality	-0,04	0,08	-0,19	-			
Mortality at 14 Months	-0,12	0,13	-0,06	0,32	-		
Muscularity	-0,35	-0,21	0,13	0,19	0,41	-	
Overall Score	-0,21	0,30	-0,11	0,24	0,31	0,57	-

The expected response of the overall index to several breeding values after one generation is depicted in Figure 1. The greatest improvement is achieved for the trait of age at first

insemination, followed by carcass weight of the cow. A minor improvement is observed for the overall score trait. Virtually no response is observed for the traits calf mortality and mortality at 14 months. Additionally, there is minimal concession made for feet & legs and muscularity.

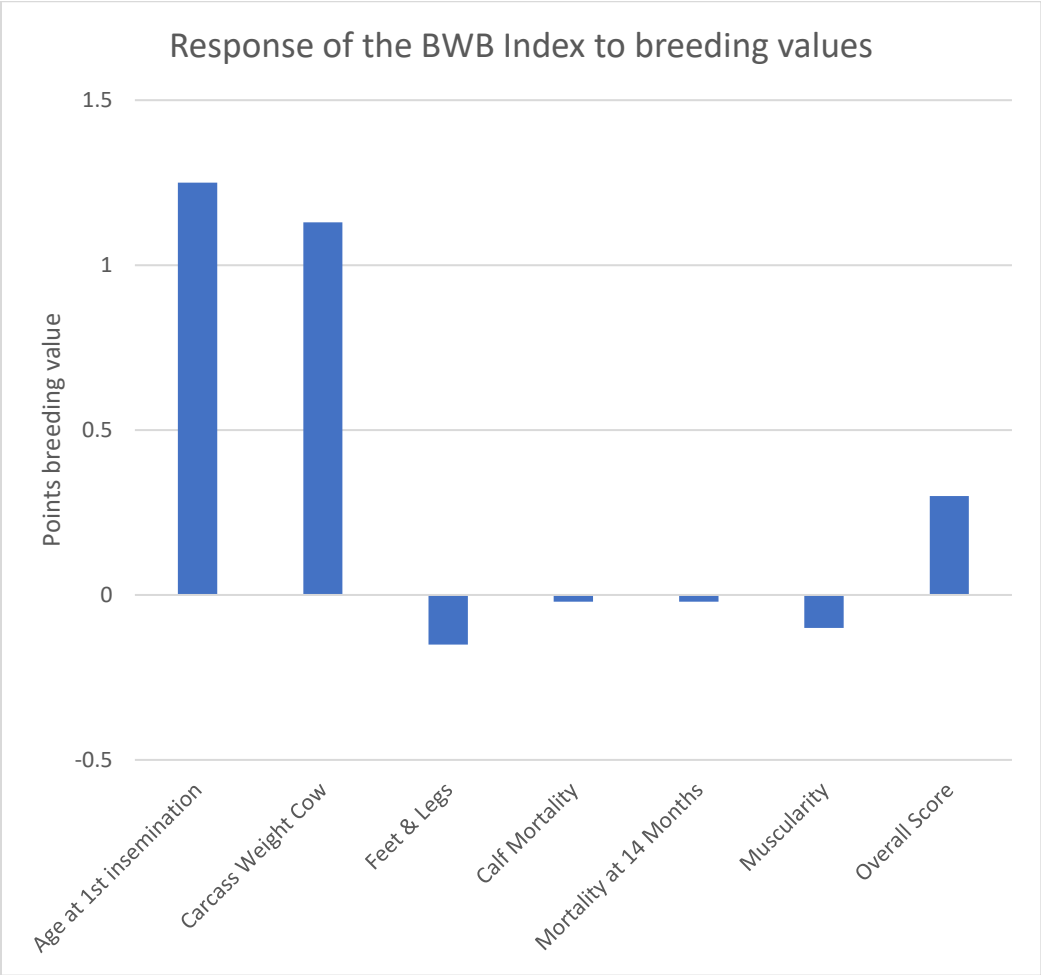

Figure 1: Response of the overall BWB Index to various breeding values.

Statistical Model

Within the BWB Index, the traits have been assigned different weighting factors, taking into account the variation in the different breeding values (BV).

$$\text{BWB Index} = 1{,}23 \times (BV_{\text{Age at First Insemination}} - 100) + 1{,}85 \times (BV_{\text{Carcass Weight of Cow}} - 100) + 0{,}28 \times (BV_{\text{Feet \& legs}} - 100) + 0{,}28 \times (BV_{\text{Calf Mortality}} - 100) + 0{,}14 \times (BV_{\text{Mortality at 14 Months}} - 100) + 0{,}28 \times (BV_{\text{Muscularity}} - 100) + 0{,}42 \times (BV_{\text{Overall Score}} - 100) + 100$$

The unit of the BWB Index is points, and the genetic variation is 10 points.

The reliability of the BWB Index is calculated from the reliability of the underlying traits (Age at First Insemination, Carcass Weight of Cow, Feet & legs, Calf Mortality, Mortality at 14 Months, Muscularity, and Overall score), and the weighting factors they have received in the index.

Publication Requirements

The BWB Index is published for every bull that has a AI-code and is used in the breeding program. The bulls are either younger than 10 years or have at least 10 registered offspring in the previous year. For young bulls for which no offspring data is available, an expected value is calculated based on the breeding values of their ancestors. The BWB Index is published three times a year, in the months of April, August, and December. Three lists are published: young, waiting, and proven. The "young bulls" list includes all bulls with a reliability of less than 35%. The "waiting bulls" list includes bulls with a reliability between 35% and 65%. The "proven bulls" list includes bulls with a reliability of more than 65%.