

Beef Genomics Project (BGP) - South Africa & Namibia

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Breeds Participating

AFRIKANER
CATTLE BREEDERS' SOCIETY OF SOUTH AFRICA
BEESTELERSGENOOTSKAP VAN SUID-AFRIKA



The brand you need



BORAN
GOD'S GIFT TO CATTLEMEN



LRF

Breeds

Participating





LRF



- ▶ Livestock Registering Federation
- ▶ Mouthpiece for the societies it represents
 - ❑ Raise questions at RPO level
 - ❑ Negotiate and interact with the ARC
- ▶ Played a big roll in the establishment of the BGP project
- ▶ Represents breeds at BGP committee level
- ▶ Collaborate with the University of the Free State to present a Diploma course in animal breeding
- ▶ Facilitate the Aldam Stockman School - Similar to The Beef School in Zimbabwe
- ▶ Facilitate communications between the University of the Free State and Pretoria and societies - enabling societies to seek help in terms of genetic improvement, etc.
- ▶ Facilitate bulk negotiations between societies and BREEDPLAN/ABRI

BGP Phase 1

- ▶ April 2015 - March 2018
- ▶ The Technology Innovation Agency (TIA) of South Africa funded the programme for R29 831 580 for three years (R10 m/annum except for first year)
- ▶ The Programme is co-funded by industry/breeders



Genomics

▶ What is **Genomics**?

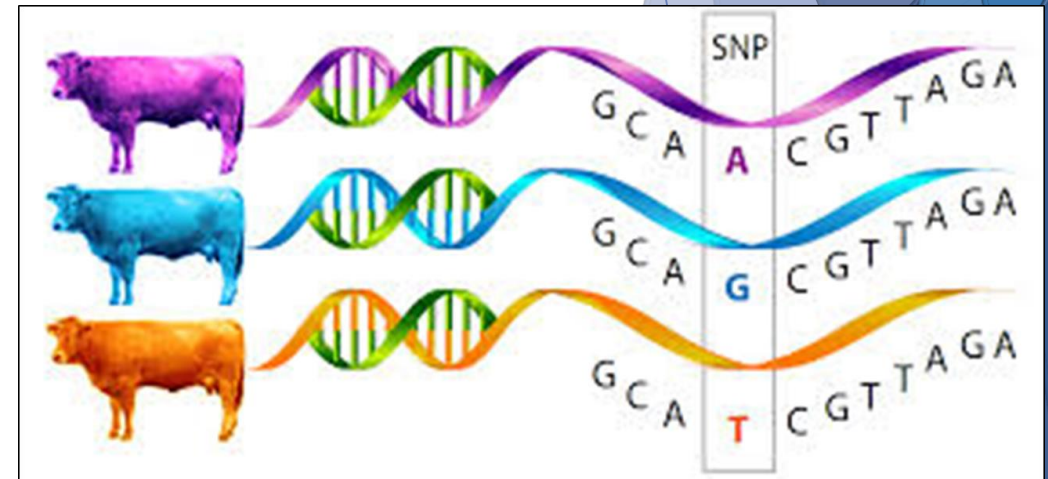
- ✓ The study of the **structure** and **function** of all the genetic material of an animal

▶ We are more interested in **Genomic selection**:

- ✓ the **inclusion of DNA information** (SNP information) in a breed's **genetic evaluation** and selection program
- ✓ Creation of GEBVs

▶ **SNP** (Single Nucleotide Polymorphisms)

- ✓ a DNA marker where there is variation between two animals of the same species.



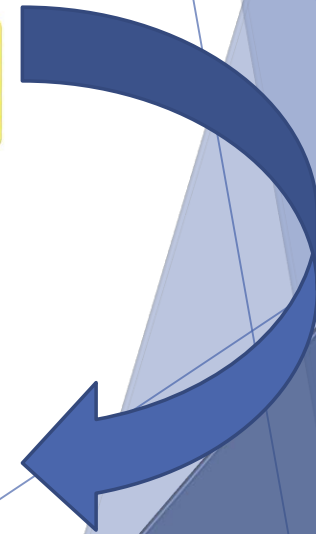
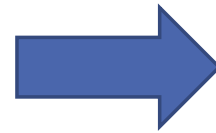
Why genomics...?

1)

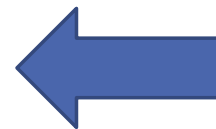
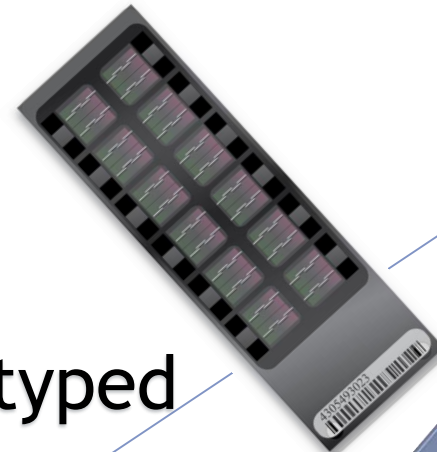
At birth



DNA sample



Genotyped



GEBV



Why genomics...?

2) Correct pedigrees

- ▶ Incorrect pedigrees often a problem
- ▶ 10% of parentages in pedigrees are incorrect
- ▶ Inclusion of Genomic pedigrees, corrects for these mistakes

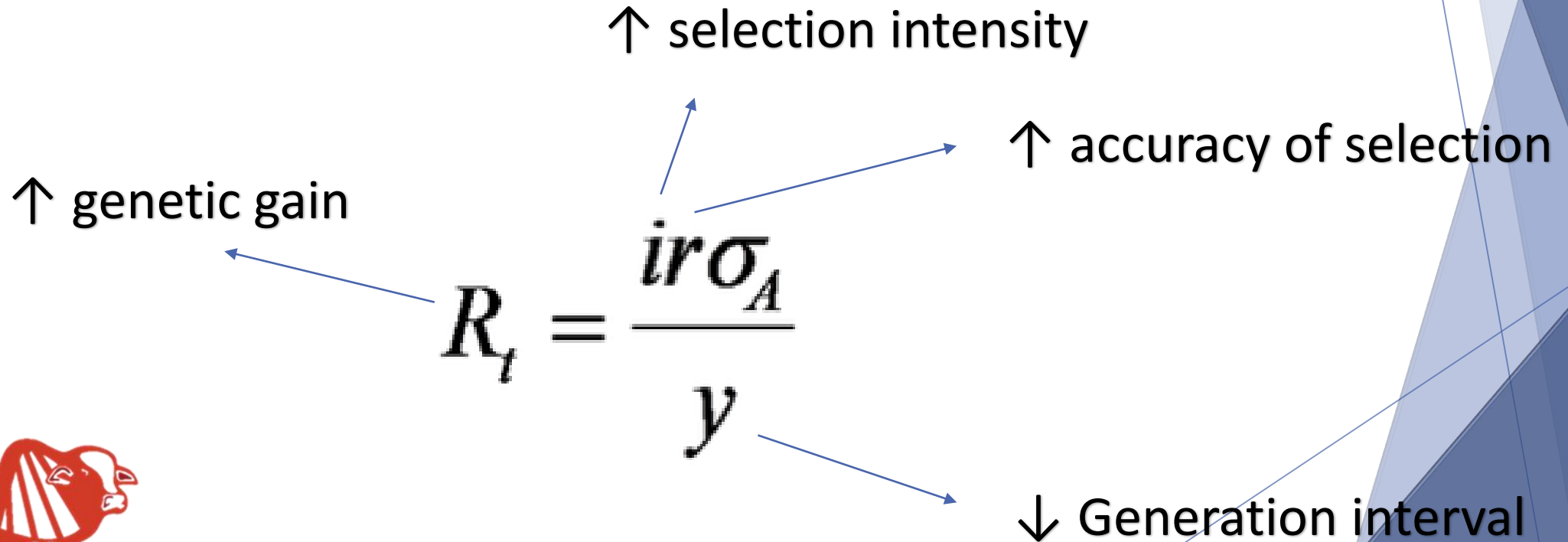
3) ↑ accuracy of selection

- ▶ The accuracy of GEBVs depend on:
 - ❖ The size of the reference population - used for prediction equations
 - ❖ The heritability of the trait
 - ❖ Extend of relationships between selection candidates and the reference population



Why genomics...?

4) Increase in genetic gain



Genomics

- ▶ South African societies realized that if we do not embrace the “new” technology, **Genomics**, our breeds are going to become obsolete, compared to breeds in other parts of the world
- ▶ Several leading breed associations world-wide already have GEBVs calculated on a routine basis, e.g.:
 - ✓ American Angus
 - ✓ Australian Angus
 - ✓ Australian Brahman
 - ✓ Australian Wagyu
 - ✓ Etc.



Genomics

- ▶ Ultimate goal of BGP project
 - ✓ Is to get to **GEBVs** for **all** the participating **breeds**
 - ✓ And eventually for **genomics** to make a difference in the lives of both commercial and smallholder farmers.



Specific objectives

- ▶ Collect good/informative performance data
 - To improve EBV accuracies
 - ✓ Faster genetic progress
- ▶ Build a Genomic reference population/training population
 - For all breeds
 - For all traits
 - BUT in particular for economically important/difficult-to-measure, e.g.:
 - ✓ Female fertility
 - ✓ Maternal ability, calf survival and fitness
 - ✓ Feed efficiency
 - ✓ Carcass and meat quality traits



Reference population



Genotyped



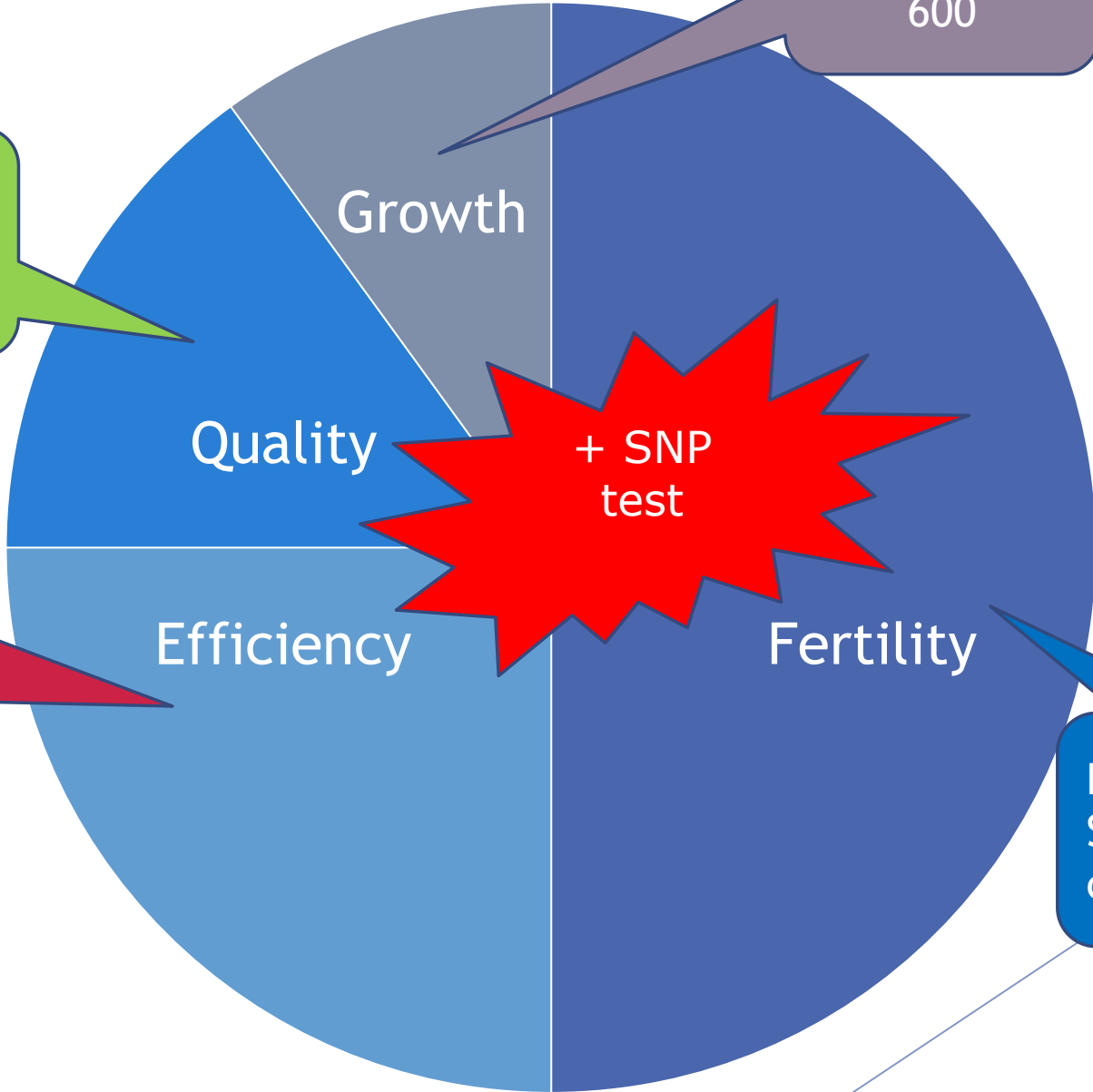
Phenotyped



Total testing

Scan data
Carcass data
Structural soundness

200
400
600



Birth weight
Calving ease
Mature cow weight
Feed Efficiency

Days to calving
Scrotum circumference



Structure of data

- ▶ Tests are **expensive**
- ▶ Data collected should be **useful**
- ▶ Data structure is extremely important for data to be included in **genetic analyses**
- ▶ Animals should be tested in Contemporary groups of at least **8 - 10 animals per group**, including the progeny of at least **2 sires**.
- ▶ There should be genetic linkage between the herds



Contemporary groups

Herd



Contemporary groups

Herd

Calving year



Contemporary groups

Herd

Calving year

Sex



Contemporary groups

Herd

Calving year

Sex

Twin/Single &
ET



Contemporary groups

Herd

Calving year

Sex

Twin/Single
& ET

Dam Age



Contemporary groups

Herd

Calving year

Sex

Twin/Single & ET

Dam Age

Calf Age



Contemporary groups

Herd

Calving year

Sex

Twin/Single & ET

Dam Age

Calf Age

Weight
Date



Contemporary groups

Herd

Calving year

Sex

Twin/Single & ET

Dam Age

Calf Age

Weight
Date

Manage-
ment
group



RFI data



Feed intake data from 2015-2018	
Brahman SA	281
Brahman Nam	520
Brangus	126
Limousin	101
Santa Gertrudis	229
Simbra (incl. Namibian data)	279
Simmentaler (incl. Namibian data)	406
Wagyu	74
Total	2016



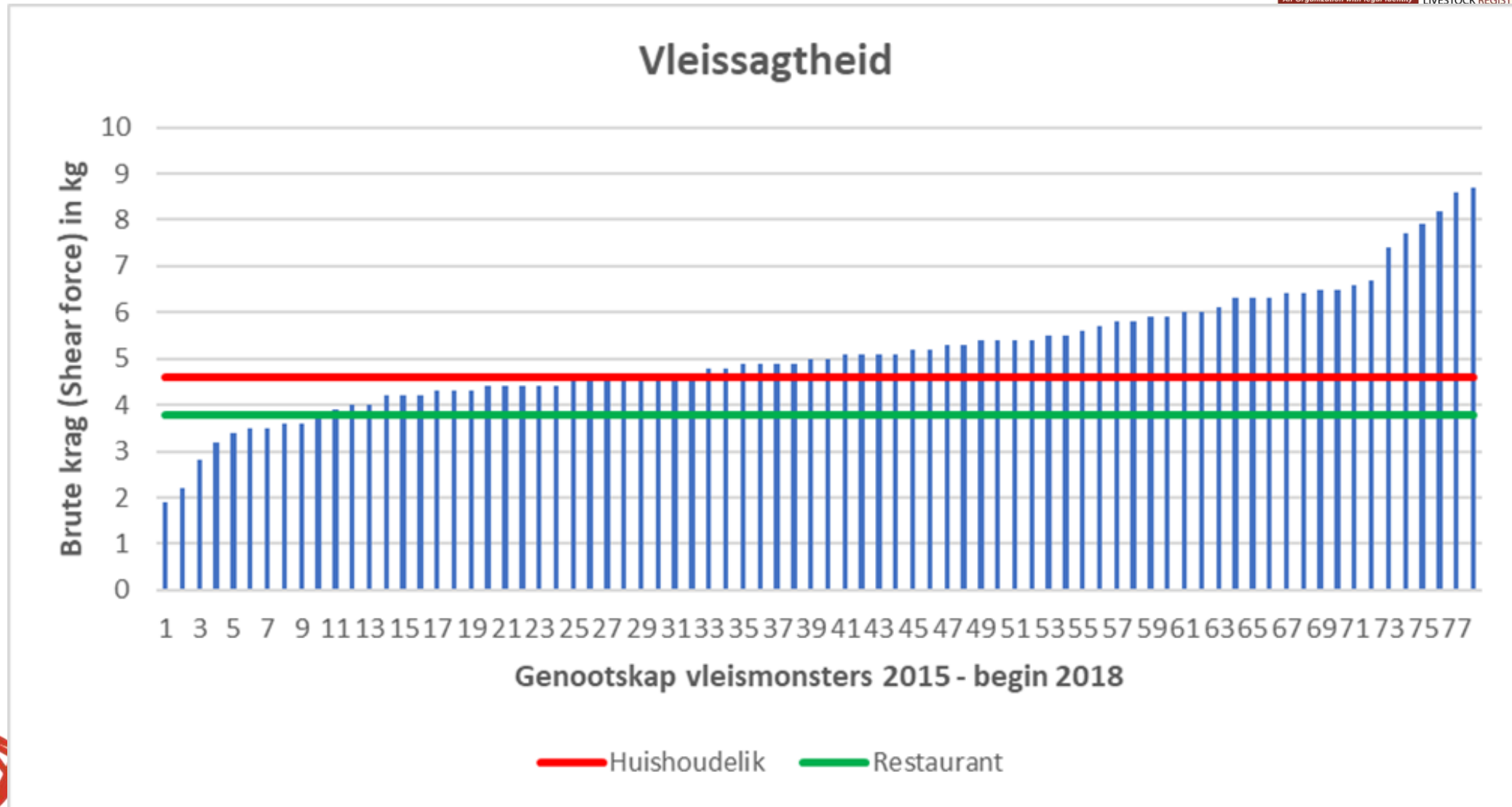
Meat quality



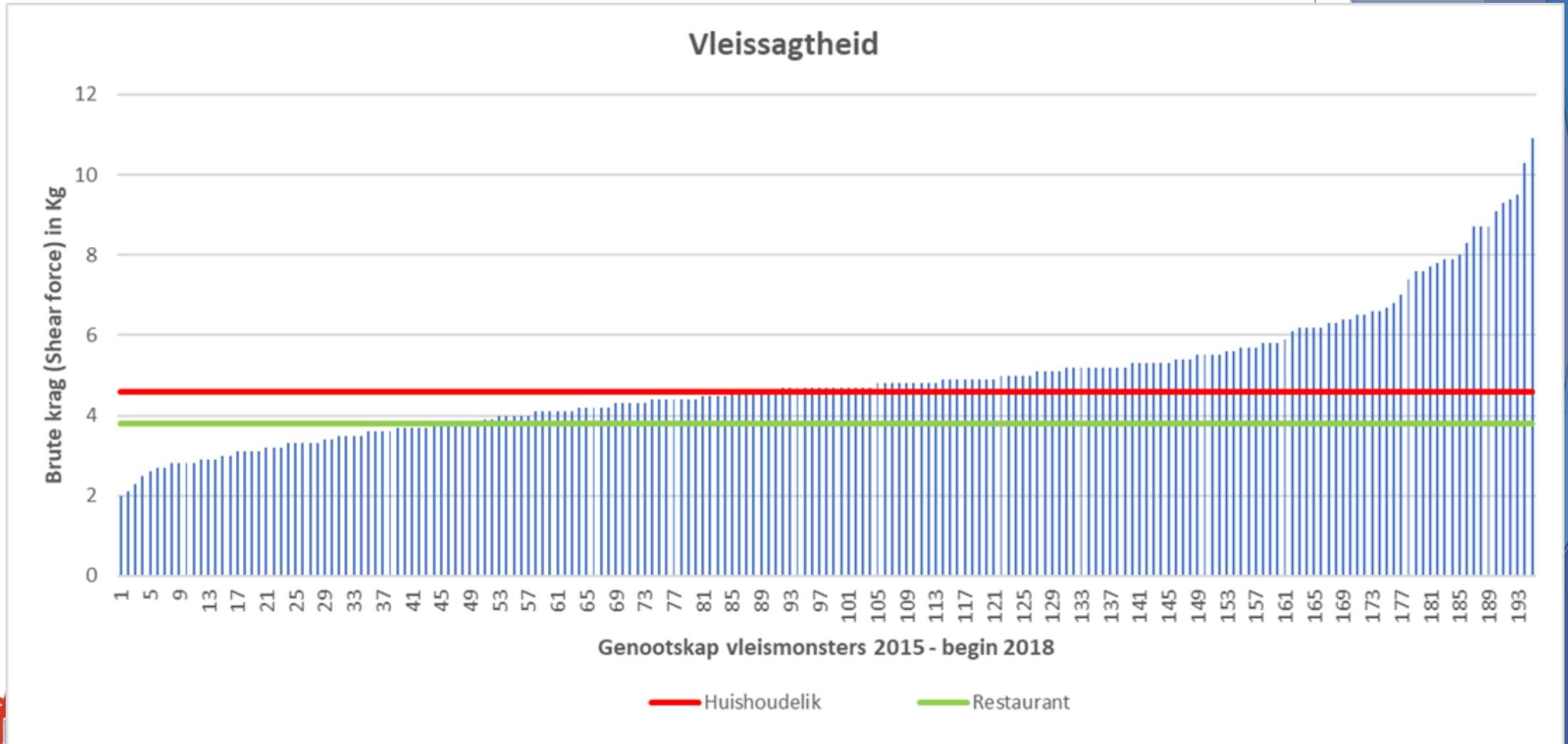
Carcass data from 2015-2018	
Brahman SA	102
Brahman Nam	52
Brangus	30
Santa Gertrudis	78
Simbra	195
Simmentaler	103
Total	560



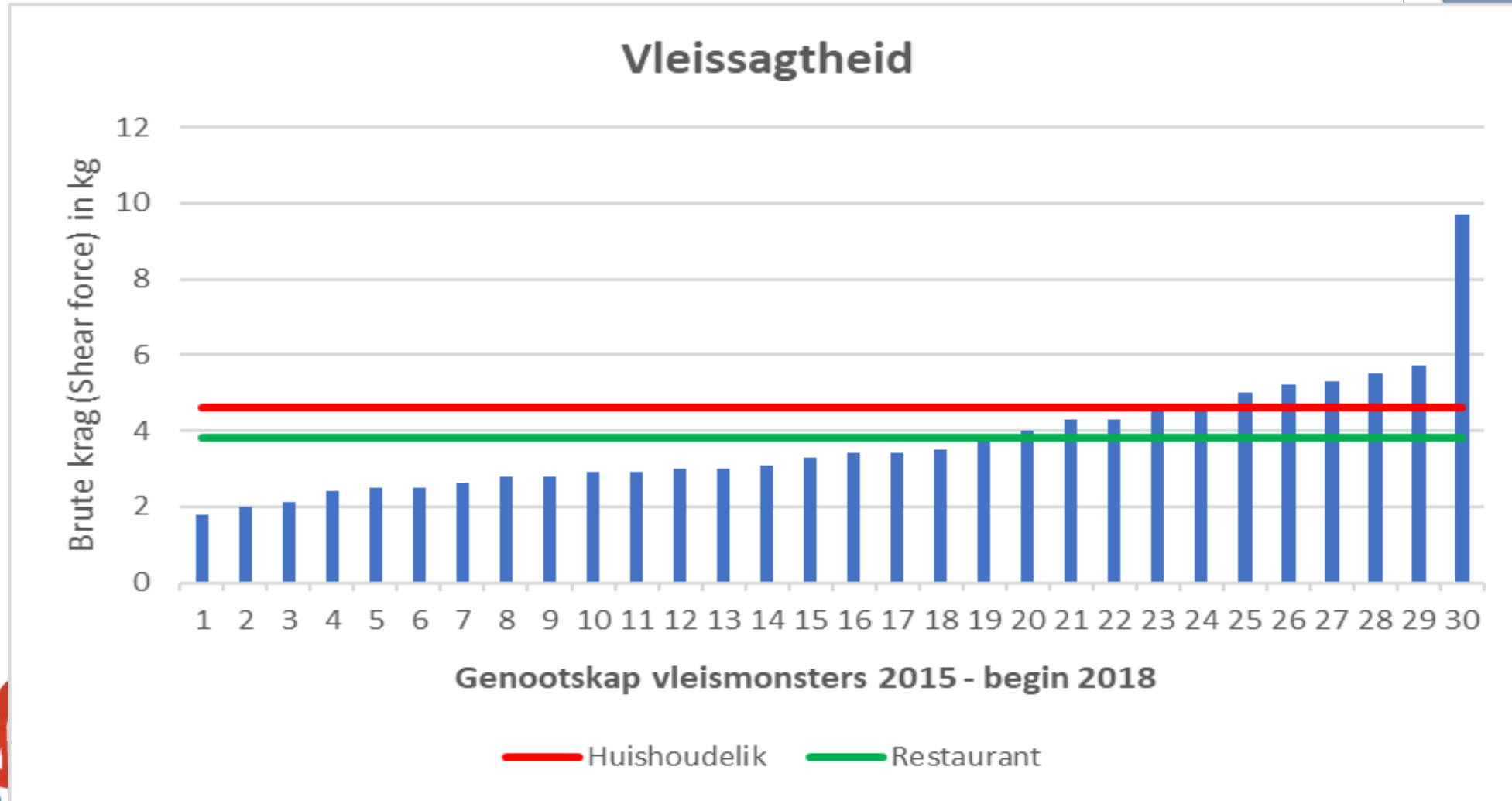
Carcass data



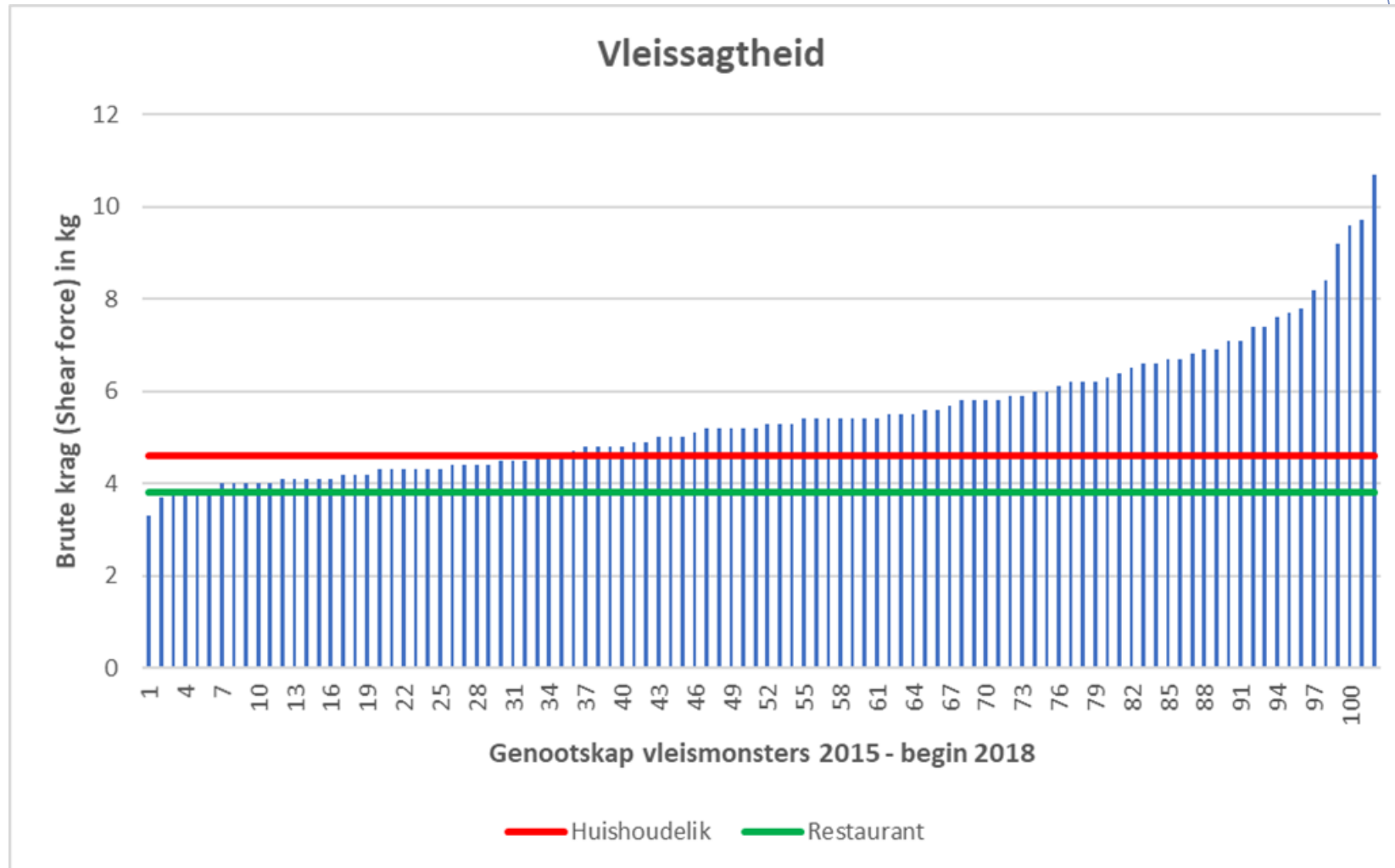
Carcass data



Carcass data



Carcass data



Meat quality & RFI data



- ▶ Number of records per breed is still small
- ▶ The BGP acted as a catalyst for farmers to start testing for difficult-to-measure/expensive traits
- ▶ After the first phase of the project ended, farmer kept on testing their animals
- ▶ Simmentaler and Brahman, with some historic data, almost have enough RFI/NFI records for BREEDPLAN to release RFI EBVs



Genotype data



Samples successfully genotyped from 2015-2018

	7K	150K	777K	Total
Brahman SA	130	41		171
Brahman Nam	134	113	11	258
Brangus		102		102
Braunvieh Nam		20		20
Limousin		25	3	28
Santa Gertrudis	69	3	2	74
Santa Gertrudis Nam		29		29
Simbra	171	9		180
Simmentaler	191	22		213
Total	695	364	16	1075



Impact study

Summary of Impact Measures

Total Benefits (PV)	R2 651 240 385
Total Input Costs (PV)	(R834 141 765)
Total Usage Costs (PV)	(R27 246 756)
Economic Net Present Value (ENPV)	R1 789 851 863
Economic Internal Rate of Return (EIRR)	18.70%
Benefit Cost Ratio (BCR)	3.08



Broader socio-economic impacts of BGP

- ▶ Protect and enhance international competitiveness and sustainability of SA beef production
- ▶ Increased food security
- ▶ Improve trade balance
- ▶ Reduce greenhouse gas emissions
 - Due to improvement in feed efficiency
- ▶ Improve scientific research capacity in genomics
- ▶ Create employment opportunities



What we learned...



- ▶ New terms and concepts:
 - Genomics
 - SNPs
 - Reference population
- ▶ How to work together
 - ✓ ...as **breeders**
 - ✓ ...as the **LRF**
 - ✓ ... as different **research institutions**
 - ✓ ... as the **broader industry**
- ▶ Other DNA laboratories also started to do SNP tests as a result of the BGP project



Keep in mind...



- ▶ Phase 1 of BGP was a steep learning curve for all of us
- ▶ Most of the benefits from BGP will only be realized in the long run
- ▶ The whole South African beef industry will eventually benefit from the project



Phase 2 of BGP

- ▶ Await final approval by TIA
- ▶ Applied for ± 12 million per annum for another 3 years
- ▶ As a consortium we were able to negotiate a better bulk price on the SNP chips, we committed to 20 000 SNPs per year.



Things to remember about Genomics

- ▶ It is NOT a magic tool
- ▶ Accurate phenotypes still need to be collected
- ▶ “Garbage in - Garbage out” also applies to genomics
- ▶ Genomic selection is not an exact science, but it is a powerful new tool for predicting breeding values



Thank you!

