University of Ljubljana Biotechnical Faculty

SELECTION ADAPTED TO LOCAL CONDITIONS HAS THE POSSIBILITY TO IMPROVE THE ECONOMY OF SMALL DAIRY CATTLE BREEDS

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INTERNATIONAL SYMPOSIUM ON ANIMAL SCIENCE 2015. & 20th INTERNATIONAL CONGRESS ON BIOTECHNOLOGY IN ANIMAL REPRODUCTION (ICBAR).09-11.09.2015. Novi Sad, Serbia

Topics

- Some facts and trends about cattle selection
- Classic & Genomic selection
- Niche production - examples
- Discussion

Facts about cattle breeding in Slovenia

- Self eficient with milk and milk
- Cattle population:
  - 450.000 cattle
  - 160.000 cows (25.800 farms – mean=6,2)
  - 60.000 suckle cows (19.200 farms – mean=3,1)
  - 100.000 dairy cows (6.600 farms – mean=15,2)
  - 80.000 milk recording cows

EU 23 mio

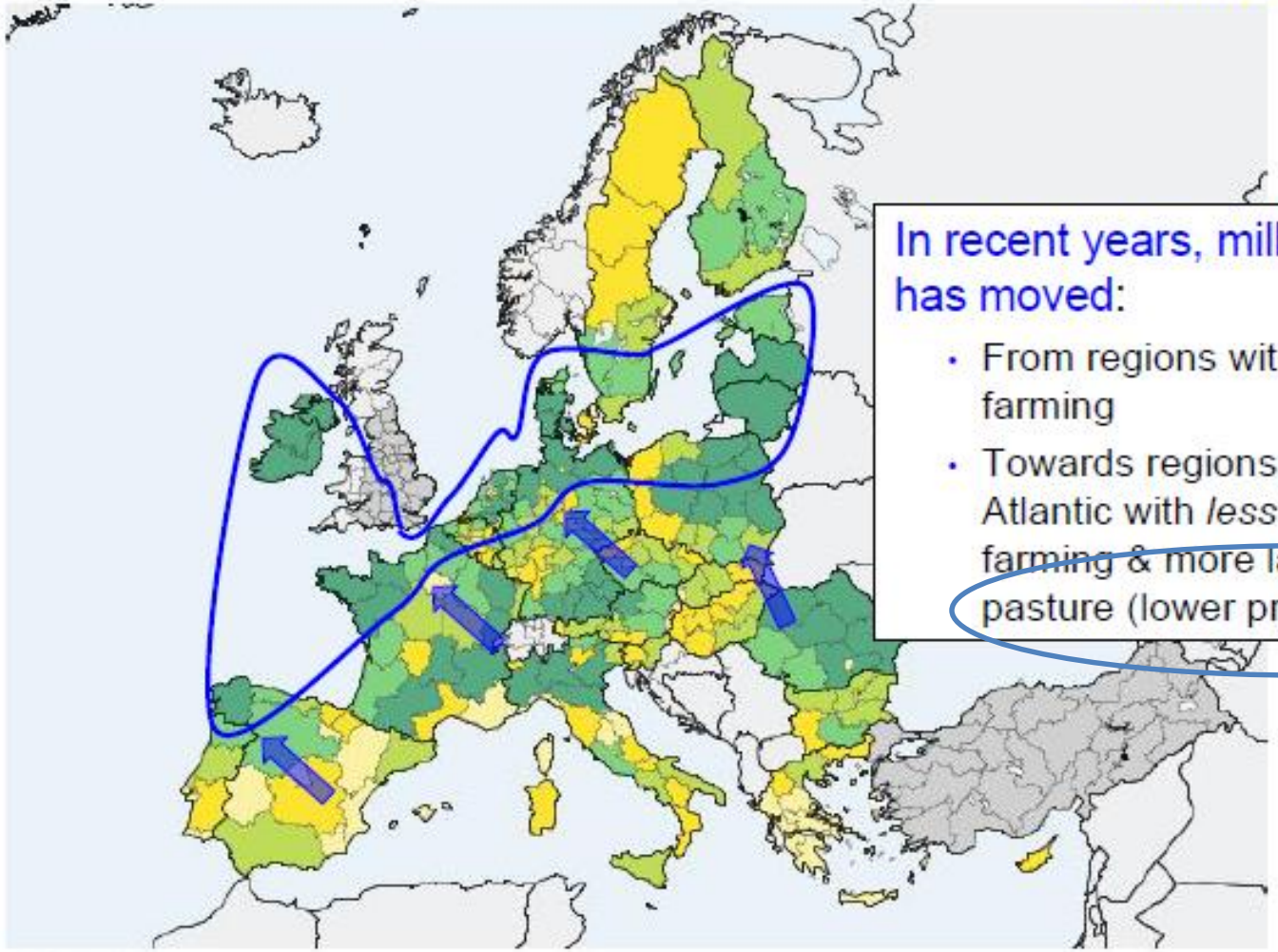
No selection!

Breed	∑ %	Dairy	Suckle	N calving's ML	Ml kg
HOL	17.5	34,400	0	3.1	7,400
BSW	7.0	12,300	2,500	3.9	5,500
SIM	39.0	40,300	32,800	3.7	5,700
Other	36.5	13,000	24,700	3.3	6,000

TRENDS IN EUROPE

Regional movements in EU Milk Production

Movement continues to Atlantic regions with less intensive farming

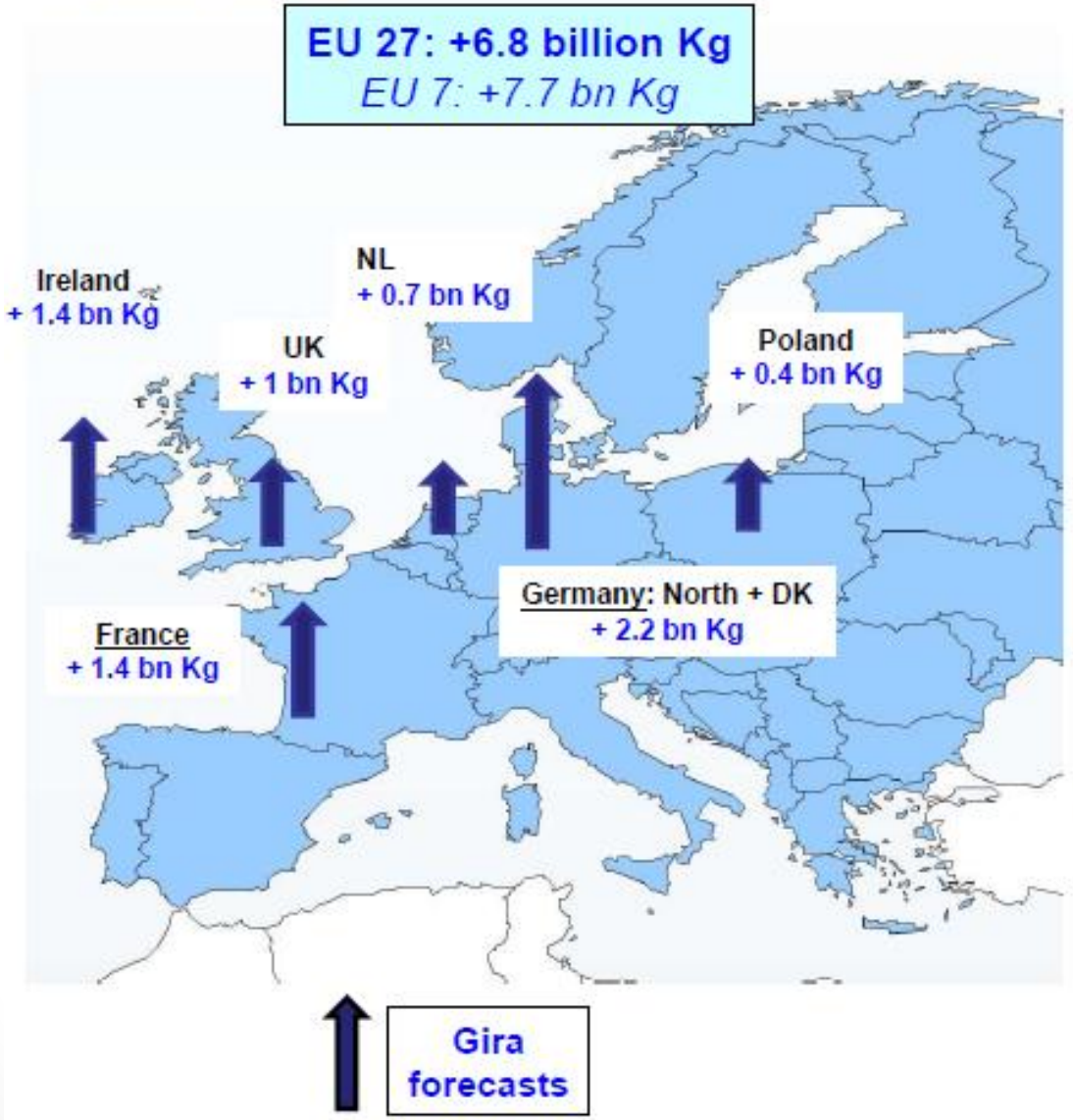


In recent years, milk production has moved:

- From regions with *intensive* farming
- Towards regions around the Atlantic with *less intensive* farming & more land suitable for pasture (lower production costs)

Source: Eurostat

Gira's forecasts for milk collection in 2016 compared to 2011



Ireland (+4.7% p.a. 2011/2016)

The UK (+1.4%):

France (Brittany) (+1.1%):

The Netherlands (+1.2%):

Germany (+1.4%):

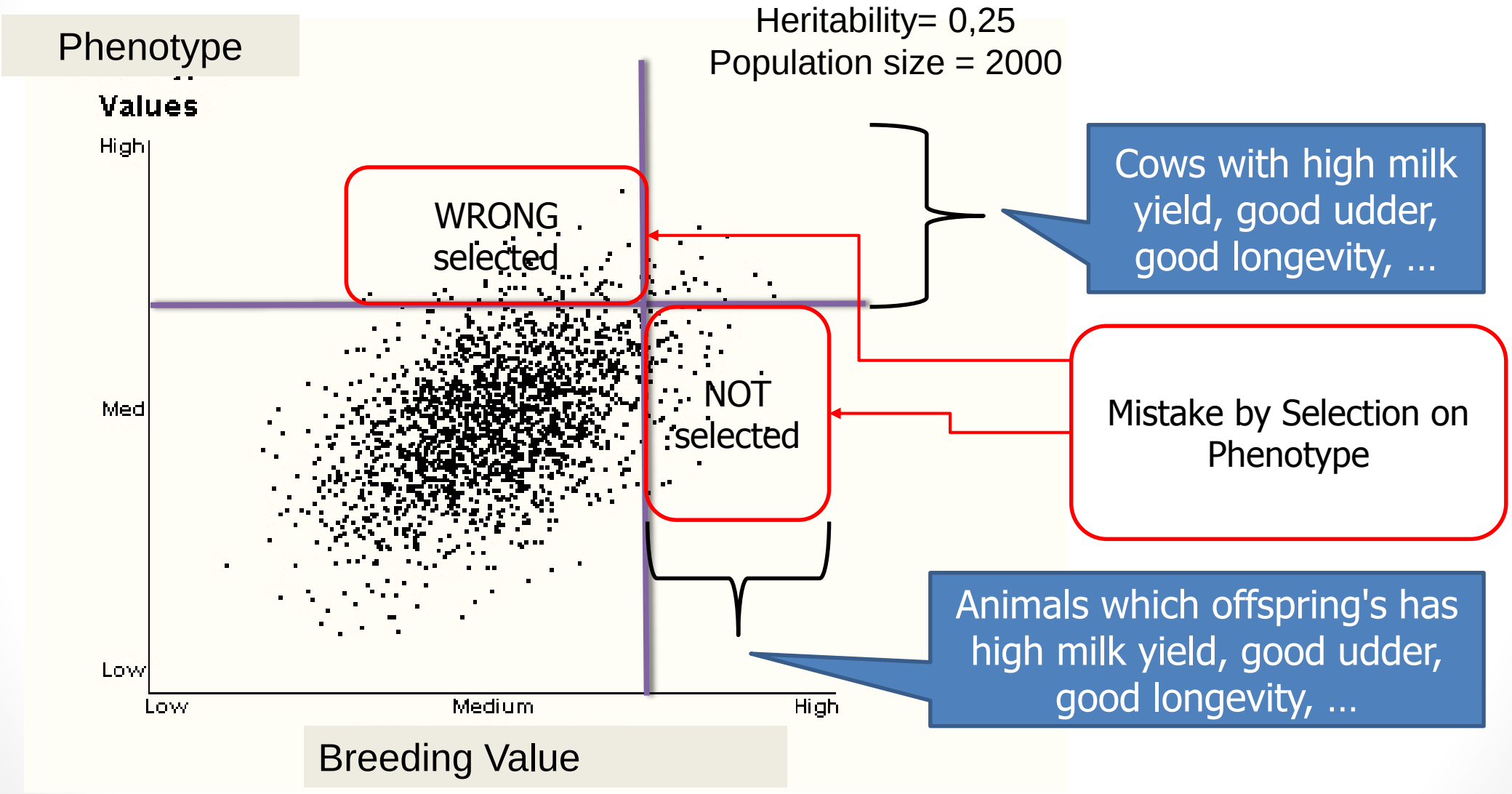
Poland (+0.9%):

The rest of the EU: (-0.6%): -0.9 bios Kg by 2016

Phenotype or Breeding Value as selection criteria?

SELECTION – HOW IT‘S WORKS?

Selection criteria - tool



How to get Breeding Value?

- Data (milk yield, fat content, SSC, WH,…)
- Pedigree
- Statistical model with several effects
- Methods:
  - BLUP animal model
  - Random regression AM
  - …

Reliable BV when offsprings get a data.

Then sires aged 5-6 years, cows are already in 2nd pregnancy!

Genetic gain

Heritability and variance are in the given time constant!

We can influence only ‚i' & ‚l'

Genetic change

$$\Delta G = \frac{i \, h^2 \, \sigma_p}{l}$$

Selection intensity

Heritability

Variability

Generation interval

Progeny test – 6 years
Genomic sel. – 2 years
with ET = for ♀

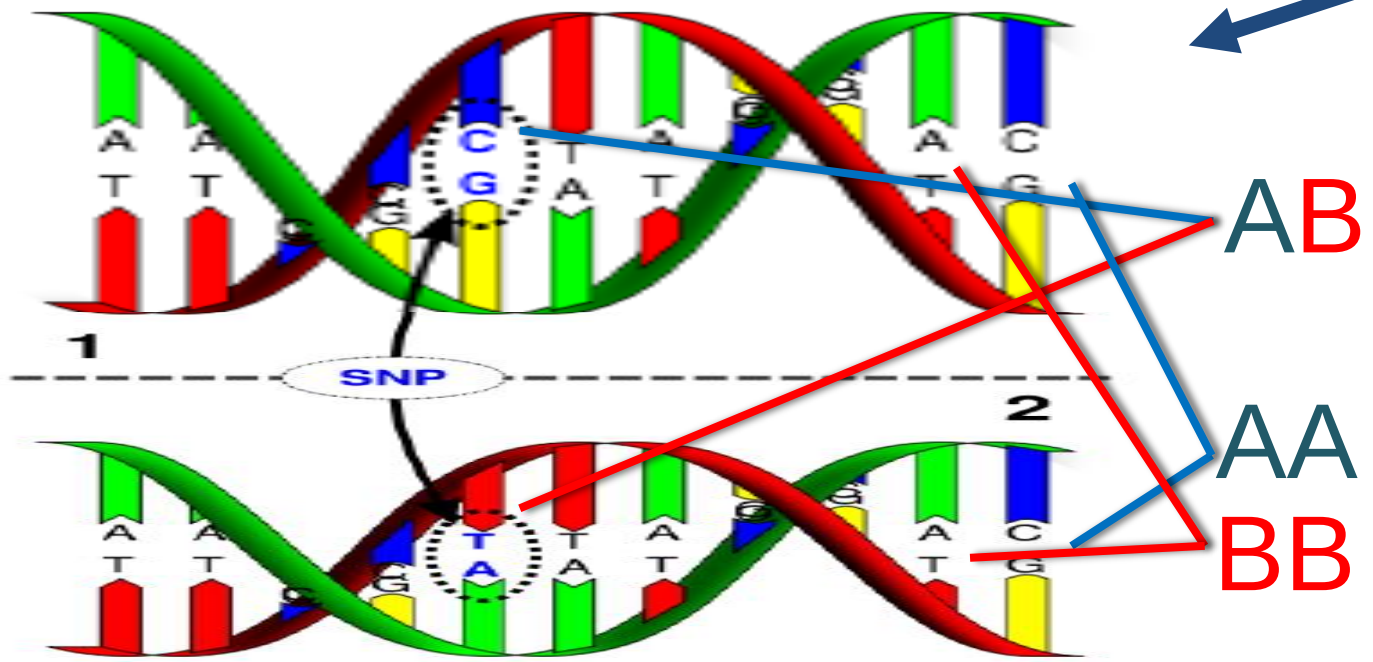
% selection	i
1	2.67
5	2.06
10	1.75
30	1.16
50	0.80
70	0.50
90	0.19
100	0

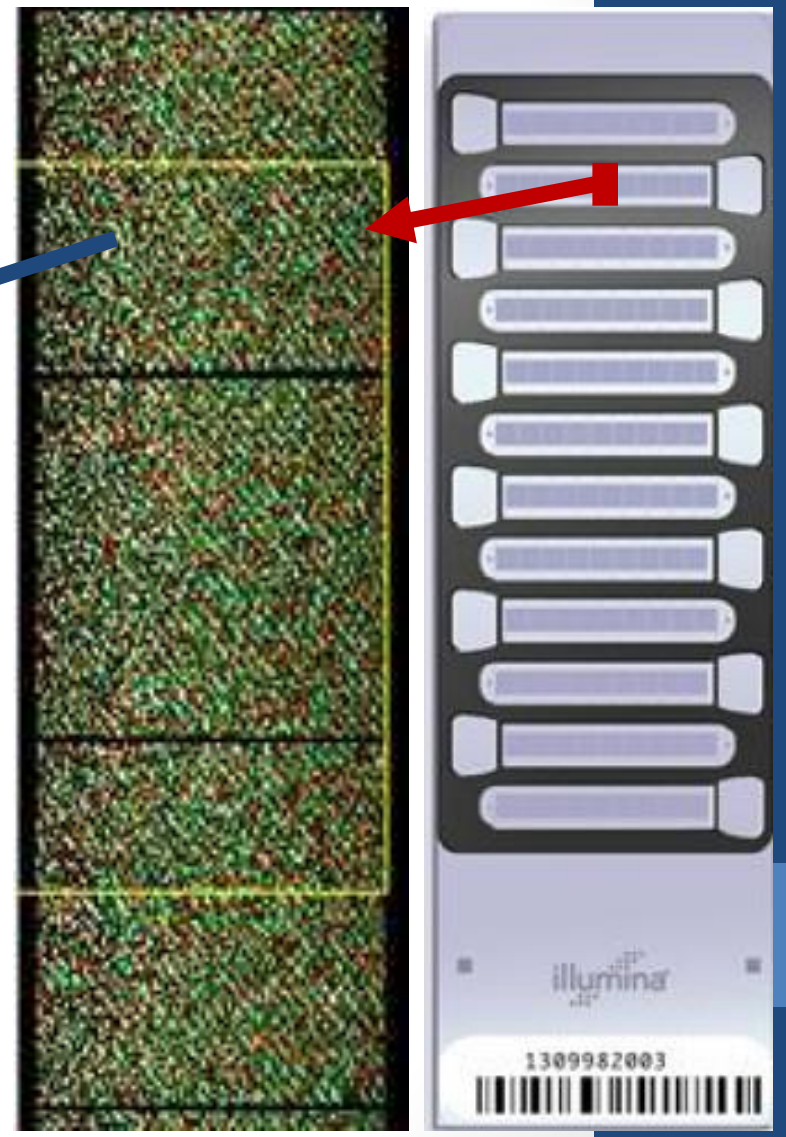
Population size
DEU 4 mio
USA 9 mio
SLO 0,1 mio

GENOMIC SELECTION

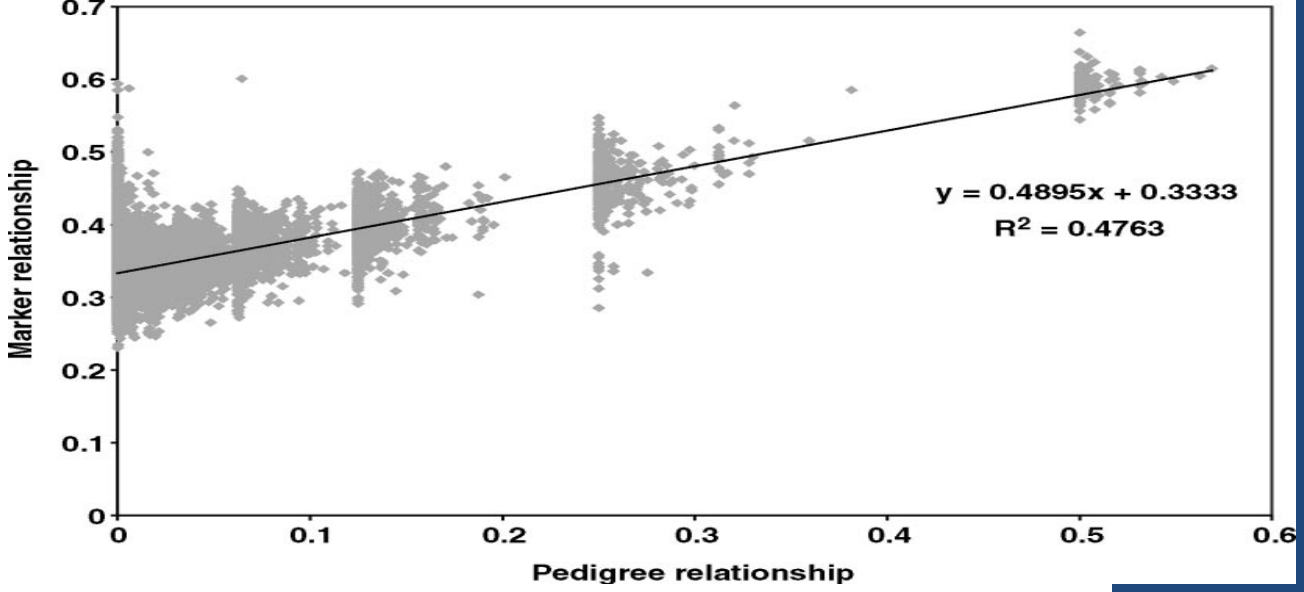
BV after birth or already before - GS

- Basic principe of GS:
  - Classic BV and
  - Genome informations (SNP-chip) for animals with reliable BV





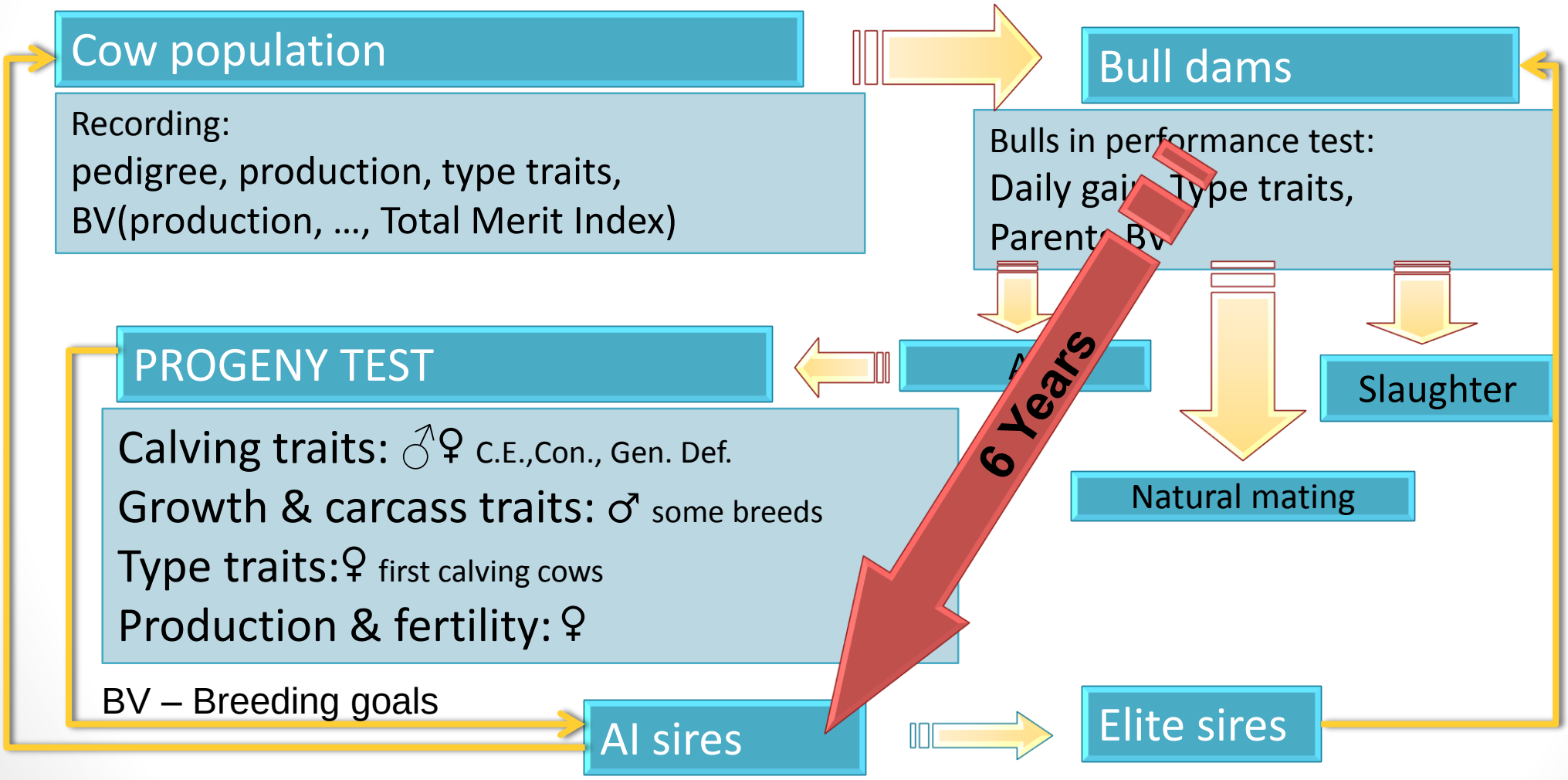
Genomic selection



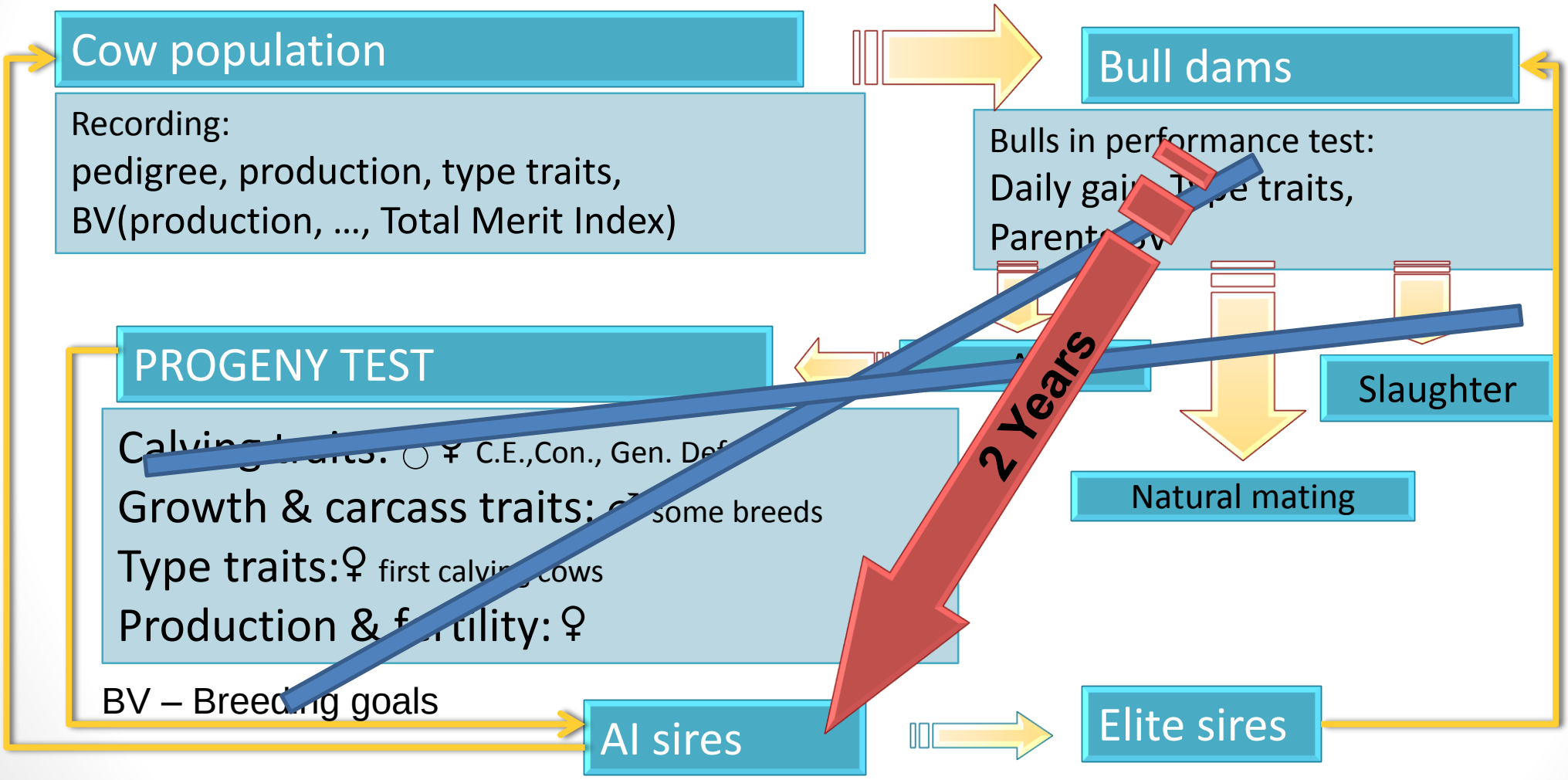
Hayes in Goddard (2008)
http://jas.fass.org/cgi/content/full/86/9/2089

- Advantages:
  - Shorter generation interval
  - Use of animals at sexual maturity
  - Greater efficiency in the selection of the traits with low heritability
  - Tool to prevent inbreeding - functional inbreeding
  - Genetic disorders prevention
- Limitations
  - A large number of animals in the base population (BV + SNP)
  - Great investment?!?

Selection Program scheme –classic PT



Selection Program scheme - GS



Good example
Genomic selection – FRA-13

- AI centre → Genomic centre
  - Beside bulls - semen, heifers - ET
  - Fair play with breeders – minimising of speculations
    - Embrio genomic selection
    - Known sex
    - Estimates of genetic disorders
    - GEBV
    - Functional inbreeding

Before ET!

Facts of our populations

- Very small in Europe – practically nothing (herd) in the World
- Competing on market with raw milk
- ‚Same' breeding program
- Breeding programmes prepared for intensive production with high management level
- Variable management level in praxis
- Pasture – grass land vs. crop production

Niche selection – product quality!

ANOTHER POSSIBILITIES?

Product quality - traits

- A 30 - curd firmness
- Beta – lactoglobulin
- Kappa casein
- Beta casein
- MIRS (Mid-InfraRed Spectroscopy)
  - FA ω-3 : ω-6 = 1 : 2-3 – pasture/cereals

Kappa casein

- Allelic forms: B, A, E,..
- BSW just A & B
- Key factor for milk coagulation properties → impact on cheese yield
- Comparison of genotype AA : BB
  - cca. 25 % rennet coagulation time
  - cca. 50% lower curd strength
  - cca. 10% lower cheese yield
    - Ex. 6000 l/lac × 5 lac = 30000 l ≈ 3000 kg of cheese
    - Difference cca. 7 % = 210 kg of cheese × 5€ = 1000 €
  - + higher breeding animals price
  - + selection on calves

Kappa casein – CHE 2012

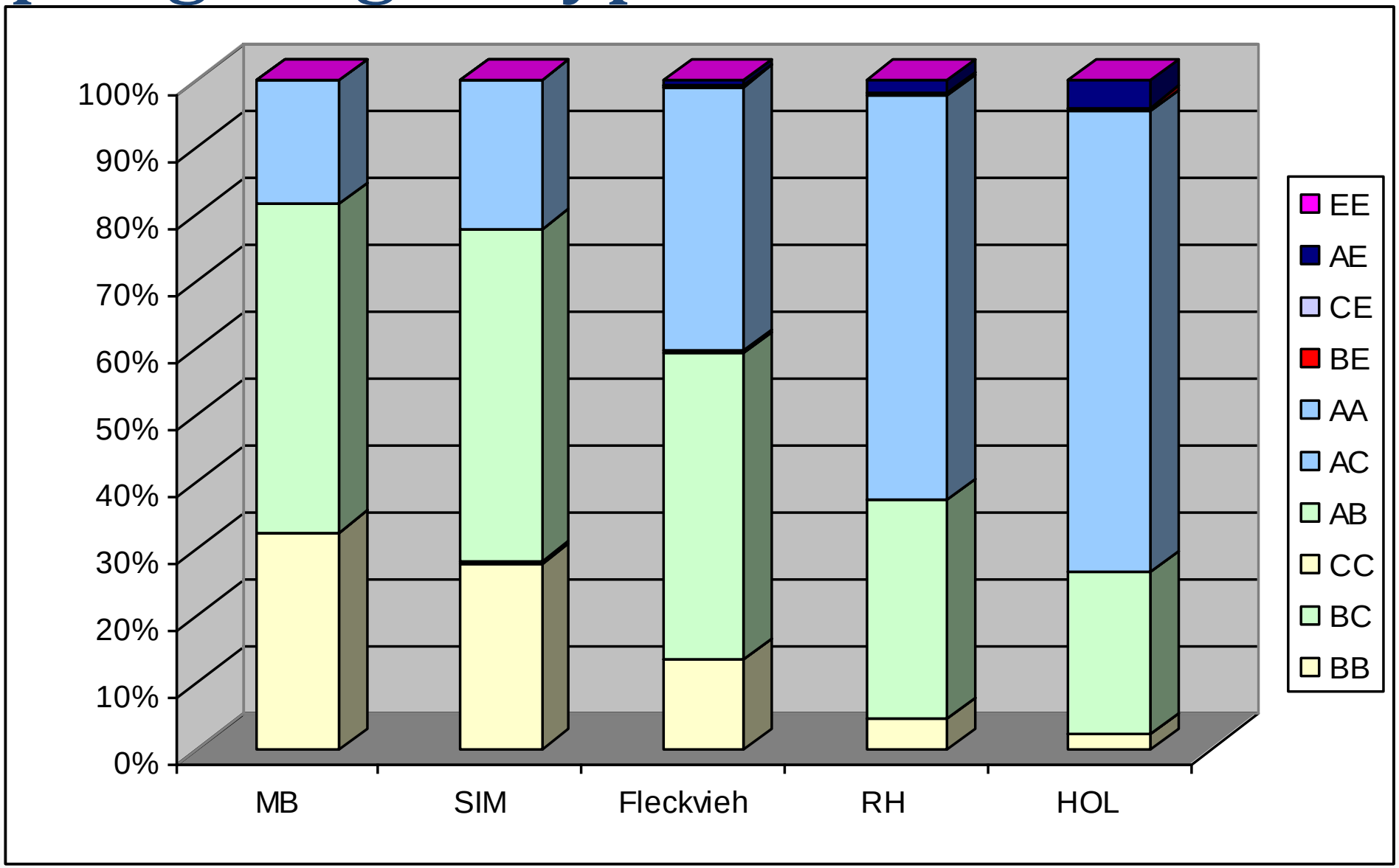
- Sires KK - AE
  - Picstone SHOTTLE-ET GB 598172
  - Sandy – Valley BOLTON-ET US 131823833

Each second daughter hold **E alel!!!**

KK genotype AI sires in CHE 2012

Rasse	Anzahl	Häufigkeit der Kappa-Kaseinvarianten			
		A	B	C	E
Normande	14	25.0%	75.0%	0.0%	0.0%
Montbéliarde	57	43.0%	57.0%	0.0%	0.0%
Simmental	174	47.1%	52.6%	0.3%	0.0%
Swiss Fleckvieh	189	62.7%	36.5%	0.3%	0.5%
Red Holstein	364	77.6%	21.2%	0.0%	1.2%
Holstein	275	82.9%	14.7%	0.0%	2.4%

Offspring KK genotypes ♂=♀



Beta casein

- Alleles variant A1 in A2. Mutation A2 to A1.

Comparative evaluation of cow β-casein variants (A1/A2) consumption on Th_2-mediated inflammatory response in mouse gut

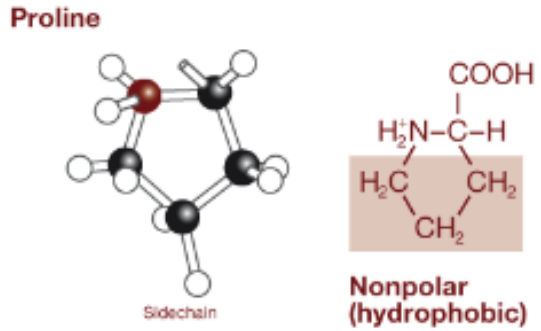
Mohammad Raies Ul Haq · Rajeev Kapila · Rohit Sharma · Vamshi Saliganti · Suman Kapila

Analysis of Slovak Spotted breed for bovine beta ca variant as risk factor for human health*

Martina Miluchová✉, Michal Gábor and Anna Trakovická

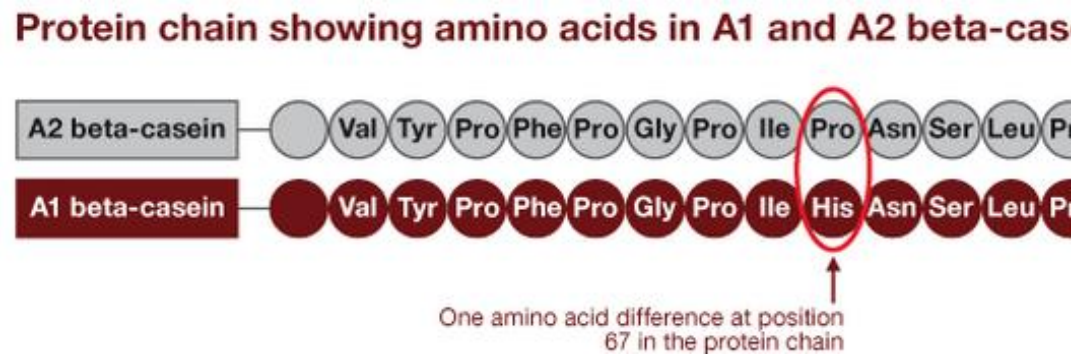
Cow's Milk Allergenicity

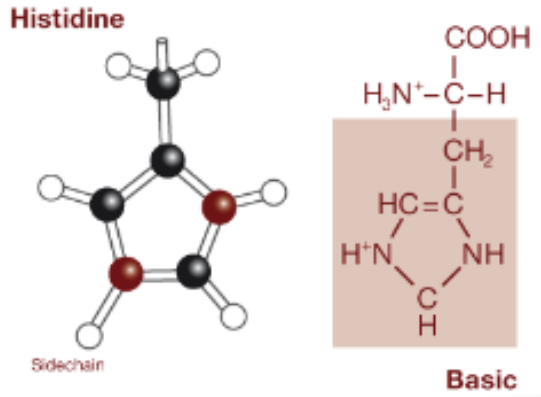
Sophia Ts



- Allele A1 associated with several disseises

beta-casomorphin-**7** (BCM **7**)!





Beta casein

- Differences between breeds
  - HOL 50-50
  - GUE < 10% A1
  - BSW ~ 25%
  - SIM ???
  - Old breeds ???
- Beta-casomorphin 7 (BCM-7) yielded during digestion of A1

Etiology:
type 1 diabetes,
cardiovascular disease,
neurological disorders such autism and schizophrenia

Selection on caseins – economic impact

- Dependent - level of interest
  - National - International
  - Dairies
  - Breeder, own milk processing or/and direct selling of milk
- Fresh milk selling A2
  - Market establishment
  - Networking - connecting!
  - Risk by low investment
- Milk processing, option connection with A2
  - An immediate result - a small investment
    - Division of cows, where part of milk is sold
    - Cooperation - Exchange of animals
- Long-term sales of breeding animals

Niche selection – product quality!

SOME EXAMPLES?

CHE- SIM

Kappa-Kasein E – eine nicht käsereitaugliche Milchproteinvariante

Gewisse Holsteinstiere vererben mit dem Kappa-Kasein E eine Milchproteinvariante, welche zu schlechter Milchgerinnung führt und die Käseherstellung beeinträchtigen kann. Produzenten von Käsereimilch wird empfohlen, bei der Auswahl der Stiere auf den Kappa-Kasein-Genotyp zu achten.

Die Käseherstellung beginnt mit dem so genannten „Dicklegen" der Milch. Dabei wird das mengenmässig wichtigste Milchprotein, das Kasein, so verändert, dass es eine elastische Gallerte bildet. Es ist wichtig, dass die Labgallerte eine genügende Festigkeit entwickelt. Schlecht gerinnende Milch führt zu deutlich geringeren Käseausbeuten, aber auch die Käsequalität kann leiden.

Einfluss der Genetik

genau in der Mitte. In den Hartkäsegebieten Norditaliens begann man vor 30 Jahren, das Kappa-Kasein B in der Milchviehzucht zu fördern.

Nachteiliger als Kappa-Kasein A

Wenig bekannt ist, dass es mit der genetischen Variante E eine weitere genetische Variante des Kappa-Kaseins gibt, die für die Labgerinnung der Milch noch nachteiliger ist als das Kappa-Kasein A. Dies ergaben Studien aus Deutschland, der Schweiz, Finnland, Italien und Estland[1]. Exemplarisch sei dies anhand einer Grafik gezeigt (siehe **Abb. 1**), die auf den Daten einer finnischen Studie basiert.

Die geringe Festigkeit der Labgallerte macht die Milch von Kühen des Kappa-Kasein Genotyps AE oder EE

(Foto: ALP)

Schneiden der Milchgallerte mit der Käseharfe

Träger der Kappa-Kaseinvariante E

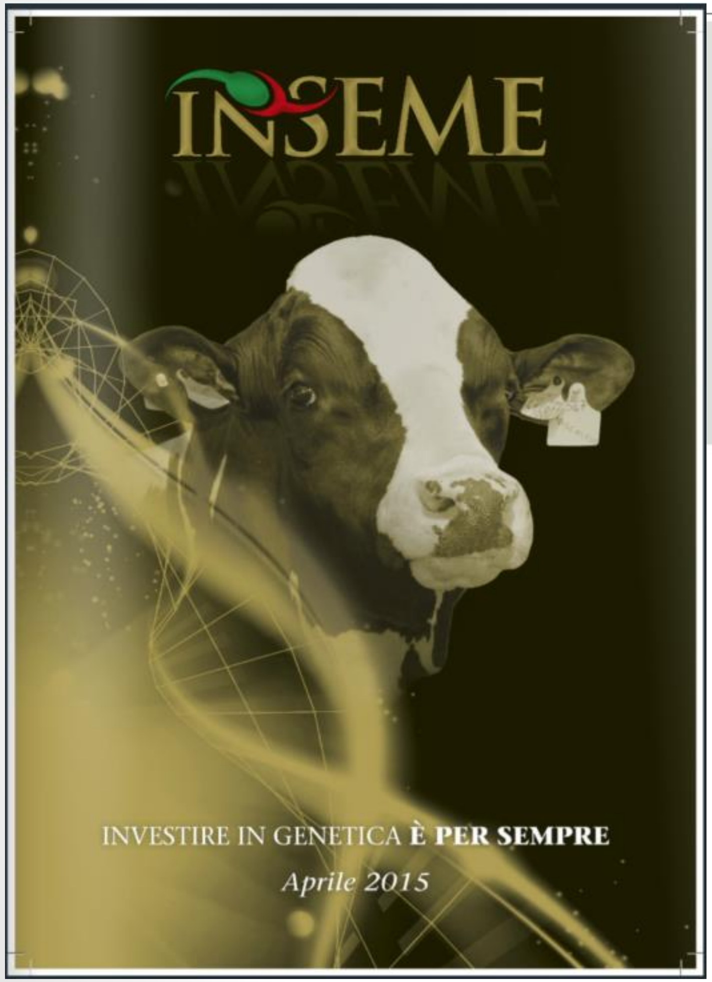
Der Kappa-Kasein-Genotyp wird für Schweizer KB-Stiere seit vielen Jahren untersucht und ausgewiesen. Daher sind bei Schweizer KB-Stieren die Kappa-Kaseingenotypen weitgehend lückenlos vorhanden.

Hingegen werden bei Jungstieren und ausländischen Stieren die Genotypen noch nicht systematisch bestimmt. Man ist aber bestrebt, in Zukunft die Genotypen aller KB-Stiere auszuweisen. Ausserdem ist es möglich, dass sich unter den Stieren des Genotyps AA und AB noch falsch identifizierte Träger des Kappa-Kaseins E befinden, weil zum Teil noch mit Methoden typisiert wurde, die keine Unterscheidung der Varianten A und E erlaubten.

Grosse Rassenunterschiede

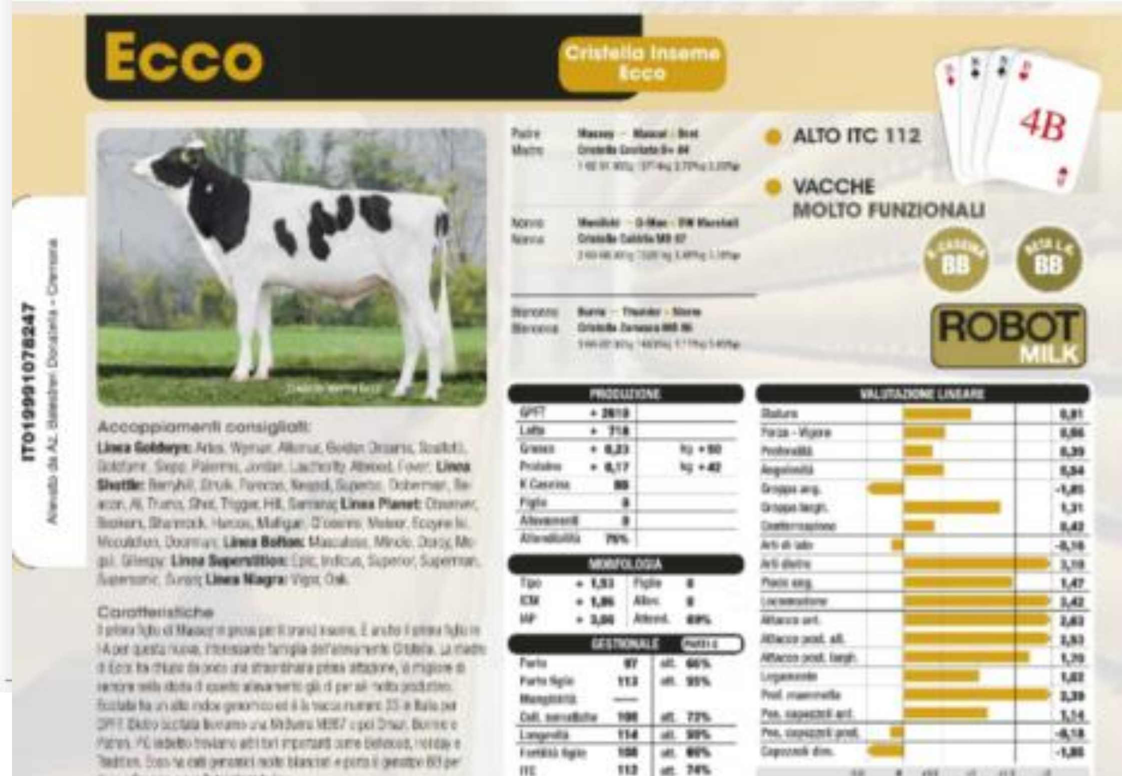
Töchter von MARCO-ET mit Genotyp Kappa-Kasein BE sind je zur Hälfte Trägerinnen der günstigen Kappa-Kaseinvariante B und der ungünstigen Kappa-Kaseinvariante E.
Foto: Nachtzuchtgruppe von **MARCO-ET** CH 120.0546.7893.1 RH

ITA - HOL


INSEME
INVESTIRE IN GENETICA È PER SEMPRE
Aprile 2015

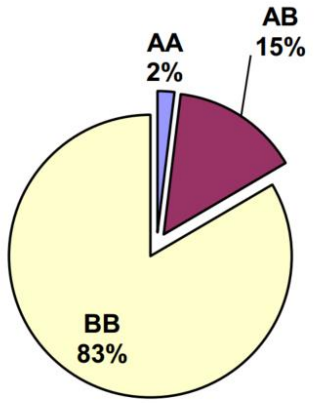

Aksel
All. Denti Aksel E93
127 FIGLIE
BETA CASEINA A2A2
FORTE MIGLIORAMENTO PRODUTTIVO CON L'ENTRATA DELLE 52 SECONDIPARE!
MAMMELLE OTTIME +3.29
FOEMINA
ROBOT MILK
PRODUZIONE
MORFOLOGIA
GESTIONALE
VALUTAZIONE LINEARE


Kappa Caseina e
Beta Lattoglobulina
PARMIGIANO REGGIANO
FORMAGGI DI MEDIA STAGIONATURA

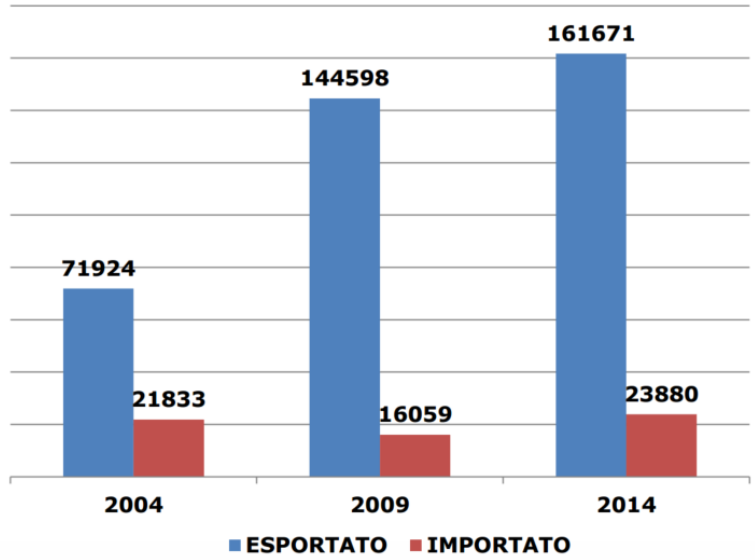

Ecco
Cristella Inseme Ecco
ALTO ITC 112
VACCHE MOLTO FUNZIONALI
4B
ROBOT MILK

ITA - BSW

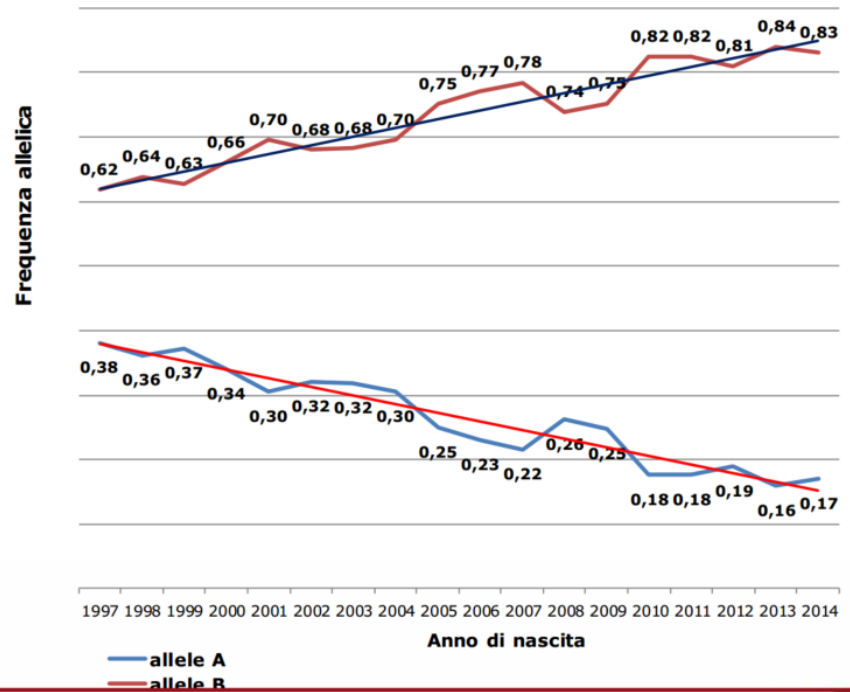
NUMERO SOGGETTI VIVENTI CON TEST K-CASEINA 23.312 FREQUENZA ALLELE B OLTRE 90%



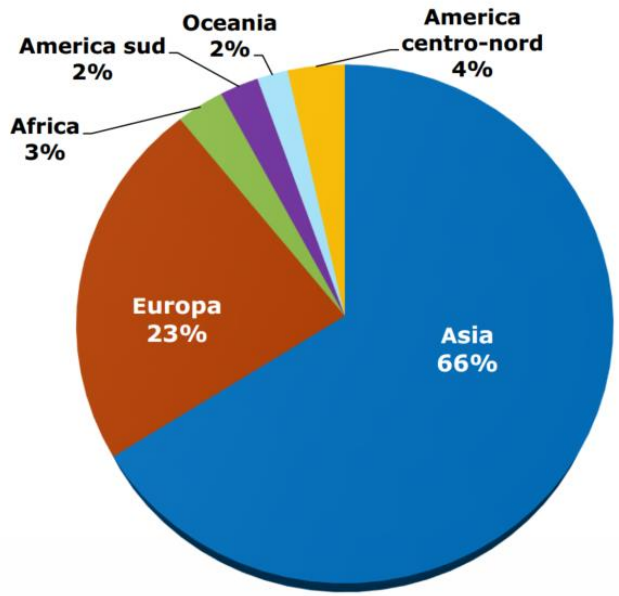
MATERIALE SEMINALE ESPORTATO E IMPORTATO



FREQUENZA K-CASEINA PER ANNO DI NASCITA



AREE D'ESPORTAZIONE DEL MATERIALE SEMINALE



Welcome to

The a2 Milk Company™

2013/14
Annual Report

Our history

2014

Company name and subsidiary names become aligned to one new brand identity: The a2 Milk Company™

a2 Milk™ UHT is launched into China

We take full ownership of the UK joint venture from Müller Wiseman, and UK business momentum continues

a2 Milk™ in Australia extends into thickened cream, and continues to drive strong market share growth in the fresh milk supermarket category

First human digestion trial published in European Journal of Clinical Nutrition reporting a digestive difference between A1 and A2 beta casein protein and supporting previous studies

2013

a2Platinum® Infant Formula is launched across China, Australia and New Zealand and total Infant Formula business gaining momentum

2012

Successfully completed capital raising and transferred listing to the NZX Main Board

Strong NZ institutional investor support

Formed a manufacturing agreement with Synlait Milk for the exclusive manufacturing of a2Platinum® nutritional powders and infant formula in New Zealand

China State Farm is appointed as sole distributor for a2Platinum® infant formula into China

Commissioned a new, state-of-the-art milk processing facility in Sydney, Australia

2011

Entered a joint venture with Robert Wiseman Dairies to manufacture and market a2 Milk™ in the UK and Ireland

The company records a profit of NZ$2.1m

2010

Full ownership of the Australian joint venture is purchased and Geoff Babidge is appointed Managing Director and CEO

2008

Strong support from first NZ institutional investor AMP

Major change in company strategic direction shifting from a licensing model to a branded product model. Consequently exiting license agreements in Korea and later the US

Consumer and healthcare professional advocacy in Australia starts driving considerable brand growth

2007

Entered a joint venture with Freedom Foods to produce and market a2 Milk™ in Australia

2004

Listed on the NZX – Alternative Market (NZAX)

2003

a2 Milk™ begins selling in Australia and New Zealand via licensees

2000

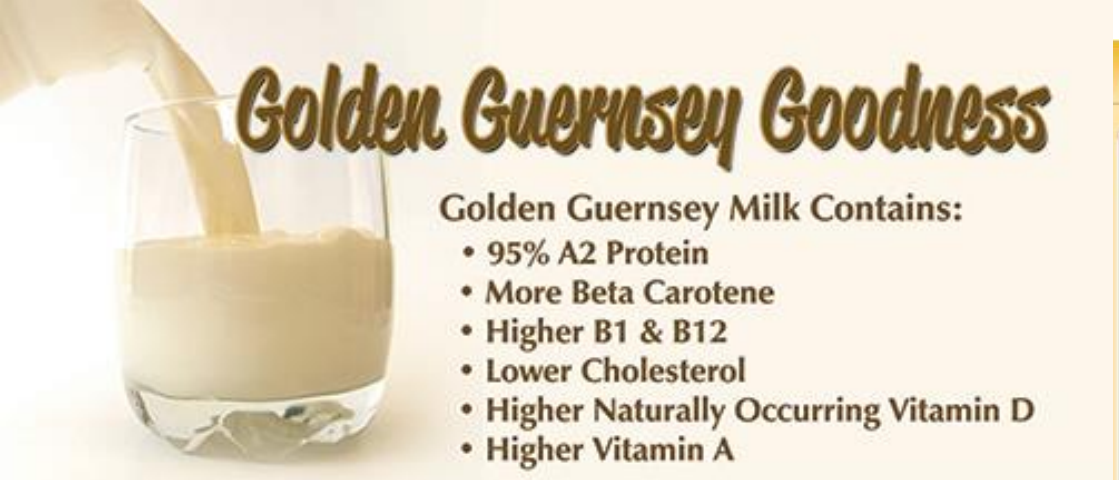
Our company is founded by Dr. Corran McLachlan and Howard Paterson, armed with unique intellectual property and growing belief of the effect different milk proteins have on human health

Dates provided above are for the full calendar year.

2013-2014

	Notes	2014 $'000	2013 $'000
Continuing operations			
Sales		110,621	94,304
Cost of sales		(70,802)	(60,671)

Golden Guernsey Goodness



Golden Guernsey Milk Contains:

- 95% A2 Protein
- More Beta Carotene
- Higher B1 & B12
- Lower Cholesterol
- Higher Naturally Occurring Vitamin D
- Higher Vitamin A

GOLDEN GUERNSEY MILK PRODUCTS

Since the Guernsey breed was developed by French monks on the Island of Guernsey in the English Channel, these beautiful cows have been known far and wide for the superior quality of the milk they produce. Golden Guernsey milk was the premium drinking milk in the good old days, when local milk was delivered right to your door.

The Golden Guernsey logo signifies that the dairy products you are consuming have been produced using 100% Golden milk from Guernsey cows. The added beta carotene gives the milk its namesake golden color, makes Golden Guernsey butter remarkably and naturally brilliantly yellow and lends a golden hue to other products manufactured using Golden Guernsey milk.

Guernsey Milk - Full of A2 Goodness

search...

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- Testimonials
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UK latest Guernsey Products (11 Articles)
The Rest of the Worlds latest Guernsey Products (6 Articles)

GENE2FARM

Next generation European system for cattle improvement and management

"Research for the benefit of SMEs" from the 7th Framework Program

Gene2Farm objectives

The Gene2Farm project will address the needs of the cattle industry, in particular the SMEs and end users needs for an accessible, robust, adaptable and reliable system to apply the new knowledge of the bovine genome to genetic improvement in cattle, to underpin sustainability and profitability of European cattle farming.

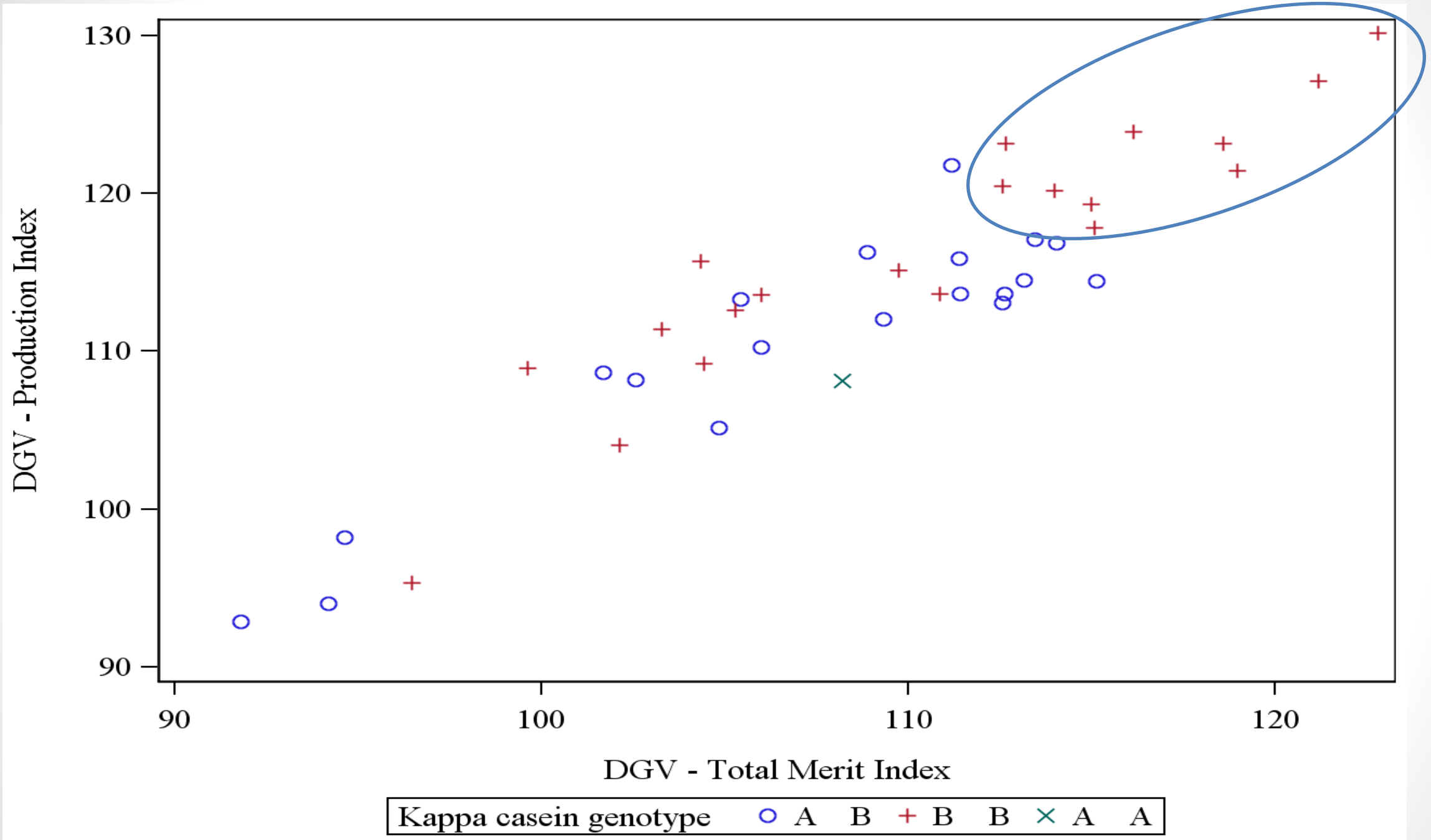
The project general objectives are:

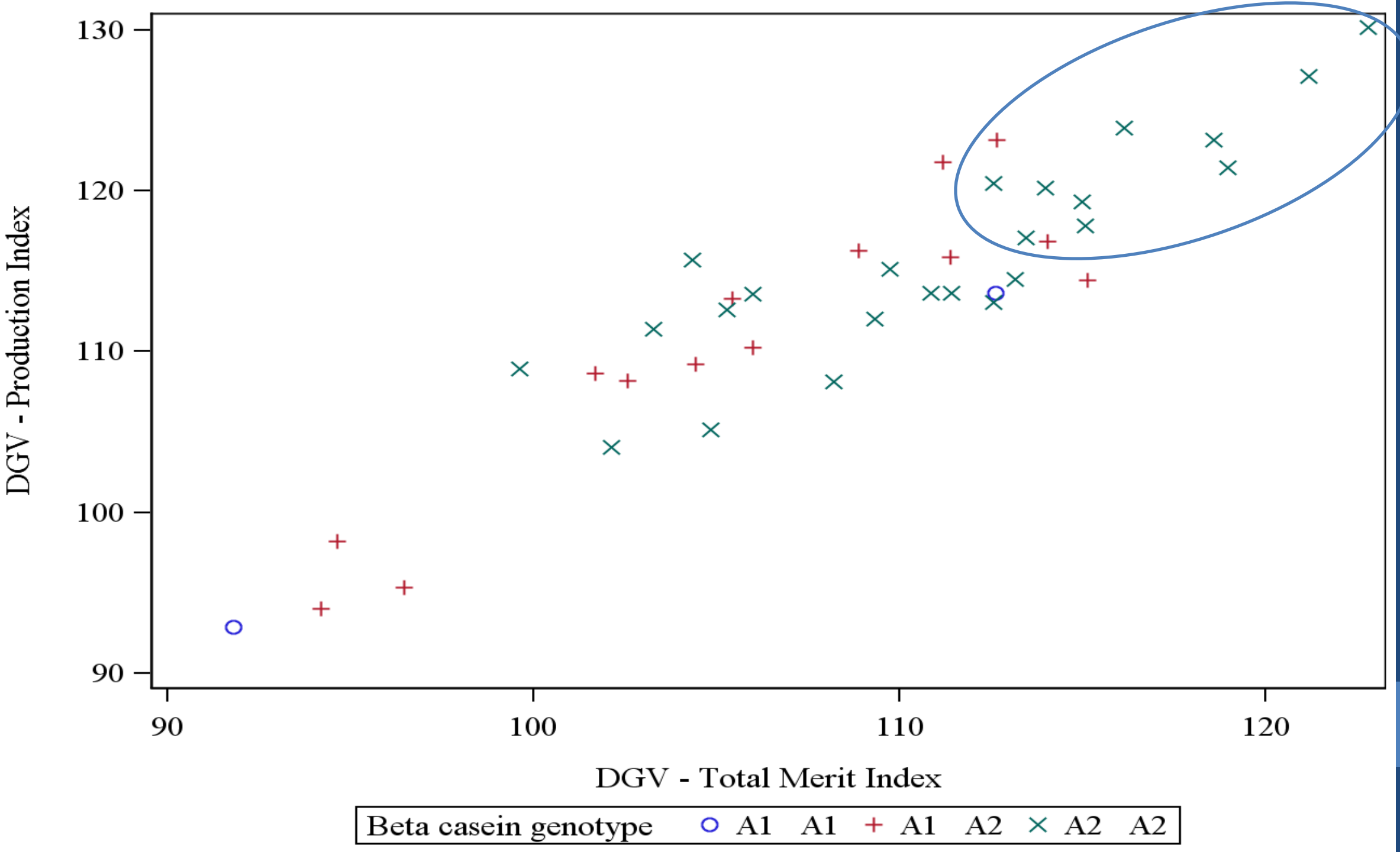
- to derive complete genome information to understand genome structure and to design high and low density genotyping panels.
- to develop the tools to impute higher density genome information from lower density genotype data and to make exchange information easier.
- to address the needs for measuring a wider range of biological variables underlying important commercial traits, in order to provide data on additional important traits for use in selection.
- to develop appropriate statistical models and applications for using the genomic and phenotypic information in order to optimise and customise genetic selection strategies.
- to disseminate the information to the SMEs, the wider cattle breeding industry and to end users.

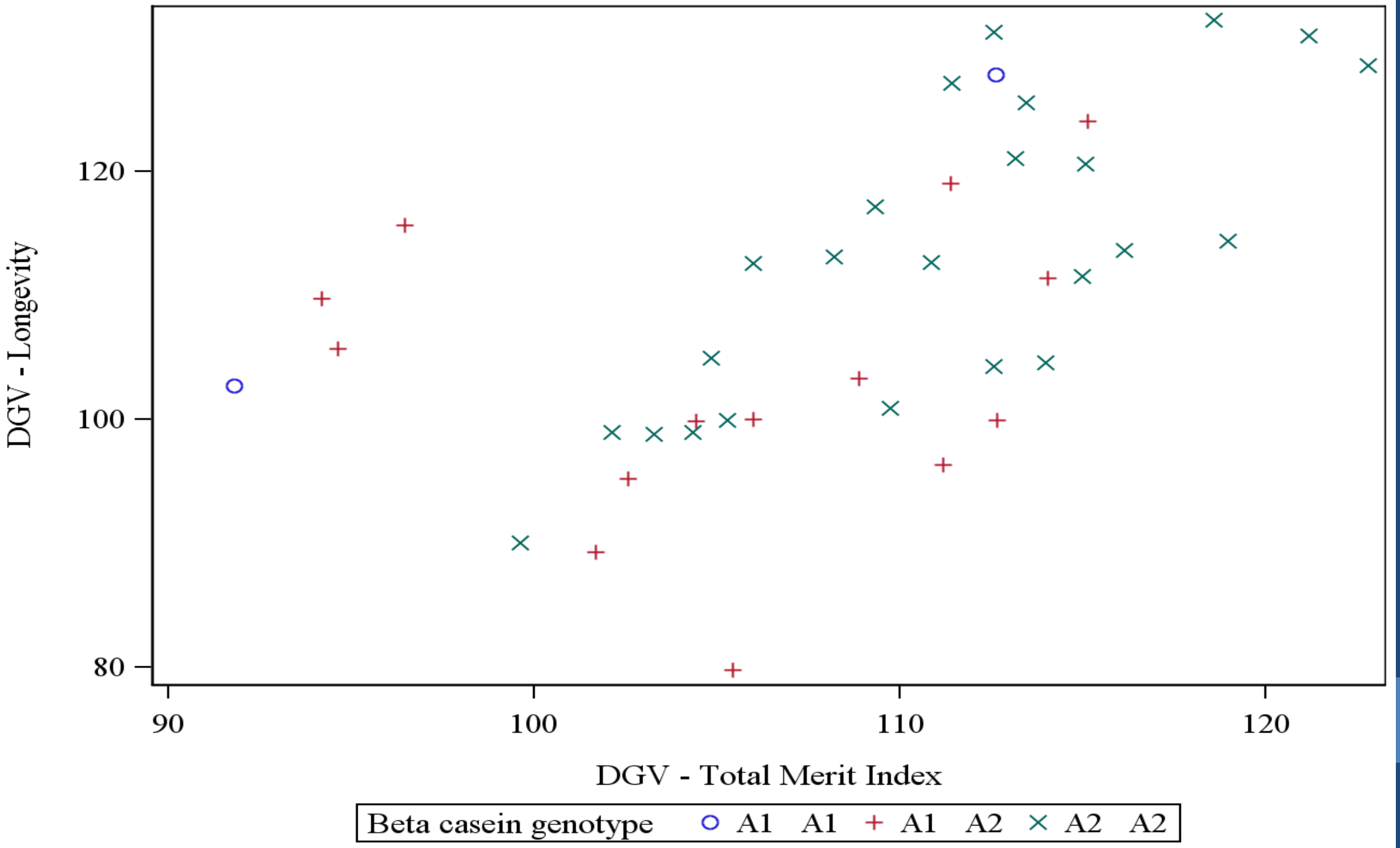
CASE STUDY -SLOVENIA BSW

40 animals - GS

Kappa casein genotype	Beta casein genotype			
	A1A1	A1A2	A2A2	Total
AA	0	0	1	1
AB	2	11	6	19
BB	0	3	17	20
Total	2	14	24	40


DGV - Production Index
130
120
110
100
90
90
100
110
120
DGV - Total Merit Index
Kappa casein genotype
A
B
B
B
A
A


130
120
110
100
90
DGV - Production Index
90
100
110
120
DGV - Total Merit Index
Beta casein genotype
A1 A1
A1 A2
A2 A2


DGV - Longevity
120
100
80
90
100
110
120
DGV - Total Merit Index
Beta casein genotype
A1 A1
A1 A2
A2 A2

Conclusions

- Competition with large populations is irrational
- The first results of the GB BSW show that the selection of the products quality is possible
- Possible strategies
  - Keep the level of production and at the same time fixing the desired allele
  - Selection for the production on pasture - forages
- Networking
  - Breeders
  - Regions with similar conditions of production
  - National
  - International

The potential advantages of niche selection

- Direct effects
  - Higher products quality
  - Better economy (on farm and national)
  - The possibility of selling special genetic material
- Indirect effects
  - Jobs
  - Preserved landscape
  - More attractive for tourism
  - …
- More options is possible!!

THANK YOU FOR YOUR ATTENTION!