European Regional Conference on Goats, Hungary, 7-13 April 2014
Debrecen, Hungary

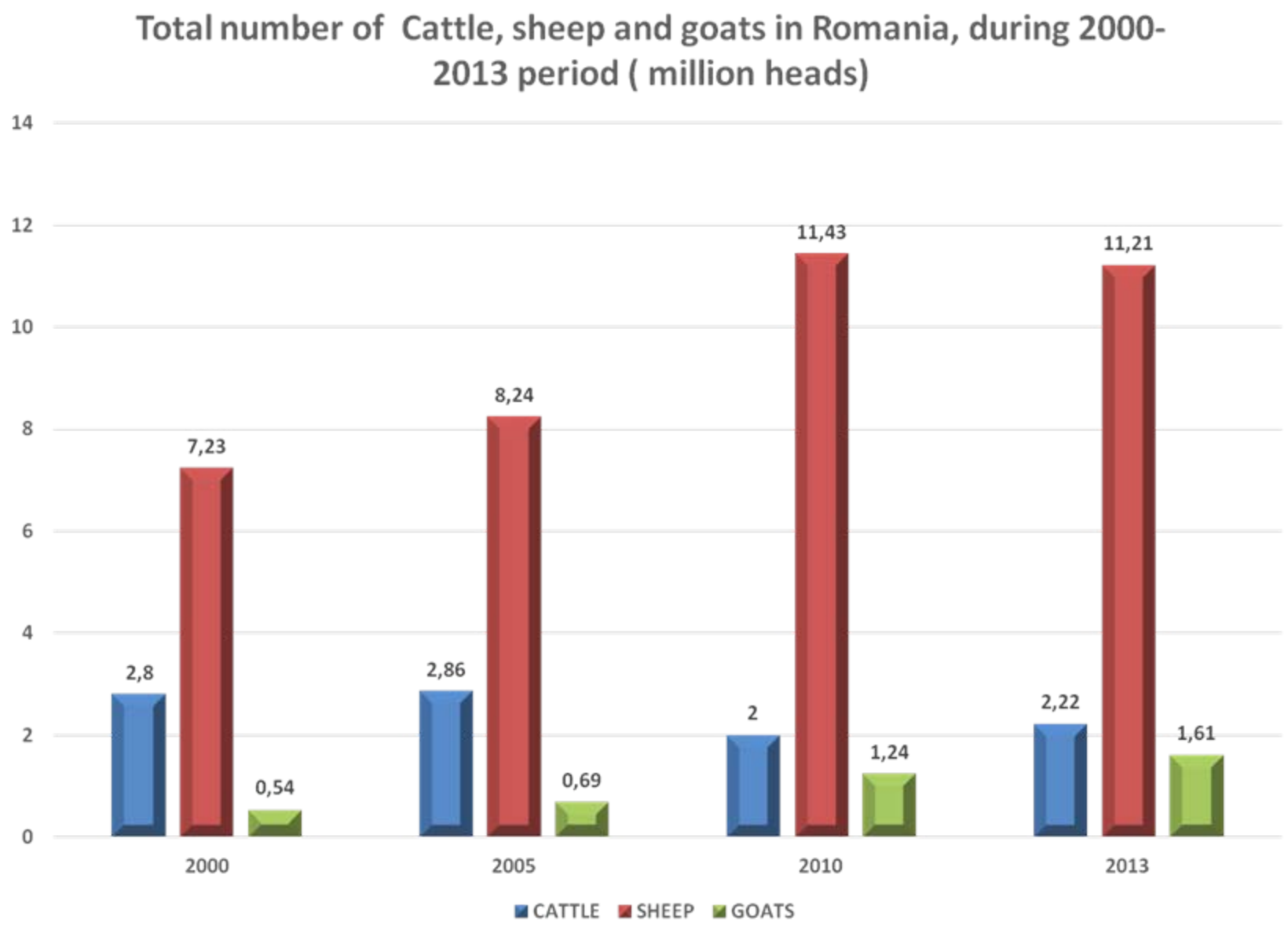
I. ROMANIAN GOAT BREEDS AND THEIR UTILIZATION AS GENETIC RESOURCES

II. SOME GENERAL ASPECTS OF ESTIMATING BREEDING VALUES IN DAIRY GOATS

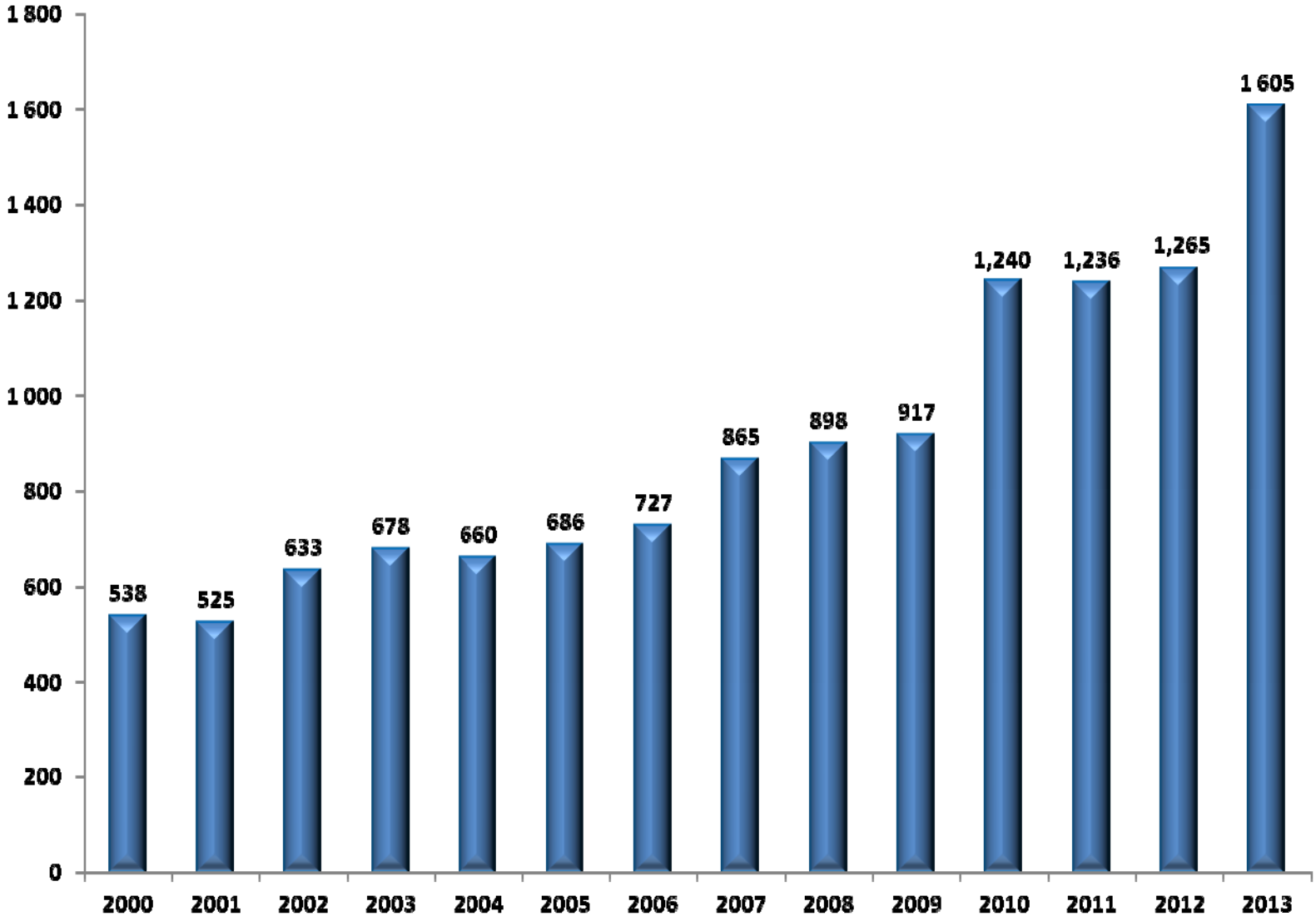
H. GROSU

ROMANIA

ROMANIAN GOAT BREEDS AND THEIR UTILIZATION AS GENETIC RESOURCES


Total number of Cattle, sheep and goats in Romania, during 2000-2013 period (million heads)
14
12
10
8
6
4
2
0
2,8
7,23
0,54
2,86
8,24
0,69
2
11,43
1,24
2,22
11,21
1,61
2000
2005
2010
2013
CATTLE
SHEEP
GOATS

Goats population - annual data, thousands goats



Number of goats per county, 31 December 2013
Total stock of goats 1,605,860

Production systems

- Practically all goat production systems in Romania are of **low input type**.

- Some **80 %** of all goats are used for milk and meat production **in peasant's subsistence** and part time farms (1-3 goat/farm).

  - **7 % of goats are keept in small commercial farms;**
  - **5 % in large commercial farms,** generally in combination with sheep (some 10 % of sheep number) .

- The number of **specialized goat farms** (20-100 goats) is **very small**, the market special demand for goat milk, goat cheese and meet being negligible.

- The goats of subsistence and part time farmers are organized during the day in flocks and pastured around the villages).

Structure of goats exploitations in Romania (April, 30,2013)

		Structure distribution			
Farm structure	No. of farms	Proportion of farms %	No. of goats	Proportion of goats %	Average number of goats per farms
Less than 10 goats	106,636	**87.93**	474,789	**41.65**	4.45
11 – 50 goats	10,925	9.01	324,273	28.45	29.68
More than 50 goats	3,718	3.07	340,788	29.90	91.60
Total	121,279	100.00	1,139,850	100.00	9.40

Source: Ministery of Agriculture and Rural Development, 2013

Goat breeds in Romania

Breed	Population	Average milk production/lactation period (l)
Carpathian	1253,000	220-350
Saanen X Carpathian	145,000	220-480
White of Banat **Other breeds**	177,000 30,000	350-400 > 550
Total	1,605,000	

- The Carpathian breed accounts for **78% of the breeds** raised in Romania.
- It is well adapted to the climate conditions, but it has a very low lactogenic productive potential, compared to Saanen and Alpina breeds raised in the EU countries.

The CARPATHIAN GOAT

Morphologic and productive traits:

- ***Mixed haired, multi-colored goat (****gray, reddish, black, or spotted****)*** , with twisted horns, medium size, and a dairy conformation.
- The long hair represents some 85% as weight of all hair, is of 6.85-20.0 cm long and have a finesse of 70-76 microns;
- The short hair (some 15 %) is of 2.7-3.11 cm long, and has some 18-24 microns finesse as average in different populations.
- The ***live weight is 38.5-52.5*** kg for ***females*** and about 56.7 kg for males
- Withers height of 61.72-69.72 cm.

- Carpathian goats are kept mainly for *milk production.*
- *Milk production* recorded for approximately 9 months averages ***240-280 l milk***, with a peak of 450 , even 800 l, with 4.5-5 % fat.
- Meat is produced practically just from suckling, early spring kids (1-2 months, 8-14 kg live weight) and reformed goats.
- ***Prolificacy*** is of about ***140 %***;
- The newborn single females weigh ≈2.9 kg, the males ≈ 3.1 kg and the twins about 200 g less.
- The goats are used for ***reproduction*** at the age of *9-12 months*.

Future of the breed

- The breed is ***adapted to the local climate***, management system, *and* ***parasitism***, and to the support capacity of vegetable production.
- Its ***genetic improvement*** suppose:
  - clarification of its ***genetic populations structure***,
  - introduction of a ***systematic production recording*** but also
  - improvement of ***management system*** and of support capacity of vegetable production

The main priority actions needed in order to further the management of goat genetic resources

- Establish **a <u>coherent and comprehensive breeding program</u>** and policy similar to other milk and kid improvement programs;
- Minimize the **<u>substitution of native breeds by exotic breeds</u>**, because it is not possible to import also the breed's ecosystem
- Most imported breeds are already extincted.

Main priority actions needed to develop further the production systems:

- A clear governmental legislative framework for the ***development*** of

(a)commercial goats farms,
(b)Sustainable production systems ***vertically integrated***

- A systematic ***propaganda*** to show that

(a)goats are in some conditions ***economically competitive*** to cattle and sheep;
(b)have a great role in the ***food security;***

- A systematic action for the creation of an ***internal market*** for goat products

Breeding Programmes in Goats

- ***A.N.C.C***. ”***CAPRIROM***” established some breeding programes for the four goats breed:

  1) The Carpathian;

  2) The WHITE of BANAT;

APRIROM

ASOCIAȚIA NAȚIONALĂ A CRESCATORILOR DE CAPRE
STR. I.C. BRATIANU, 248
OP 4 , CP 415, 900316
CONSTANTA
TEL: 0241-626511;FAX.0241-548186, MOBIL: 0723.350.035, 0740781056
E-mail: caprirom@canals.ro ; caprirom@yahoo.com
www.caprirom.ro
Nr 353 din 30.08.2011

PROGRAMUL DE AMELIORARE ŞI UTILIZARE

A POPULATILOR LOCALE DE CAPRINE DE RASA CARPATINA

Tabel 3 . Miscarea efectivului de caprine in perioada 2011-2014

Categorie	2011	2012	2013	2014
Tapi	160	223	335	
Capre	3151	4450	6650	
Alte categorii	1300	2200	3300	
Alte intrari*	-	2000	2000	
Total caprine	4611	8873	12285	

***intrari femele de reproductie**

Presedinte ANCC Caprirom

Ing Gore Iancu

Asociația Națională a Crescătorilor de Capre din România ★ CAPRIROM

Responsabil
Ing . Anghelescu Claudiu

Breeding Programm for the CARPATHIAN Goat

I. Rotational mating between male goats families

•The designed showed in the table below is proposed. This design aims to match the couples by male goat families, thus reducing the inbreeding along 4 generations.

•Besides the administrative number of the founder, each family also has a ranking number, from 1 to 12

Generation	Family couples (1, 2, 3, 4, 5, 6, 7, 8) Male × female										
I	1 × 2	2 × 3	3 × 4	4 × 5	5 × 6	6 × 7	7 × 8	8 × 9	9 × 10	10 × 11	11 × 12	12 × 1
II	1 × 3	2 × 4	3 × 5	4 × 6	5 × 7	6 × 8	7 × 9	8 × 10	9 × 11	10 × 12	11 × 1	12 × 2
III	1 × 4	2 × 5	3 × 6	4 × 7	5 × 8	6 × 9	8 × 11	10 × 1	11 × 2	12 × 3	1 × 5	2 × 6
IV	1 × 7	2 × 6	3 × 8	4 × 9	5 × 10	6 × 11	7 × 10	8 × 11	9 × 3	10 × 4	11 × 6	12 × 3

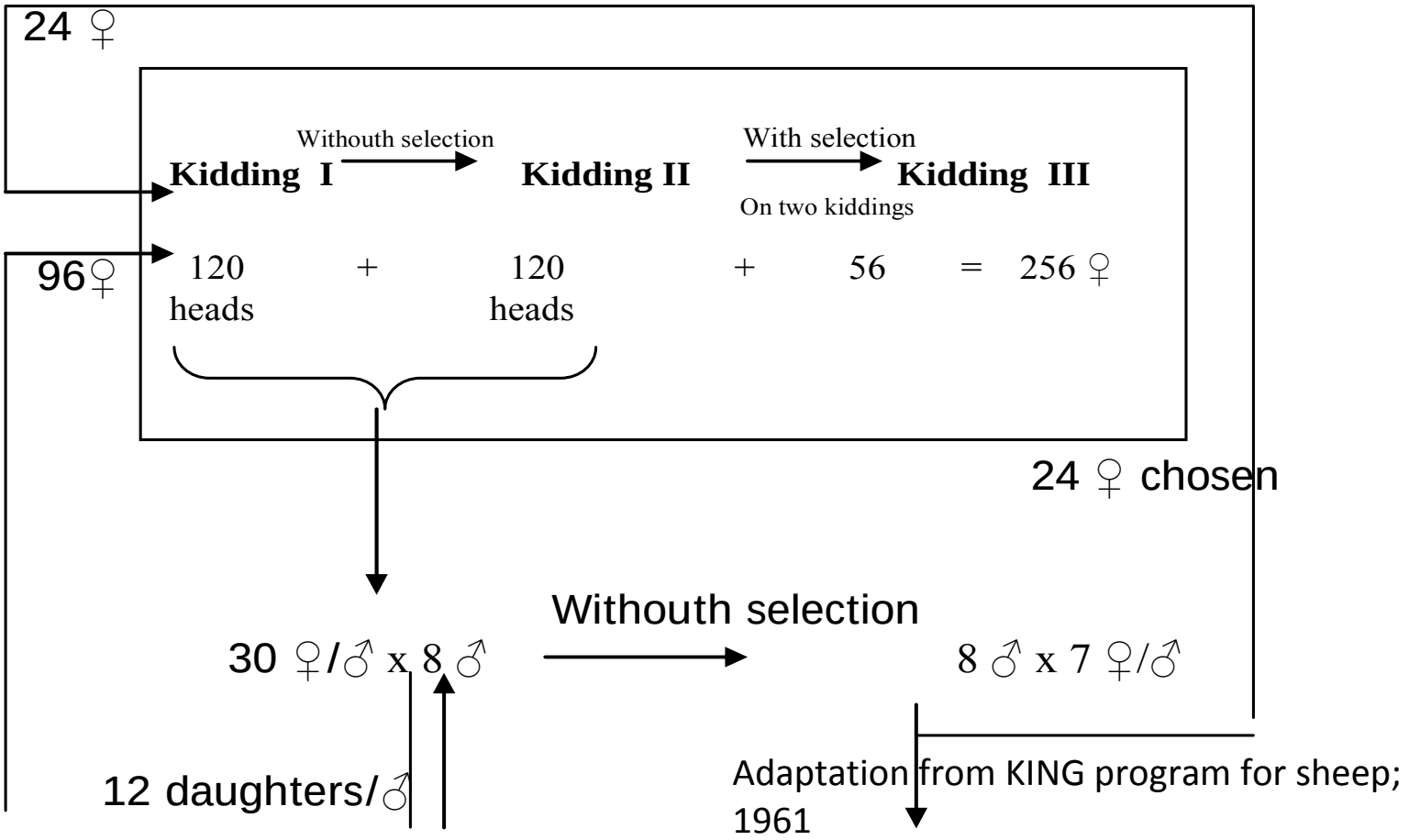
- In generation I, ***male goats from family 1 are mated to goats from family 2***, male goats from family 2 with goats from family 3, male goats from family 1 with goats from family 6 and so on.

- In generation II, male goats from family 1 are mated to goats from family 3, male goats from family 1 are mated to goats from family 12, and so on for other two generations.
- In each family, the male goats are culled at the age of 4-5 years, and the goats at the age of 8.
- ***Each male goat is replaced by one of his sons*** produced by the combination of families presented for generation I.
- The culled goats are replaced by young goats produced by the same combination. The selection of the replacement young males and females is done according to the average of the traits of the particular family.

Male goats rotation: during the period in which this program is used, depending on the number of families, the spare male goats, the number of goats per male goat and the reproduction technology (natural service or AI), the male goats are rotated as follows:

- Exchange of male goats between breeders, while observing the sanitary-veterinary norms
- Sales of parent stock between farms, against payment or compensation in equivalent parent stock

A *proposal* Selection scheme for the improvement of milk yield in the Carpathian Goats (for a herd with 256 dairy goats)



8 ♂ selected by the ***average records of the mothers*** and on ***12 half-sisters***, each with two records

Genetic and phenotypic parameters for milk yield in Carpathian Dairy Goat

	Specification	MU	Value
1	Average milk yield	Kg	275
2	Standard deviation	Kg	55
3	Coefficient of variation	%	20
4	Phenotypic variance (v_P)	Kg^2	3025
5	Heritability	0.25	0.25
6	Genetic variance	Kg^2	756.25

Selection objective (H)

Improvement of breeding value of males for milk yield

$$H = A_i$$

Selection Index (I) for milk yield

$$I = b_1 \cdot \overline{P}_{MOTHER} + b_2 \cdot \overline{P}_{HALF\_SISTERS}$$

$$V = \begin{bmatrix} \frac{1+(m_1-1)\cdot R}{m_1} & 0 \\ 0 & \frac{\frac{1+(m_2-1)\cdot R}{m_2}+(n-1)\cdot t}{n} \end{bmatrix} \cdot V_P$$

$$V = \begin{bmatrix} \dfrac{1+(3-1)x0.3}{3} & 0 \\ 0 & \dfrac{\dfrac{1+(2-1)x0.3}{2}+(12-1)x(0.25x0.25)}{12} \end{bmatrix} xV_P =$$

$$\begin{bmatrix} 1555.2 & 0 \\ 0 & 325 \end{bmatrix} xV_P$$

$$C = \begin{bmatrix} 0.5xh^2 \\ 0.25xh^2 \end{bmatrix} xV_P = \begin{bmatrix} 364.5 \\ 182.25 \end{bmatrix}$$

$$b = C' \cdot V^{-1} = \begin{bmatrix} 364.5 & 182.25 \end{bmatrix} \cdot \begin{bmatrix} 1555.2 & 0 \\ 0 & 325 \end{bmatrix}^{-1}$$

$$b = \begin{bmatrix} 0.23 & 0.56 \end{bmatrix}$$

$$\downarrow$$

$$b_1 = 0.23$$

$$b_2 = 0.56$$

So, the selection criterion (I) will be as follows

$$I = 0.23x\overline{P}_{Mother} + 0.56x\overline{P}_{HALF\_SISTERS}$$

Response to selection per generation (R)

$$R_{Male} = r_{HI} \cdot i \cdot \sigma_H = 0.51x1.0915x27 = 14.95\_\mathrm{Kg\_Milk}$$

$$R_{Female} = 0$$

$$\overline{R} = \frac{R_{Male} + R_{Female}}{2} = \frac{14.95 + 0}{2} = 7.48\_kg\_milk$$

Length of intervals

$$L_{DD} = \frac{48*2+48*3+24*4}{120} = 2.8\ years$$

$$L_{SD} = \frac{96*2+24*3}{120} = 2.2\ years$$

$$L_{SS} = 3\ years$$

$$L_{DS} = 4\ years$$

$$\overline{L} = \frac{L_{DD}+L_{DS}+L_{SS}+L_{SD}}{4} = \frac{2.8+4+3+2.2}{4} = 3\ years$$

$$\Delta G_{kg} = \frac{\overline{R}}{\overline{L}} = \frac{7.48}{3} = 2.49\ kg\ milk$$

$$\Delta G_{\sigma_A} = \frac{\Delta G_{kg}}{\sigma_A} = \frac{2.49}{729} = 0.0034\,\sigma_A$$

$$\Delta G_{kg} = \left(\frac{\Delta G_{kg}}{\overline{P}_{Milk}}\right) * 100 = \left(\frac{2.49}{275}\right) * 100 = 0.90\%$$

SOME GENERAL ASPECTS OF ESTIMATING BREEDING VALUES IN DAIRY GOATS

Genetic evaluation of goats in the USA
Production traits

- **1983** – First aplication of **Sire Model** for : milk yield, milk fat and milk protein.
- **1984** – the **dams** were also evaluated.
- **1987** – the **sire model** was replaced by the **Individual Animal Model**. The breeding values for the thee production traits were aggregated in an index (MFP$), using the economic values specific for cattle.
- **MFP$ = $0,010(PTAMilk) + $1.15(PTAFat) + $2.55(PTAProtein)**
- The best individuals are kept for reproduction, in the decreasing order of the values. The elite group includes only the **top 15% sires.**
- The genetic progress estimated for the three traits varies from one breed to another, but it is not larger than **1%** per year.

Genetic evaluation of goats in the USA
Body traits

- 1986 – first genetic evaluation for the final score (**Sire Model**);
- 1989 – introduction of the linear evaluation system, which takes into consideration 14 body traits**.**
- During 1995, a **multitrait animal model** replaced the **sire model** for type traits (Luo et al., 1995)

$$PTI = 100 \cdot \left[2 \cdot \left(\frac{PTA_{FCM}}{SD_{FCM}} \right) + \left(\frac{PTA_{FINAL\_SCORE}}{SD_{FINAL\_SCORE}} \right) \right] / 3$$

Canada

- A **production index** (PINDX) is computed for milk and fat yield:

$$PINDX = 100 + 0.14 \cdot EBV_{MILK} + 4.4 \cdot EBV_{FAT}$$

- A **type index** (TINDX) combines the type EBVs with the same emphasis as used in the calculation of final score on farm:

$$TINDX = 100 + \left(\begin{array}{l} 0.23 \cdot EBV_{GA} + 0.12 \cdot EBV_{DC} + 0.15 \cdot EBV_{BC} + 0.15 \cdot EBV_{FL} + 0.15 \cdot EBV_{SL} + \\ + 0.08 \cdot EBV_{FU} + 0.08 \cdot EBV_{RU} + 0.04 \cdot EBV_{TE} - 5 \end{array} \right) \cdot 152$$

- Type traits are scored on a **scale of 1 to 9**, with 1 being extremely poor, 5 average and 9 ideal. The eight traits evaluated are general appearance (**GA**), feet and legs (**FL**), dairy character (**DC**), body capacity (**BC**), medial suspensory ligament (**SL**), fore udder (**FU**), rear udder (**RU**) and teats (**TE**).

Canada

- A **combined production** and type index (PTINDX) combines the above with 60% emphasis on production and 40% on type:

$$PTINDX = 100 + 0.832 \cdot (PINDX - 100) + 0.555 \cdot (TINDX - 100)$$

Official Buck Evaluations

- Yield evaluations are considered official for bucks having at least 5 daughters with production records, and type evaluations require 3 daughters to be classified.

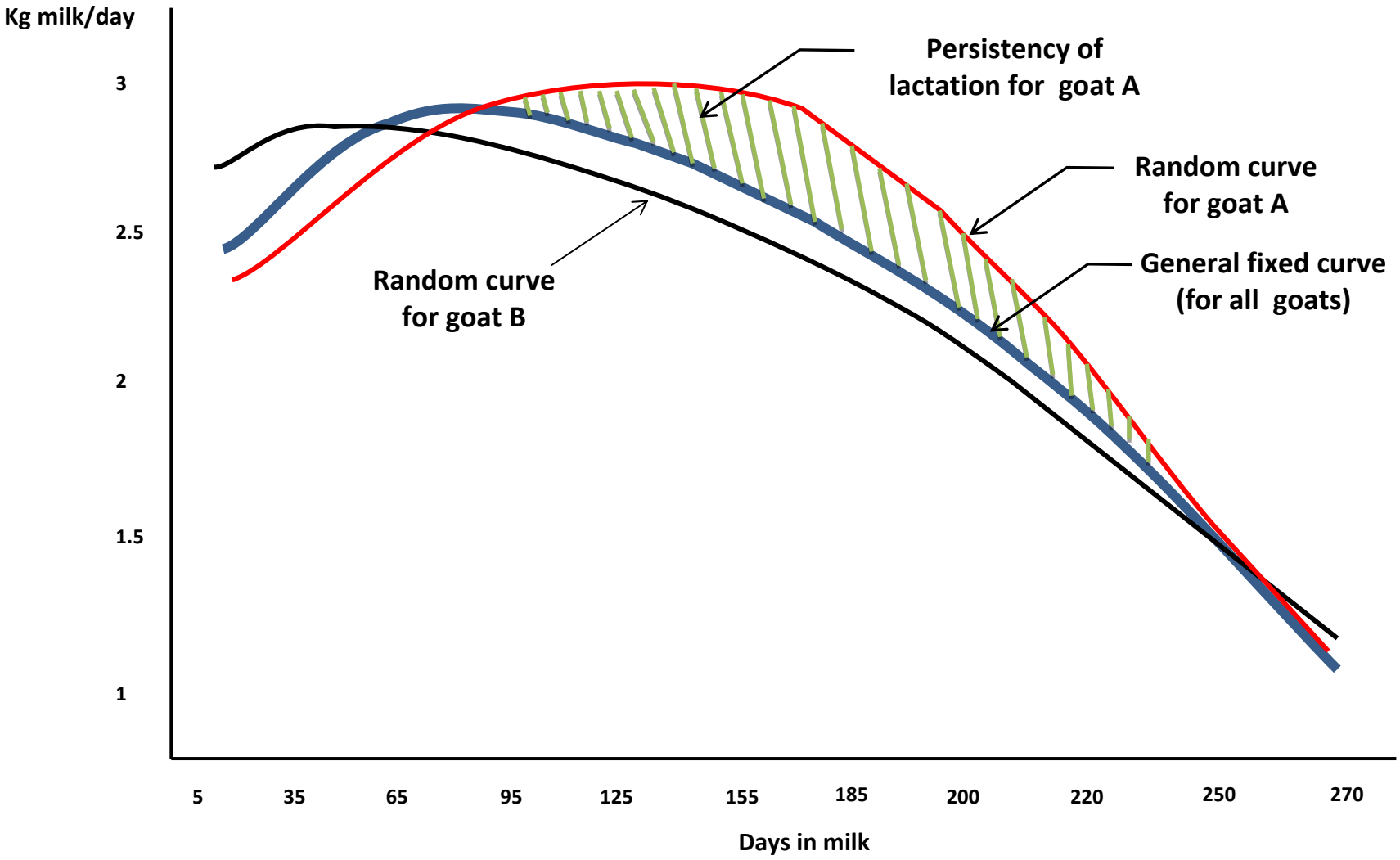
Genetic evaluation of goats in some European countries (Germany, France , Norway , Poland, Slovenia)

- Generally they use the same procedures as the USA and Canada;
- However, the genetic evaluation of the goats focuses just on the improvement of the milk yield.
- France is the exception, which evaluates for the body traits since 1995.

Test day animal model

- The main advantages, over the traditional procedure of evaluating lactational records is **the ability to account for environmental effects** on **each test day** and to model individual curves.
- **Schaeffer and Deckkers** (1994) proposed the ***Random Regression Test Day Animal Model***.
- Different equations are used to model the lactation curves :
  - Legendre polynomials,
  - Wilmink function ,
  - Splines function,
  - Covariance functions, etc
- Each individual test day can be **better accounted for** using a **random regression test day model** (Schaeffer & Dekkers 1994), resulting in **better accuracy in the genetic evaluation of males and females**

Lactation curve in dairy goats



Test day animal model

$$y_{ijkl} = HTD_i + \sum_{m=1}^{5} b_{mj} X_m + \sum_{m=1}^{5} \alpha_{mk} X_m + \sum_{m=1}^{5} \gamma_{mk} X_m + e_{ijkl}$$

$$PBV_{305} = \sum_{m=1}^{5} \alpha_{mk} \times X_m$$

Test day animal model

- Several countries currently tested the test day model in order to be used in the near future for national genetic evaluations in dairy goats.
- **Canada was the first country** worldwide to tested in **1994:**

  (Schaeffer, L.R. and Sullivan, B.P. 1994. Genetic evaluation of **dairy goats using test day yields**. *Proc. 5th WCGALP, Guelph, Canada, vol. 18,* 182)
- Other such countries are:
- - **NORVAY, *2007;*** *(Validation of Test-Day Models for Genetic Evaluation of Dairy Goats in Norway; S. Andonov,* at all.)*
  - ***GERMANY, 2008*** *(Use of a test day model for dairy goat milk yield across lactations in Germany; Zumbach B, Tsuruta S, Misztal I, Peters KJ; J Anim Breed Genet.)*
  - ***GREAT BRITAIN, 2013*** (*Estimation of genetic parameters for milk yield across lactations in mixed-breed dairy goats; S. Mucha at all; only experimental trial)*

Evaluation Methods in Dairy
ional team of authors (Romania,
Portugal) represents a complex
c field of applied genetics, since
y and at the beginning of the 20th
nomics.

NICOLAE SĂULESCU,
nber of the Romanian Academy

ory of Genetic Evaluation Methods in Dairy
t a high scientific level, proper to the
ndards. Both professionally and in terms of
, the publishing of this monograph by the
the Romanian Academy is a distinguished

ALEXANDRU T. BOGDAN,
onding member of the Romanian Academy

Genetic Evaluation Methods in
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proper mathematical tool, as well
n decision-making in this field.

CONDREA DRĂGĂNESCU

monograph regarding the evolution of the

HISTORY OF GENETIC EVALUATION METHODS IN DAIRY CATTLE

HORIA GROSU, LARRY SCHAEFFER, PASCAL ANTON OLTENACU, DUANE NORMAN, REX POWELL, VALENTIN KREMER, GEORGIOS BANOS, RAPHAEL MRODE, JULIO CARVALHEIRA, JANUSZ JAMROZIK, CORNELIU DRĂGĂNESCU, SORIN LUNGU

HISTORY OF GENETIC EVALUATION METHODS IN DAIRY CATTLE

HISTORY OF GENETIC EVALUATION METHODS IN DAIRY CATTLE

(December, 2013)

- Horia Grosu, Romania
- Larry Schaeffer, Canada
- Pascal Anton Oltenacu, U.S.A.
- Duane Norman, U.S.A.
- Rex Powell, U.S.A.
- Valentin Kremer, United Kingdom
- Georgios Banos, Greece
- Raphael Mrode, UK
- Julio Carvalheira, Portugal
- Janusz Jamrozik, Canada
- Corneliu Draganescu, Romania
- Sorin Lungu, Romania

HISTORY OF GENETIC EVALUATION METHODS IN DAIRY CATTLE

1. Genetic Evaluations

I. YEARS 1920-1970

2. **Daughter-Dam Comparisons**
3. Selection Index
4. **Contemporary Comparisons**
5. USDA Modifed Contemporary Comparisons
6. Cumulative Differences
7. Regressed Least Squares

II. YEARS 1971-2000

8. Linear Models
9. Sire Models
10. **Animal Models .**
11. **International Models (MACE-INTERBULL; UPPSALA)**
12. Multiple Traits
13. **Test Day Models**
14. Genetic Change
15. Threshold Models
16. Survival Analysis

III. YEARS 2001-present

17. **Genomics Era**