



Management of genetic and economic progress in a population

Modul no. 3: Animal Breeding

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Genetic and economic progress in Animal Breeding

- Defining breeding objectives
- Animal pedigrees (DNA tests)
- Genetic evaluation - estimation of breeding values
 - Selection and mating
- Creation of new generation
- Achieving genetic progress

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Genetic progress and selection

Selection variables (indicators of selection)

Genetic gain

Selection differential

Selection criterion

Selection intensity

Generation interval

Selection pressure

Accuracy of selection

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Genetic progress and selection

Genetic progress (response of selection)

Genetic gain ($\Delta G, R$)

$$\Delta G = (h^2 \cdot d) / j$$

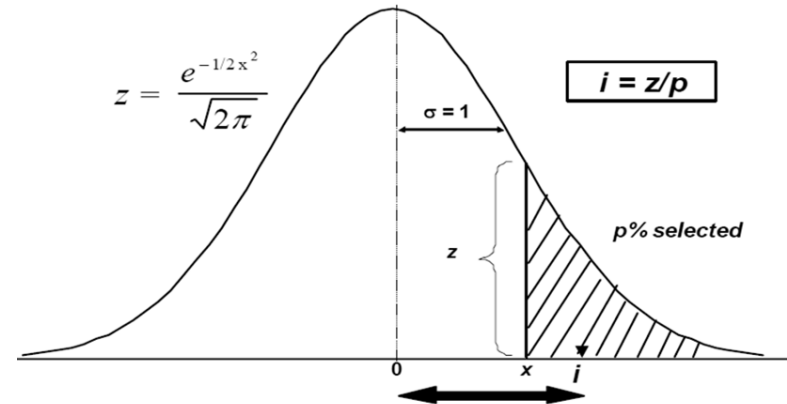
(heritability x selection differential) / generation interval

Selection differential

$$d = i \cdot \sigma_p$$

selection intensity x phenotypic standard deviation

Selection intensity (i)

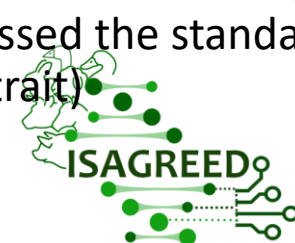


Source: https://ansari.iut.ac.ir/sites/ansari.iut.ac.ir/files//files_course/predicting_response_to_selection.pdf

Normal distribution curve

standardized selection differential

- (proportion of variability expressed the standard deviation of a trait)



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Genetic progress and Environment

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Environment

Herd – feeding- housing
(technology, welfare)

Time - generation - year - season - month – day

Age - stadium- sex

Farmer

Interaction genotyp - environment

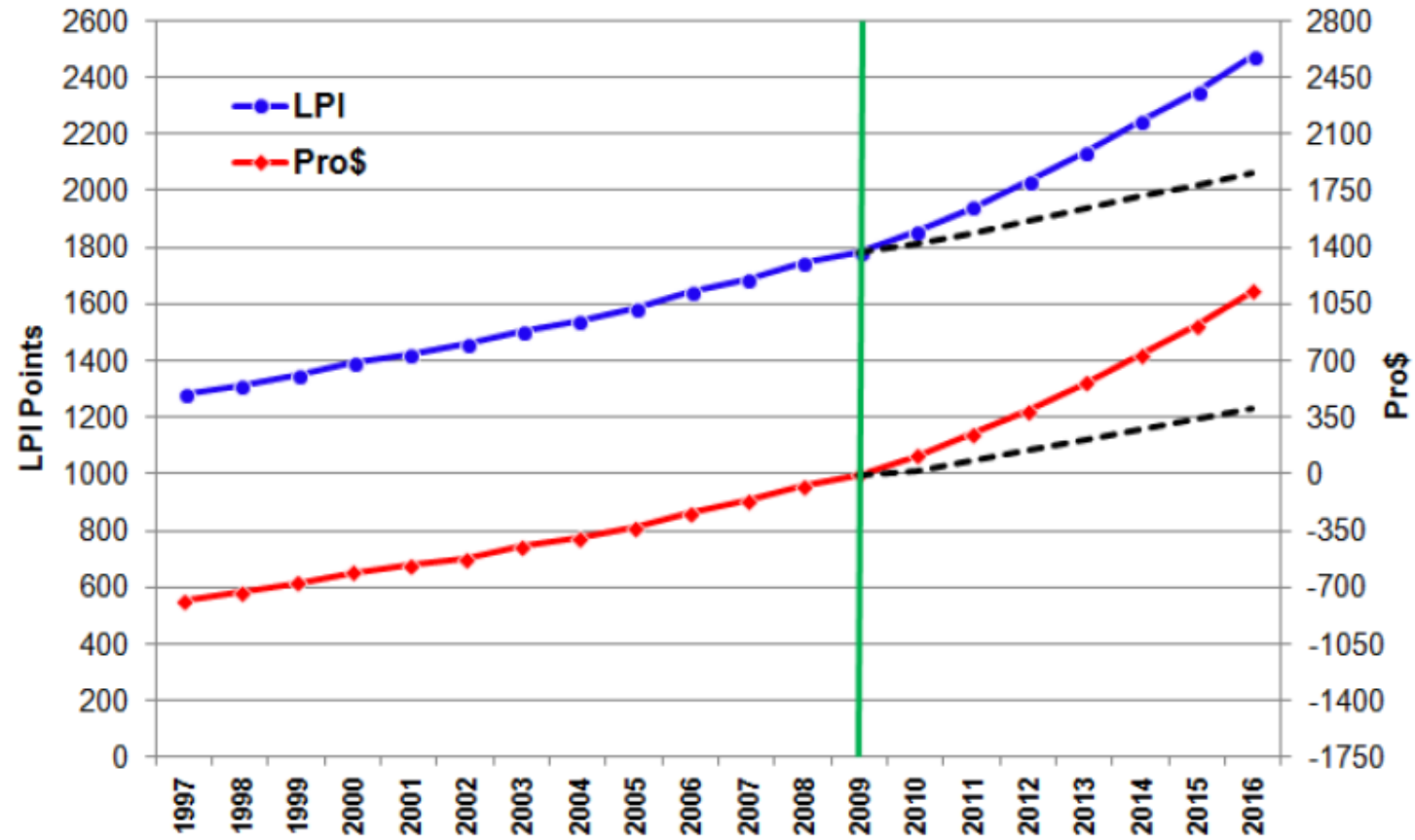
Genetic progress and genomic selection

- Genomic selection is an approach using molecular genetic markers in animal selection and breeding (animal genotyping)
- **Genomic selection allows a significant increase in the genetic gain of individual cattle traits.**
- Current high proportion of genomically screened young bulls used in breeding.
- Presumption of the existence of well-established traditional systems of performance control and systems of genetic evaluation of animals.
- Traditional breeding values
- Genomic breeding values
- Combined breeding values



Genetic progress and genomic selection

Figure 1: Genetic Trend Realized for LPI and Pro\$ in Canadian Holsteins Before and After Genomics



Lynsay Beavers, Industry Liaison Coordinator, CDN
Brian Van Doormaal, General Manager, CDN

April 2017

Erasmus+ project 2021-1-SK01-KA220-HED-000032068



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Genetic progress and genomic selection

Table 1: Comparison of Total 5-Year Genetic Gain Realized by Traits Before and After the Introduction of Genomics in Canada

Trait	Total Gain Realized	
	Before Genomics (2004-2009)	Last 5 Years (2011-2016)
Milk Yield (kg)	355	603
Fat Yield (kg)	14.0	29.8
Protein Yield (kg)	11.8	24.0
Fat Deviation (%)	0.01	0.07
Protein Deviation (%)	0.00	0.04
Conformation	3.20	5.06
Mammary System	3.19	4.94
Feet & Legs	1.86	3.99
Dairy Strength	1.78	2.63
Rump	1.34	1.05
Herd Life	1.12	3.36
Somatic Cell Score	0.04	0.12
Mastitis Resistance	0.92	2.46
Metabolic Disease	0.10	1.42
Persistency	-0.22	1.41
Daughter Fertility	-0.72	1.06
Milking Speed	0.06	0.51
Milking Temperament	-0.09	1.89
Daughter Calving Ability	0.23	2.29

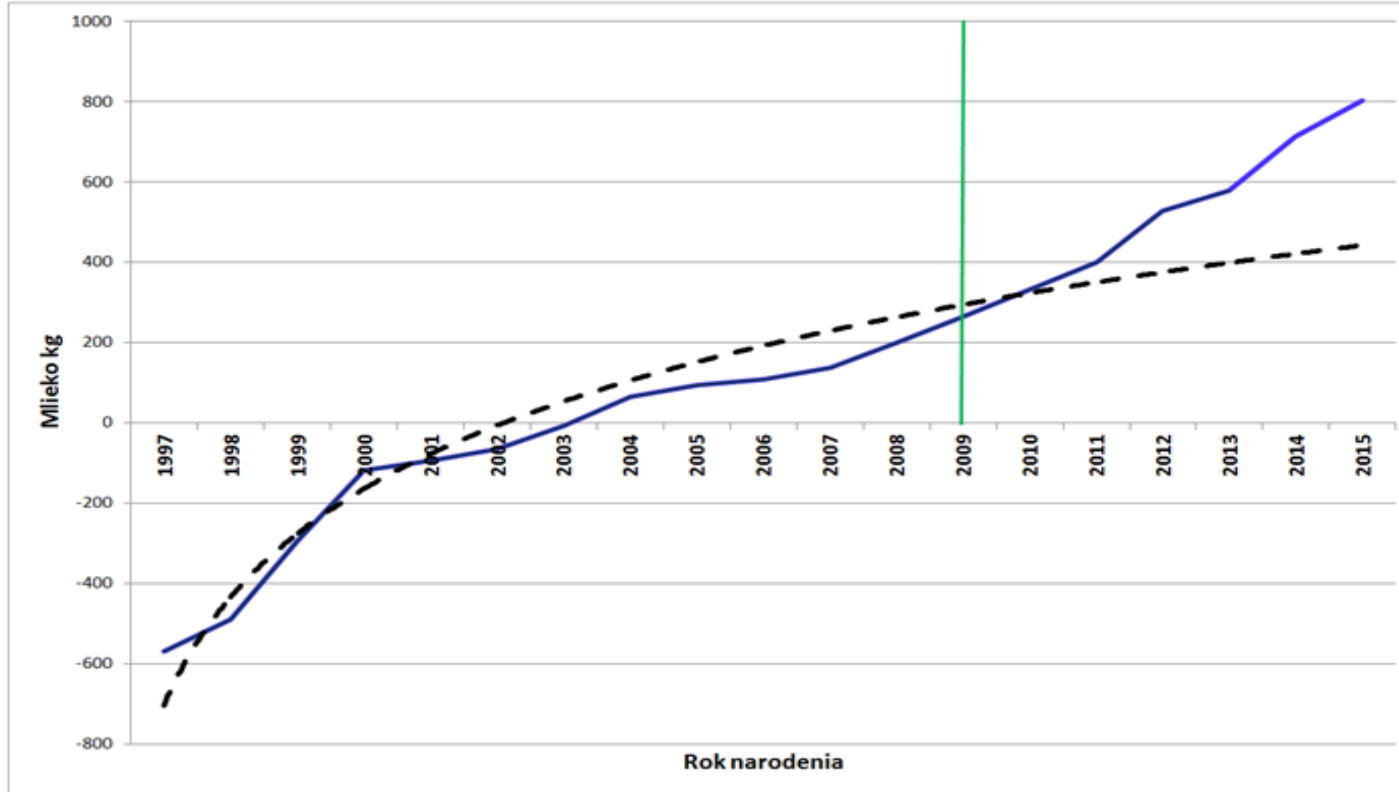
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April 2017



Genetic progress and genomic selection

Genetic trend of cows breeding values in Slovakia (milk, kg)



Zdroj: Candrák, 2017

Genetic progress and complex solutions approach

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PRODUCTION
EXTERIOR
LONGEVITY
SOMATIC CELLS
CALVING EASY
FERTILITY
HEALTH
TEMPERAMENT
...
COMPLEX
SELECTION INDEXIS



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Genetic progress and new traits

WORKSHOP

Animal variation in methane emissions and
harmonization of protocols

5-7 November 2014, Granada, Spain

Global Dry Matter Initiative (gDMI)



Source: <https://edepot.wur.nl/287563>

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Genetic progress and economy

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Biotechnology

Sustainability



Economic Efficiency



Biodiversity

GOAL

... healthy animals and healthy food ...



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Thank you for your attention!

This presentation has been supported by the Erasmus+ KA2 Cooperation Partnerships grant no. 2021-1-SK01-KA220-HED-000032068 "Innovation of the structure and content of study programs in the field of animal genetic and food resources management with the use of digitalisation - Inovácia obsahu a štruktúry študijných programov v oblasti manažmentu živočíšnych genetických a potravinových zdrojov s využitím digitalizácie". The European Commission support for the production of this presentation does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



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