OPTIMIZATION OF SEX RATIO IN AN OFFSPRING SELECTION PLAN FOR MILK PRODUCTION TRAITS OF RAMS FROM PALAS MILK LINE

R. Popa, H. Grosu, Dana Popa, M. Maftei, Livia Vidu, Georgeta Diniță, Nicoleta Işfan, Carmen Nicolae

University of Agricultural Science and Veterinary Medicine of Bucharest, Faculty of Animal Science
e-mail: poparasvan@yahoo.co.uk

Abstract

The aim of this paper is the optimization of sex ratio in an offspring selection plan of rams, according to Robertson and Rendell model for bovines (1951), which will be propose for implementation in Palas Milk Line for genetic increase of milk production traits. The method used in this paper work is modeling, which exist in the most animal breeding scientifically papers. After the simulations, we observed that the most convenient variant was that which prefigure offspring testing in nucleus of 8 rams and a weight of two groups by 45% and 55% respectively.

Key words: offspring selection plan, optimization

INTRODUCTION

The breeding program represent a deliberate combination of breeding factors for obtains populations with economic adapted genetic structures.

Based on three criteria, we can judge the breeding programs and choose optimum variant [1]:

- the selection effect;
- the inbreeding management (to sustain the genetic variability);
- the expenses related with program realization and implementation.

These three criteria can not be separated in choosing of optimum variant.

The selection plan is an indissoluble component of breeding program.

The selection plan is drafts which contain all operations related with replace animals in nucleus.

Each component of this draft can constitute an object of optimization: population size and structure, demographical parameters, animal recording (recording method, capacity of testing space, family structure in testing space, etc.), selection method (BLP or BLUP).

The selection plan efficiency must be seen from two points of view: genetic and economic. These two aspects must be optimum combined, so that the final variant shall ensure maximum genetic gain with minimum effort, expenses and time.

From genetic point of view, in 1944 Dickerson and Hazel [3] say that a selection plan is efficient if: (a) selection effect increase more than generation interval, or (b) selection effect increase and generation interval decrease.

MATERIAL AND METHOD

The used biological material is represented by Palas Milk Sheep Line, an ICDDOC Palas Constanta creation.

The method used in this paper work is modeling.

The population structure:

- nucleus: 400 females and 16 males;
- birth rate: 125%;
- survival rate: 82%;
- $h^2 = 0,27$; R = 0,30;
- average performance: 200 kg milk/lactation;
- c.v.% = 28%, $\sigma_P = 56$ kg; $\sigma_A = 29,12$ kg;
- number of rams selected by offspring (s) used in Elite group = 16;
- the average reproduction period of rams = 5 years;
- the weight of Elite group is 40% (160 sheep) and Testing group is 60% (240 sheep), characteristically values of original variant of Robertson and Rendell plan;

The genetic gain is induced within population just by males (selected in two moments), females being choose on reproduction activity without selection (genetic gain induced within population by sheep is zero).

The effect of selection per generation will be estimated for the two moments: the male's selection based on mother performance and daughter's average performances respectively:

$$R_{M.} = r_{A,P_M} \cdot i \cdot \sigma_A = r \cdot h \cdot i \cdot \sigma_A$$

$$R_{daughters} = r_{A,\bar{P}_{daughters}} \cdot i \cdot \sigma_A = r \cdot h \cdot \sqrt{\frac{n}{1+(n-1)\cdot t}} \cdot i \cdot \sigma_A$$

in which:

r_{A,P_M} = ascendant's selection accuracy (when mother performance is information source);

$r_{A,\bar{P}_{daughters}}$ = offspring's selection accuracy;

i = selection intensity (different for the two moments);

σ_A = additive standard deviation;

n = number of relatives which offer the information;

t = phenotypical relationship between relatives ($t = r \cdot h^2$)

In this case, the testing capacity is represented by number of half sibs which can be recorded.

The half sibs which can be recorded will be produced by mating of candidates rams with a part of nucleus females (testing group). The weight of these represented the result of optimization calculation. The half sibs which can be recorded will be named "selection base".

Such optimizations exist on bovines, but not on sheep, because the offspring selection is applied on sheep just for carcass quality traits in Bradford and Colburn plans ([2], [4], [5]).

RESULTS AND DISCUSSIONS

For sex ratio optimization have been imagined more variants of plan: with 14, 12, 10, 8 and 5 rams, and those variants were applied to different population sizes and structure.

By sex ratio increase is modified offspring selection accuracy and selection intensity for both moments.

From all simulated plan variants, the results are synthesized presented in Table 1.

The results were as fallows:

- in all simulated variants, the biggest selection effect per generation is offer by a population constitute from 400 females;
- the sex ratio increase cause a structure population modification for selection effect maximization (Elite group weight decrease);
- the variant which offer a maximum selection effect per generation is that with 5 rams tested in Elite group, in a population size of 400 females and a population structure of 45% Elite and 55% Testing.

Because in analyzed population is not applied artificial insemination, the normal sex ratio in guided mating system is 1:25, and we recommend to be implemented the variant with 8 rams tested in Elite group, in a population size of 400 females and a population structure of 45% Elite and 55% Testing.

Table 1 Synthesis of results concerning the sex ratio optimization in Palas Milk Line

Specification	s = 14			s = 12			s = 10			s = 8			s = 5		
	E	T	R	E	T	R	E	T	R	E	T	R	E	T	R
100	70	30	0,7137	70	30	0,7347	65	35	0,7579	65	35	0,7854	60	40	0,8346
200	60	40	0,9465	60	40	0,9703	55	45	0,9972	55	45	1,0284	50	50	1,0839
300	55	45	1,0968	55	45	1,1213	50	50	1,1493	50	50	1,1811	45	55	1,2371
400	50	50	1,2085	50	50	1,2340	50	50	1,2613	45	55	1,2930	45	55	1,3480

1. E = Elite group weight
2. T = Testing group weight
3. R = selection effect per generation (in additive standard deviations)
4. s = number of rams in Elite group

CONCLUSIONS

The selection plan efficiency must be seen from two points of view: genetic and economic. These two aspects must be optimum combined, so that the final variant shall ensure maximum genetic gain with minimum effort, expenses and time.

For ICDDOC Palas Constanta Milk Sheep Line we propose for genetic increase of milk traits an offspring selection plan, according to Robertson and Rendell plan for bovines, whose components must be optimized.

Respecting the selection plans optimization principles, some restrictions related with reproduction physiology and inbreeding management, a maximum genetic gain will be obtain in a population size by 400 females, with a weight of the two groups by 45% Elite and 55% Testing respectively, and 8 rams tested in Elite group.

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