

SELECTION INDICES TO IMPROVE PRODUCTIVE TRAITS IN LOCAL SHEEP

BY

EHAB MOUSTAFA MOHAMED SHAAT

A thesis submitted in partial fulfillment
of
the requirements for the degree of

MASTER OF SCIENCE
in

Agriculture
(Animal Breeding)

Department of Animal Production
Faculty of Agriculture
Ain Shams University

1995



APPROVAL SHEET

**SELECTION INDICES TO IMPROVE PRODUCTIVE TRAITS IN
LOCAL SHEEP**

BY

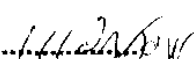
EHAB MOSTAFA MOHAMED SHAAT

B.Sc. Agric. Sci. (Animal Production)
Cairo University, Fayoum Branch, 1989

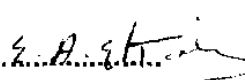
This thesis for M.Sc. degree has been approved by:

Prof. Dr. E. A. Afifi 

Prof. of Animal breeding Faculty of Agriculture,
at Moshtohor, Zagazig University.

Prof. Dr. H. M. K. Mansour 

Prof. of Animal breeding Faculty of Agriculture,
Ain Shams University.

Prof. Dr. E. A. El -Tawil 

Prof. of Animal breeding Faculty of Agriculture,
Ain Shams University.

Date of examination: 22 / 11 / 1995

ACKNOWLEDGMENT

All praises are to Allah, who gave me sincere love of my professors and colleagues, patience and every thing to finish this work .

Sincere thanks are due to my mother , my father and my sisters, for their love, patience and confidence throughout . This work is dedicated to them .

I like to express my sincere appreciation to Dr. Esam El-Tawil, professor of animal breeding, faculty of Agriculture, Ain Shams University, the chairman of the advisor committee, for his advises, encouragement, revision of the manuscript and supervising this work .

Sincere gratitude and appreciation are to Dr. Helmy Metawi, Researcher in Sheep and Goats Research Division, Animal Production Research Institute, Ministry of Agriculture, for the stimulating environment he has provided me with, his suggestion, guidance, revision the manuscript and supervising this work .

I am greatly indebted and grateful to Dr. Hussein Mansour, professor of animal breeding, faculty of Agriculture, Ain Shams University, for his continuous help in statistical analysis, reading the manuscript, guiding and encouragement, I appreciate his efforts to extend and broaden my understanding of life sciences and his extraordinary contribution of time.

My deepest gratitude are deserved to Dr. Salah Galal, professor of animal breeding, faculty of Agriculture, Ain Shams University, for suggesting study and for his continuous encouragement, guidance and reading the manuscript .

Appreciation is extended to Dr. L. D. Van Vleck and Dr. K. G. Boldman, Agriculture Research Service, USDA R. L. Hruska US Meat Animal Research Center, University of Nebraska,

Lincoln, USA . for the effort they spent in deviling the software of Animal Model. The author gratefully thank to them and thier co-workers for providing us the MTDFREML program .

I wish to express my sincere appreciation to my close friend Mr. Hazem Almahdy, Assistant Research, in Sheep and Goats Research Division, Animal Production Research Institute, Ministry of Agriculture, for his great help and assistance . I am highly indebted to him for invaluable support to finish this work .

A special word of thankfulness is due to Ms. Hoda M. Abd El-Raoof, Assistant Research, in Buffalo Breeding Research Department , Animal Production Research Institute, Ministry of Agriculture, for her continuous encouragement and extended helping hands whenever I needed them .

Thank is accorded to all the staff of Sheep and Goats Research Division, Animal Production Research Institute, Ministry of Agriculture, for their direct and indirect assistance and cooperation .

Selection Indices to Improve Productive Traits in Local Sheep

BY

Ehab Moustafa Mohamed Shaat

B.Sc. Agric. Sci. (Animal Production)
Cairo University, 1989
Faculty of Agriculture (Fayoum Branch)

Under the supervision of **Prof. Dr. E. A. El-Tawil**

Prof. of Animal Breeding

Dr. H. R. Metawi

Researcher in Sheep and Goat Research Division
Animal Production Research Institute

ABSTRACT

Ehab Moustafa Mohamed Shaat. Selection Indices to Improve Productive Traits in local Sheep. Unpublished master of science, University of Ain Shams, Faculty of Agriculture, Department of Animal Production, 1995.

Estimating the heritabilities of weights at 120, 180 days of age and number of lambs born per ewe joined were the first goal of this study. Evaluation of genetic and phenotypic correlations between these traits formed the second goal. While, the third goal was constructing different selection indices including different combinations between these traits for Ossimi and Rahmani sheep.

The studied traits were analyzed twice. The first analysis utilized a fixed model to estimate the effect of location, age of dam, season, sex, year and type of birth. While in the second analyses an animal model with REML procedure were used to estimate the variance components of studied traits. In general, all main effects had significant effect on lamb body weights in both Ossimi and Rahmani sheep. Also fixed effects influences significantly the number of lambs born per ewe joined with exception of season of lambing in Ossimi sheep. That had insignificant effect ($P < .001$). In Rahmani sheep season of lambing was significant but the other fixed effects were not significant. Heritability estimates were 0.26, 0.24 and 0.03 in Ossimi and 0.13, 0.26 and 0.09 for Rahmani for weights at 120 and 180 days of age and number of lambs born per ewe joined traits, respectively.

Genetic and phenotypic correlations were high between body weight traits while they were very low and negative between number of lambs born per ewe joined and each of weight at 120 and 180 days of age in both breeds.

Several selection indices were examined in both Ossimi and Rahmani. The highest expected genetic improvement for the all traits was obtained when the following indices were used, with a correlation between the index and the aggregate genotypic value (r_{IH}),

For Ossimi

$$I_1 = -0.0896 W120 + 0.5145 W180 + 0.4133 LB_j, \text{ with } (r_{IH}) = 0.44.$$

$$I_2 = 0.1563 W120 + 0.3540 LB_j, \text{ with } (r_{IH}) = 0.23.$$

$$I_3 = 0.2453 W180 + 0.4707 LB_j, \text{ with } (r_{IH}) = 0.33.$$

For Rahmani

$$I_1 = 0.1018 W120 + 0.3693 W180 + 1.3984 LB_j, \text{ with } (r_{IH}) = 0.37.$$

$$I_2 = 0.1848 W120 + 1.3461 LB_j, \text{ with } (r_{IH}) = 0.31.$$

$$I_3 = 0.2835 W180 + 1.3670 LB_j, \text{ with } (r_{IH}) = 0.34.$$

The relative efficiency (RE) in genetic gain was also used to compare the constructed indices. The (RE) was 92% and 83% as compared with gain expected from the first index for I_2 and I_3 , respectively, in Rahmani sheep, while it was 75%, 53% in Ossimi for I_2 and I_3 , respectively.

Key words: Sheep, Lambs Body Weights, Prolificacy and Selection Index.

Table of Contents

	Page
1. Introduction	1
2. Review of Literature	2
2.1. Factors Affecting Growth and Reproductive Traits	2
2.1.1. Factors Affecting Growth Traits	2
2.1.1.1. Location	2
2.1.1.2. Age of Dam	3
2.1.1.3. Season of Birth	3
2.1.1.4. Year of birth	4
2.1.1.5. Sex	4
2.1.1.6. Type of Birth	5
2.1.2. Factors Affecting Reproductive Traits	6
2.1.2.1. Location	6
2.1.2.2. Season of Lambing	6
2.1.2.3. Year of lambing	7
2.2. Genetic Parameters	8
2.2.1. Heritability	8
2.2.2. Genetic and Phenotypic Correlations	21
2.2.2.1. Genetic Correlation	21
2.2.2.2. Phenotypic Correlation	26
2.3. Selection Index	30
2.3.1. Relative Economic Value	31
2.3.2. Efficiency of Selection Index	33
3. Materials and Methods	37
3.1. Management	38
3.2. Lambs Performance Traits	39
3.3. Reproductive Trait	39
3.4. Statistical Analysis	39

	Page
3.4.1. Estimation of Factors Affecting Lamb Growth Traits and Productive Trait	40
3.4.2. Estimation of genetic and phenotypic parameters	41
3.5. Estimation of Relative Economic Values	43
3.6. Construction of Selection Index	44
4. Results and Discussion	47
4.1. Factors Affecting Growth and Reproductive Traits	47
4.1.1. Factors Affecting Growth Traits	47
4.1.1.1. Location	48
4.1.1.2. Age of Dam	48
4.1.1.3. Season of Birth	49
4.1.1.4. Block of Years	49
4.1.1.5. Sex	50
4.1.1.6. Type of Birth	50
4.1.2. Factors Affecting Reproductive Traits	59
4.1.2.1. Location	59
4.1.2.2. Season of Lambing	60
4.1.2.3. Block of Years	60
4.2. Genetic Parameters	65
4.2.1. Heritability	65
4.2.2. Genetic Correlation	67
4.2.3. Phenotypic Correlation	68
2.3. Selection Index	71
5. Summary and Conclusions	78
6. References	81
7. Arabic Summary	

List of Tables

	Page
Table 1. Heritability (h^2) estimates of 120-day weight (W120) and their standard errors (SE), when available, by different method in some breeds reported in the literature	12
Table 2. Heritability (h^2) estimates of 180-day weight (W120) and their standard errors (SE), when available, by different methods in some breeds reported in the literature	14
Table 3. Heritability (h^2) estimates of number of lamb born per ewe joined (LB _j) and their standard errors (SE), when available, by different methods in some breeds reported in the literature.....	16
Table 4. Range of the heritability for 120-day weight obtained by different method	20
Table 5. Range of the heritability for 180-day weight obtained by different method	20
Table 6. Range of the heritability for LB _j obtained by different method	20
Table 7. Estimates of genetic correlations (r_G) of 120-day, 180-day and other body weights in different breeds	23
Table 8. Estimates of genetic correlations (r_G) between number of lambsborn (LB) and body weights in different breeds	25
Table 9. Estimates of phenotypic correlations (r_p) of 120-day, 180-day and other body weights in different breeds	27
Table 10. Estimates of phenotypic correlations (r_p) between number of lambs born (LB) and body weights in different breeds	29
Table 11. Distribution of the lambs and sires in the two breeds	37
Table 12. Least squares means (LSM) and standard errors (SE), for birth weight (BW) and weaning weight (WW), kg, in Ossimi sheep.....	51

	Page
Table 13. Analysis of variance of some factors affecting birth weight (BW) and weaning weight (WW) in Ossimi sheep, kg ²	52
Table 14. Least squares means (LSM) and standard errors (SE), for 120-day (W120) and 180-day (W180) weight, kg in Ossimi sheep	53
Table 15. Analysis of variance of some factors affecting 120-day (W120) and 180-day (W180) weights in Ossimi sheep, kg ²	54
Table 16. Least squares means (LSM) and standard errors (SE), for birth weight (BW) and weaning weight (WW), kg, in Rahmani sheep	55
Table 17. Analysis of variance of some factors affecting birth weight (BW) and weaning weight (WW) in Rahmani sheep , kg ²	56
Table 18. Least squares means (LSM) and standard errors (SE) for 120-day (W120) and 180-day (W180) weight, kg in Rahmani sheep	57
Table 19. Analysis of variance of some factors affecting 120-day (W120) and 180-day (W180) weights in Rahmani sheep, kg ²	58
Table 20. Least squares means (LSM) and standard errors (SE), for number of lambs born per ewe joined (LB _j), in ssimi sheep	61
Table 21. Analysis of variance of some factors affecting number of lambs born per ewe joined (LB _j) in Ossimi sheep	62
Table 22. Least squares means (LSM) and standard errors (SE), for number of lambs born per ewe joined (LB _j), in Rahmani sheep	63
Table 23. Analysis of variance of some factors affecting number of lambs born per ewe joined (LB _j) in Rahmani sheep	64
Table 24. Estimates of additive genetic variance (σ^2_a) and residual variance (σ^2_e) for 120-day (W120), 180-day (W180) weights and number of lambs born per ewe joined (LB _j) in Ossimi and Rahmani	70