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GENETIC TRENDS FOR EWE TRAITS IN TWO FLOCKS OF RAHMANI AND OSSIMI SHEEP

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SUMMARY

This study was carried out on a total of 11150 Rahmani and 9226 Ossimi ewe records progeny of 357 and 226 sires, respectively, during the period from 1959 to 1999 to estimate genetic trends in ewe traits. Mixed model methodology based on a multi-trait animal model was used. Data were classified and analyzed in two periods according to the management system. Animals in the first period (1959 -1970) had one breeding cycle per year while in the other period (1970-1999) they had a breeding cycle every eight months. Estimated annual genetic change, based on predicted breeding values, for ewes conceived/ewes joined, lambs born/ewe lambed, lambs weaned/ewe lambed and kilograms born/ewe lambed for the first period was -.000098, -.000488, -.000509 and -.003055, respectively in Rahmani, and -.000472, .000678, .000462 and .008425 in Ossimi and in the second period the change was -.000118, -.000200, -.000044 and -.000555 in Rahmani, -.000131, -.000544, -.000662, and -.000156 in Ossimi, respectively. All these trends were statistically non significant except for those lambs born per ewe lambed and lambs weaned per ewe lambed for Ossimi in the second period. Generally, the study indicated lack of effective directional selection in those flocks

Keywords: Selection, Conception, Litter size, , ,Heritability, Genetic correlations

INTRODUCTION

Recently, numbers of sheep population in Egypt have increased rapidly, reaching about five million heads (CAPMS, 2003). Ossimi and Rahmani sheep represent about 35% of the total population of sheep in Egypt (Galal et. al, 2002). Thus, the Animal Production Research Institute of the Ministry of Agriculture has made one of its concerns to investigate the possibility of genetically improving these two breeds. Estimation of genetic trends over time is problematic because of the difficulty to conduct experiments in uniform conditions over a period of several generations, so that changes in performance of a selected population may reflect, in part, both environmental and genetic changes. Theoretically it is possible to simultaneously maintain a control population to remove the influence of environmental change (Hill, 1972), but this could prove expensive especially over a long period of time. Genetic trends for ewe traits in Rahmani and Ossimi breeds have not been examined. The objectives of the present research were to estimate additive genetic change in ewe reproductive traits in two experimental flocks of Rahmani and Ossimi Egyptian sheep breeds.

MATERIALS AND METHODS

The data for this study represent a total of 11,150 Rahmani (R) and 9,226 Ossimi (O) ewe records progeny of 357 and 226 sires, respectively, collected at the Egyptian Ministry of Agriculture experimental stations over 40 years period (1959-1999). Ossimi flocks were raised in three experimental stations, Mehallet-Mousa (mid Nile Delta), Seds (mid Egypt) and El-Gemmeza (south Nile Delta), while Rahmani were raised in two stations, Mehallet Mousa and El-Serw (north Nile Delta). Data were classified into two periods according to the management system. Animals bred in the period from 1959 to 1970 had one breeding cycle (mainly September) every year and lasting for 35 days, while during the period from 1970 to 1999 they had a breeding cycle every eight months, in September, May and January, each lasting for 35 days. Ewes and rams were first mated at about 18 months of age. Ewes were assigned to ram breeding groups at random with the restriction that mating between very closely related animals is avoided. Each group of 30-35 ewes was exposed to a fertile ram in a separate mating pen. If the ram was unable to serve the ewes, he was substituted by another ram after one week of his removal. Data were connected by rotating sires across stations for each breed. Lambs were kept with their dams all the time up to weaning (three months for the first period and two months for the second period).

In the period from December to May, the flocks grazed Egyptian clover (*Trifolium alexandrinum*). In the rest of the year they grazed crop and vegetable stubbles and green fodder (sorghum) if available. In addition, a concentrate mixture consisting of 24% corn, 38% cotton-seed meal, 37% wheat bran and 1% salt, clover hay and rice straw in summer and autumn seasons were provided. Extra supplementary concentrate feed of about ¼ kg/head a day was offered two weeks prior to mating season for flushing the ewes and also during the last two to four weeks of pregnancy and lasting through the first weeks of lactation. Sheep were allowed to drink two or three times daily.

Animals were shorn two times a year, in March and in September. At lambing, new born lambs were identified and their type of birth, sex and pedigree recorded. Weights were recorded within twenty four hours of birth and at 30-day intervals thereafter.

Four ewe traits were considered, conception (CON) measured as ewe conceived per ewe joined, number of lambs born per ewe lambed (LB), number of lambs weaned per ewe lambed (LW) and kilograms born per ewe lambed (KB). The averages of ewe traits were .759, .945, .802 and 2.1 in Rahmani and .655, .734, .605 and 2.4 in Ossimi for CON, LB, LW and KB, respectively.

Data were analyzed by breed in the two periods. The fixed main effects included in the model were year in case of once-a-year mating or year/block of lambing in case of twice-a-year mating (in the second period years were grouped into fifteen blocks, each of two years including three lambing seasons), location (three for Ossimi and two for Rahmani), season of lambing for the mating-every eight months system (February, October and

June) and parity (1, 2, ..., 11). Based on previous findings of other workers using the same data (Ahmed, 1991 and Shaat, 1996) of the non-importance of interactions in considered traits, these interactions were not included in the model.

A Multi Trait Animal Model program (MTDFREML) of Boldman *et al*. (1993) was used to estimate the breeding values with Best Linear Unbiased Prediction (BLUP) methodology.

Genetic trends were obtained by regressing the estimated breeding values on years of birth (regression on blocks was divided by 2 to render it to year basis for the second period). The standard error of the linear regression estimates based on the lack of fit was used as the error for genetic trend.

The assumed model was:

$Y = X\beta + Zu + e$,

where,

Y is the vector of observations;

X the incidence matrix for fixed effects;

β the vector of an overall mean and fixed effects of year of lambing in case of once-a-year mating or year/block of lambing in case of twice-a-year mating , location, season of lambing, and parity;

Z the incidence matrix for random effects;

u the vector of random effect (animals additive genetic effect) associated with the incidence matrix Z; and

e vector of random errors normally and independently distributed with $(0, I\sigma^2_e)$.

The trait conception was measured by taking ewes conceived per ewes joined (1 if conceived and 0 if not), while the traits lambs born and lambs weaned/ewe lambed were measured by taking numbers of lambs born and weaned for each ewe lambing. Total kilograms born for each ewe was considered as kilograms born per ewe lambed trait.

Generation interval was estimated by calculating the average of four ages: that of sires at birth of their sons, of sires at birth of their daughters, of dams at birth of their sons and of dams at birth of their daughters.

Deviation of selected parents from the mean of their birth cohorts, as indication of selection differential, was estimated by subtracting the average deviation of the selected dams minus the mean of their cohorts for each season within years for each trait.

RESULTS AND DISCUSSION

Genetic change was negative for all studied traits in Ossimi and Rahmani except in period 1 for LB, LW and KB traits in Ossimi. All studied traits for both periods in the two breeds were not significant except LB and LW traits in Ossimi for period 2 which were significant ($P < .05$). Table 1 shows the estimates of annual genetic change for both Rahmani and Ossimi breeds and its standard errors in the ewe traits for both periods and Figures 1,2,3 and 4 show the trends of these genetic changes.

The low and mainly non-significant genetic change are due to the actual lack of directional selection in these flocks beside the fact that heritability for these traits is rather low. Table 2 shows the estimates of these heritabilities obtained in the present study. These estimates agree with those reported by other authors on the same flocks (Shaat, 1996 and Aboul Naga *et al*., 1985)

Table 1. Estimates of annual genetic change per year x 10^4 and its standard errors between parenthesis x 10^4 for Ossimi and Rahmani ewe traits in the two studied periods

Period	1959 – 1970				1970 – 1999			
Breed	CON	LB	LW	KB	CON	LB	LW	KB
Ossimi	-4.72 (±2.79)	6.78 (±6.63)	4.62 (±7.70)	84.25 (±46.34)	-1.31 (±1.01)	-5.44* (±2.45)	-6.62* (±.2.79)	-1.56 (±5.89)
Rahmani	-.98 (±.1.01)	-4.88 (±.2.80)	-5.09 (±2.96)	-30.55 (±33.39)	-1.18 (±9.35)	-2.00 (±1.62)	-.44 (±1.17)	-5.55 (±7.89)

CON, conception; LB, number of lambs born per ewe lambed; LW, number of lambs weaned per ewe lambed; KB, kilograms born per ewe lambed
* $p < .05$

Analysis of variance for figures in Table 1 showed that differences between periods and between breeds and their interaction were not significant (P>.05).

Estimates of genetic change for LB in the present study is similar to those reported by Burfening *et al*. (1989) working on total number of lambs born in Rambouillet sheep, of -.004 per year. In Swedish sheep, Gates and Urioste (1995) estimated genetic change per year for litter size at weaning as -.06. However, a positive genetic change of .0014 was found by Bhuiyab and Curran (1993) in Romney Marsh sheep for prolificacy (number of live lambs per ewe joined).

Estimates of heritability obtained from the animal model for ewe traits are presented in Table 2.

Table 3 shows estimate of the average deviation of selected dams from the mean of their birth cohorts for both Rahmani and Ossimi sheep in both periods.

Estimates in Table 3 express the deviation of selected dams from the mean of their birth cohorts, as indication of the selection differential; these estimates are very low for all studied traits except for KB trait in both breeds for the two periods. These low estimates of both heritability and of selection differential are reasons for the low annual genetic change. Moreover, both breeds had a relatively long generation interval.

Table 2. Estimates of heritability and its standard errors between parenthesis for Ossimi and Rahmani ewe traits in the two studied periods

Period / Breed	1959 – 1970				1970 – 1999			
	CON	LB	LW	KB	CON	LB	LW	KB
Ossimi	.01 (±.006)	.03 (±.0018)	.04 (±.0024)	.08 (±.0046)	.01 (±.0004)	.03 (±.0011)	.04 (±.0015)	.02 (±.0008)
Rahmani	.01 (±.0005)	.02 (±.0009)	.03 (±.0014)	.13 (±.0054)	.01 (±.0003)	.03 (±.001)	.02 (±.0007)	.04 (±.0013)

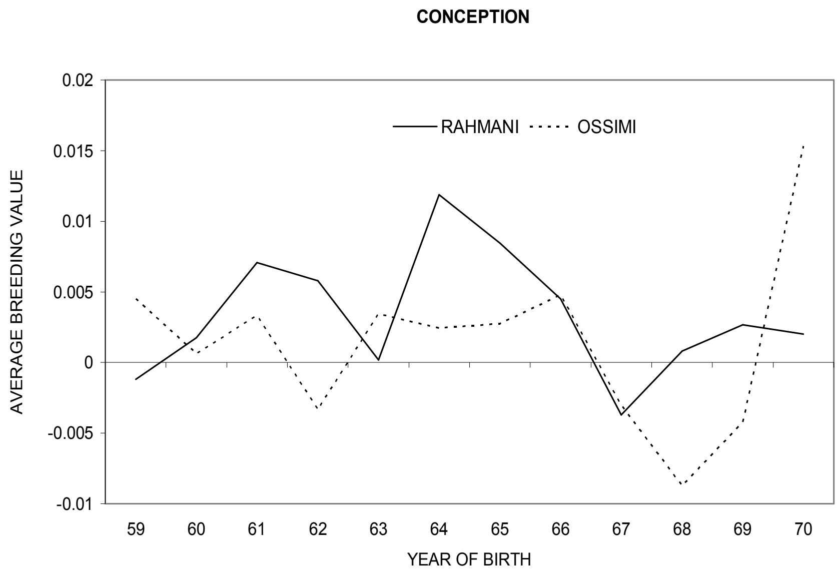
CON, conception; LB, number of lambs born per ewe lambed; LW, number of lambs weaned per ewe lambed; KB, kilograms born per ewe lambed
* $p < .05$

Table 3. Estimates of average deviation of selected dams from the mean of their birth cohorts for conception and lambs born, lambs weaned and kilograms born/ewe lambed for the two breeds Ossimi and Rahmani in both periods

Period / Breed	1959 – 1970				1970 – 1999			
	CON	LB	LW	KB	CON	LB	LW	KB
Ossimi	.01	.02	.02	.28	.03	.04	.06	.15
Rahmani	.01	.04	.03	.18	.05	.10	.09	.37

CON, conception; LB, number of lambs born per ewe lambed; LW, number of lambs weaned per ewe lambed; KB, kilograms born per ewe lambed
* $p < .05$

Figures 1 and 2 illustrate genetic trends for different ewe traits in period 1 for both Ossimi and Rahmani breeds.



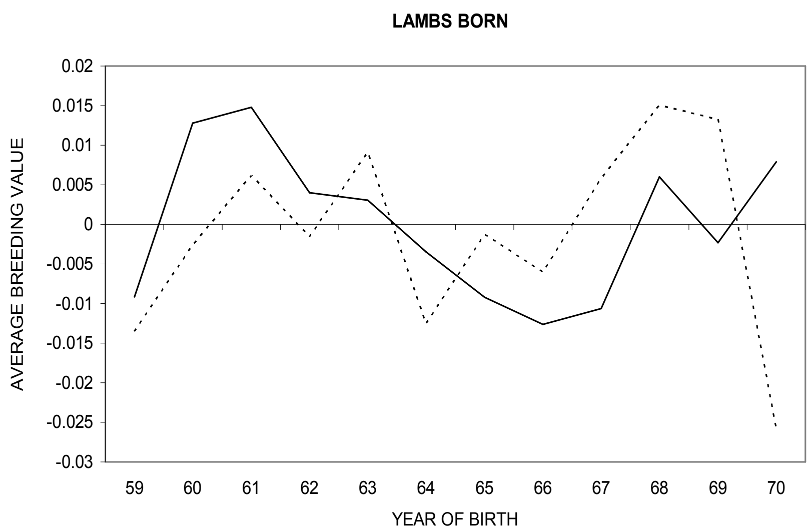


Figure 1. Genetic trends for ewe traits (conception and lambs born) in the Rahmani and Ossimi breeds in period 1.

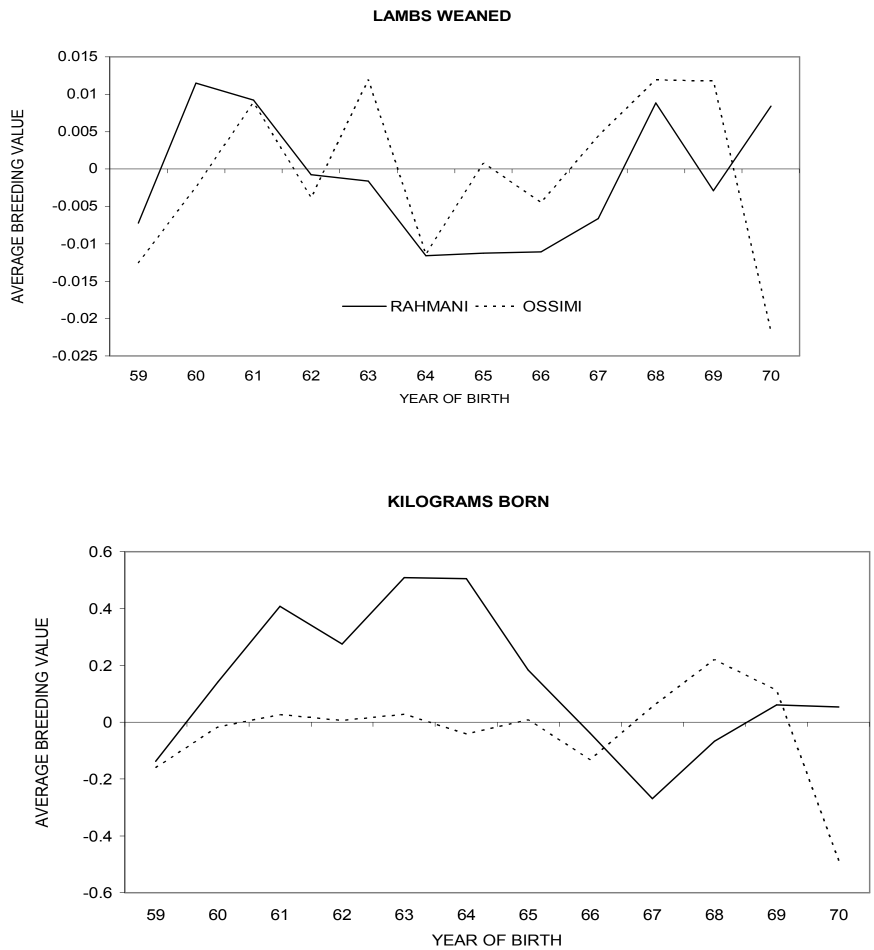
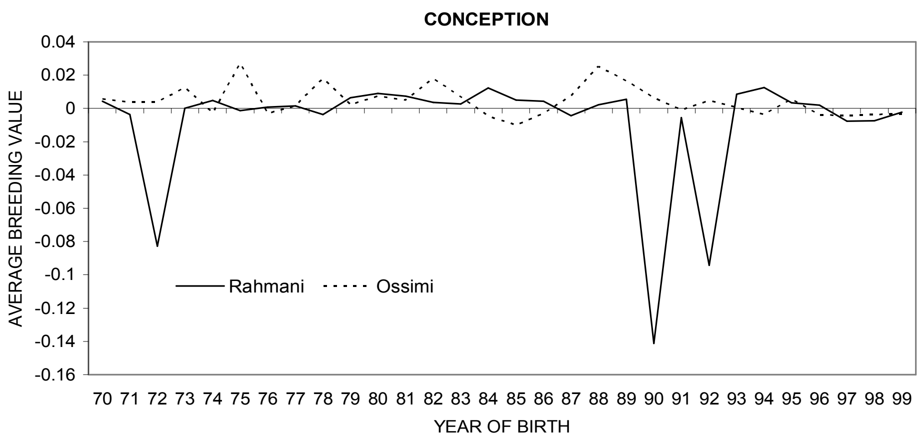


Figure 2. Genetic trends for ewe traits (lambs weaned and kilograms born) in the Rahmani and Ossimi breeds in period 1.

Estimates of generation interval in the present study were close to each other in the two breeds, being 4.34 years in Ossimi and 4.29 years in Rahmani, and close to that obtained by Mansour *et al*. (1977) for Egyptian Barki sheep of 4.4 years. However, different estimates for generation interval were reported by Prod'Homme and Lauvergne (1993) who found that generation interval on the sire side was between 2.2 and 4.1 years and on the dam side between 3.9 and 5.6 years. Moreover, Lush (1958) stated that generation interval in sheep ranged from 4 to 4.5 years.

Figures 3 and 4 show genetic trends for different ewe traits in period 2 for both Ossimi and Rahmani breeds



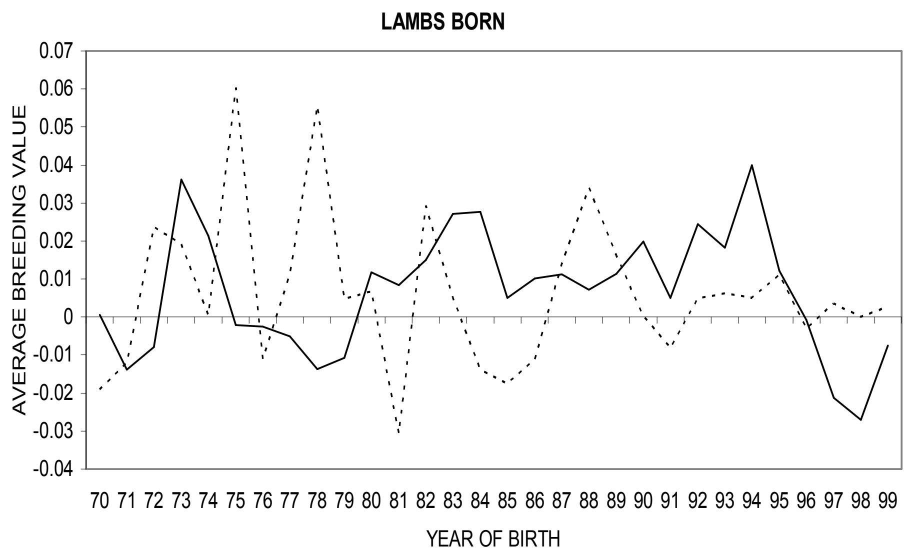


Figure 3. Genetic trends for ewe traits (conception and lambs born) in the Rahmani and Ossimi breeds in period 2

Shrestha *et al*. (1996) concluded that differences in genetic trends among breeds can be related to selection criteria which varied between the meat type sire and fecund type dam breeds. Also, they reported that estimates of genetic change varied according to breed, lamb weight and procedure for estimation.

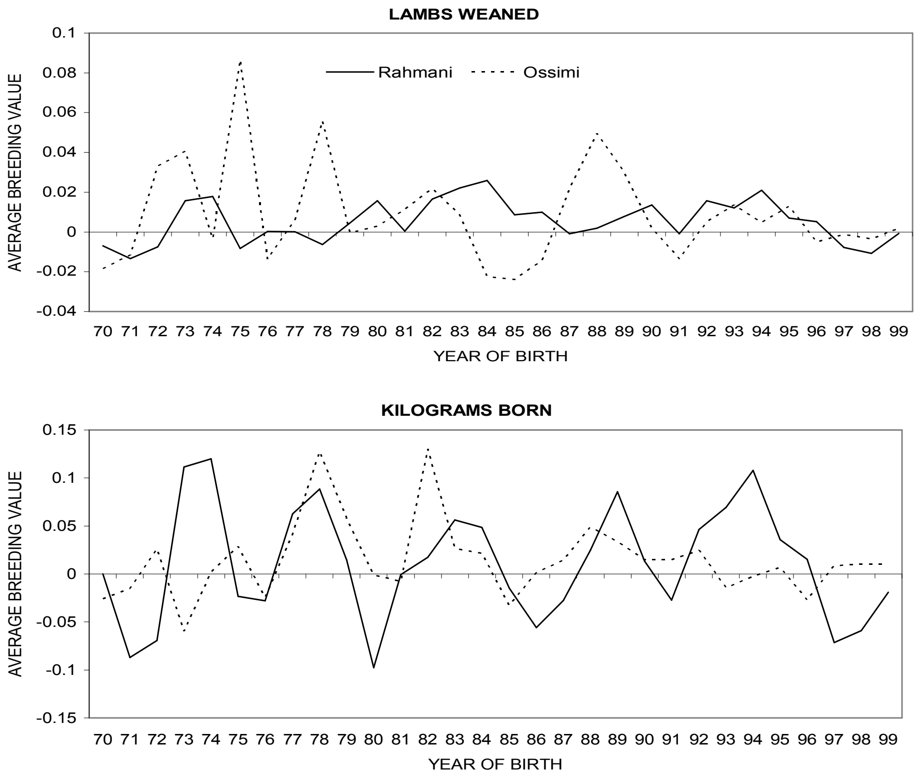


Figure 4. Genetic trends for ewe traits (lambs weaned and kilograms born) in the Rahmani and Ossimi breeds in period 2

Results of this work showed, in general, no or low genetic improvement in the studied traits during the period of study. The main reason for this could be the absence of clear and focused selection criteria during the period of the study. Rams were selected mainly according to their vigor, body conformation, and semen quality and libido test while ewes were selected only according to type of birth and birth weight and were culled if they had not lambed in the last two consecutive breeding seasons. Estimate of deviation of selected parents from the mean of their birth cohorts (Table 3), as an indication of the selection differential, was very low for the ewe traits.

CONCLUSION

The relatively low annual genetic progress made in the two breeds reflects the actual lack of consistent directional selection for clear selection goals. The nearly zero genetic change could be explained by the fact that they are traits expressed at later stages relative to when selection was made and the traits themselves are not expressed directly by the ram where most selection is usually derived.

However, both breeds had a relatively long generation interval which leaves a room for accelerating the genetic improvement by shortening it.

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اتجاهات وراثية لصفات النعاج في قطعان أغنام الرحمانى والأوسيمى

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اشتملت هذه الدراسة علي ١١١٥٠ سجل نعاج رحماني و ٩٢٢٦ سجل نعاج أوسيمى مولودة من ٣٥٧ و ٢٢٦ أب على الترتيب. خلال الفترة من ١٩٥٩ إلي ١٩٩٩. وذلك لتقدير الاتجاهات الوراثية والبيئية والمظهرية في صفات النعاج.

تم استخدام نموذج الحيوان المتعدد الصفات لتقدير القيم التربوية للحيوانات. قسمت البيانات إلي فترتين: الأولى من سنة ١٩٥٩ إلى ١٩٧٠ احتوت على موسم تلقيح واحد في السنة والثانية من سنة ١٩٧٠ إلى ١٩٩٩ واحتوت علي ثلاث مواسم تلقيح كل سنتين. تم حساب التغير الوراثي علي أساس انحدار القيم التربوية علي سنة الميلاد. استخدمت صفات الخصوبة (النعاج التي ولدت/النعاج التي لقحت) ، عدد الحملان المولودة لكل نعجة ولدت ، عدد الحملان المفطومة لكل نعجة ولدت ، عدد الكيلو جرامات المولودة لكل نعجة ولدت بالنسبة للنعاج.

كان التغير الوراثي لصفات النعاج غير معنوي في جميع الصفات المدروسة بالنسبة للفترتين فيما عدا صفتي عدد الحملان المفطومة وعدد الحملان المولودة للأوسيمى في الفترة الثانية فقط. وكانت قيم التغير الوراثي في الفترة الأولى هي –٠.٠٠٠٠٩٨، –٠.٠٠٠٤٨٨، –٠.٠٠٠٥٠٩ و –٠.٠٠٣٠٥٥ في الرحمانى ، –٠.٠٠٠٤٧٢، ٠.٠٠٠٦٧٨، ٠.٠٠٠٤٦٢ و ٠.٠٠٨٤٢٥ في الأوسيمى. أما في الفترة الثانية فكانت –٠.٠٠٠١١٨، –٠.٠٠٠٢٠٠، –٠.٠٠٠٤٤ و –٠.٠٠٠٥٥٥ في الرحمانى ، –٠.٠٠٠١٣١، –٠.٠٠٠٥٤٤، –٠.٠٠٠٦٦٢ و –٠.٠٠٠١٥٦ في الأوسيمى بالنسبة لصفات الخصوبة ، عدد الحملان المولودة لكل نعجة ولدت ، عدد الحملان المفطومة لكل نعجة ولدت، عدد الكيلو جرامات المولودة لكل نعجة ولدت على الترتيب. كانت قيم التغير المظهري غير معنوية في جميع الصفات ماعدا صفة الخصوبة حيث كانت معظم القيم سالبة خاصة في الفترة الثانية. أما التغيرات البيئية فكانت جميعها موجبة خلال الفترة الأولى عدا صفة عدد الكيلوجرامات المولودة، أما الفترة الثانية فكانت قيم التغيرات البيئية سالبة في جميع الصفات المدروسة للنعاج.