

HETEROSIS OF SOME ECONOMIC TRAITS IN LOCAL BREEDS OF GOATS, DAMASCUS AND THEIR CROSSES UNDER TWO DIFFERENT REGIONS IN EGYPT

Eissa, M.¹; M.M. Abdelsalam²; M.H. Hammoud² and Zeinab A. Khalifa¹

¹ Animal Production Research Institute, Ministry of Agric., Dokki, Cairo, Egypt.

² Department of Animal Production, Fac. Agriculture, Alex. Univ., Alex., Egypt.

ABSTRACT

Data of 532 records of 150 does reared at a Valley farm and 382 does at a Desert farm during the period 1999-2003 were used to estimate the hypothetical and real heterosis of some economic traits under two different regions. In each region, the genotypes were local Baladi or Barki (B), Damascus (D) and DB.

The first generation gave greater and heavier litters either at birth or at weaning and yielded more milk than the local breed in both farms. The DB does produce milk with the highest protein and fat percentages. In Valley farm, the DB does milked for longer period than those in the Desert farm and the former does had the longest lactation length (24 weeks). The hypothetical heterosis value was positive in both farms and ranged from + 2.82 to + 23.07 in the Valley farm and ranged from + 0.37 to + 12.72 in the Desert farm. The positive value of real heterosis was found in case of protein and fat percentage in both farms while in Valley farm litter size at weaning and lactation length showed positive real heterosis (+ 16.66 and + 4.34, respectively). Results showed that there was a good prospect of crossbreeding amongst goats to achieve higher milk production for long period which reflected on growth of kids.

INTRODUCTION

In Egypt, the local goats characterized by low kid performance, milk production, growth performance and high reproductive performance (Abdelsalam *et al.*, 1997). Thus, crossbreeding with the Damascus goats has been conducted to improve low productivity. Consequently crossbred goats have some advantages over purebred goats as a result of heterosis. Heterosis usually gives a crossbred an improvement over the average of its parent purebreds for a certain trait. This could be expressed in percentage and known as hypothetical heterosis. However, the crossbreds in some cases are found superior to that of the parent having the desired trait, this is known as real heterosis. The objective of this study is to estimate hypothetical and real heterosis for some economic traits in goats reared under Valley and Desert farms to throw a light on how these economic traits among crossbreds in desirable direction are inherited.

MATERIALS AND METHODS

Data originated from the crossbreeding program carried out at the two farms in Egypt; first is the Experimental Farm of the Faculty of Agriculture, Alexandria University, situated in east of Alexandria, representing the Valley farm, and the second is Bourg El-Arab Experimental Farm, belonging to Animal Production Research Institute, Ministry of Agriculture, situated in the Coastal Zone of the Western Desert at the border of a newly reclaimed area, representing the Desert farm. The management of the flocks studied was earlier described by Eissa *et al.* (2001).

Data of 532 records of 150 does reared at the Valley farm {49 Damascus (D), 57 local (Baladi, B) and 44 DB} and 382 records of does at the Desert farm {131 Damascus (D), 124 local (Barki, B) and 127 DB} were collected during the period 1999-2003. Data of litter size at birth and weaning, litter weight at birth and weaning, post kidding body weight, milk yield, lactation length, protein and fat percentage were analyzed using least-squares analysis with unequal subclass numbers using GLM procedure (SAS, 2000). Data of each farm was analyzed separately. All data were analyzed for estimating both the hypothetical and real heterosis. The hypothetical and real heterosis were calculating as follows:

Hypothetical heterosis (%) =

$$\frac{\text{Mean of crossbreds} - \{(\text{Mean of parental I} + \text{Mean of parental II}) / 2\}}{(\text{Mean of parental I} + \text{Mean of parental II}) / 2} \times 100$$

$$\text{Real heterosis (\%)} = \frac{\text{Mean of crossbreds} - \text{Mean of superior parent breed for the trait}}{\text{Mean of superior parent breed for the trait}} \times 100$$

RESULTS AND DISCUSSION

It is evident from Tables 1 and 2 that the first generation of crossbred (DB) exceeded the local breed in all traits studied and the hypothetical heterosis had positive values in both farms and ranged from + 2.82 to + 23.07 in Valley farm and from + 0.37 to + 12.72 in Desert farm, while the real heterosis were ranged from - 22.59 to + 16.66 and from - 22.61 to + 6.89 in Valley and Desert farms, respectively. The positive heterosis values showed that these traits are in desirable direction. The values of + 12.5, + 20.68 and + 7.69, + 7.14 of hypothetical heterosis in Valley and Desert farms for litter size at birth and at weaning, respectively indicates that crossbred does were more prolific than local breeds and they had more maternal influence than the local breeds in both farms. It is clear to note that the crossbred does in Desert farm gave the same number of litter at birth and at weaning (1.4 kids and 1.2 kids, respectively), while the crossbred does (DB) in Valley farm had the same litter size at birth (1.8 kids) and had greater litter size at weaning (1.4 kids vs. 1.2 kids) in comparison to Damascus breed. The crossbred does in

Valley farm had + 16.66 real heterosis for litter size at weaning means that they were in good mothering ability. The positive hypothetical heterosis of weight of litter at birth and at weaning reflects the ability of DB does to born and weaned heavier kids. The small and zero heterosis values estimated may result from a combination of dominance effects and epistatic effect included in the heterosis effects. These results are in agreement with the findings of Hirooka *et al.* (1996) and Shiwu *et al.* (2004). In this respect, Bablu (2002) stated that any increase in performance of crossbred does was mainly due to the non additive gene actions like epistasis, dominance and over-dominance. In addition, Getz (2004) reported that the traits with low heritability like fitness and reproduction show more advantage from heterosis.

Table 1: Heterosis for economic traits of Damascus x local goats in the Valley farm.

Traits	Means \pm SE			Heterosis (%)	
	Local Baladi (B)	Damascus (D)	DB	Hypothetical	Real
Litter size at birth	1.4 \pm 0.05	1.8 \pm 0.03	1.8 \pm 0.06	+ 12.5	0
Litter size at weaning	1.18 \pm .05	1.2 \pm 0.04	1.4 \pm 0.05	+ 20.68	+ 16.66
Litter weight at birth (kg)	2.9 \pm 0.2	4.9 \pm 0.2	4.1 \pm 0.3	+ 5.12	- 16.32
Litter weight at weaning (kg)	15.6 \pm 0.5	24.5 \pm 0.4	22.8 \pm 0.6	+ 13.71	- 6.93
Lactation length (weeks)	16 \pm 0.2	23 \pm 1.1	24 \pm 0.9	+ 23.07	+ 4.34
Lactation yield (kg)	92.5 \pm 5.1	181 \pm 8.3	140.1 \pm 6.9	+ 2.82	-22.59
Protein (%)	3.1 \pm 0.2	2.6 \pm 0.1	3.3 \pm 0.1	+ 15.78	+ 6.45
Fat (%)	3.4 \pm 0.2	3.1 \pm 0.1	3.5 \pm 0.1	+ 7.69	+ 2.94
Post kidding weight (kg)	25.1 \pm 0.9	40.2 \pm 0.6	34.2 \pm 0.3	+ 4.74	- 14.92

The hypothetical and real heterosis for lactation length for crossbred does reared in Valley farm was + 23.07 and + 4.34, respectively, and in desirable direction which would be of greater advantage in producing more milk in a lactation. This reflects the heavier and greater number of litter at weaning. Also, the hypothetical heterosis of lactation length for DB does in Desert farm (+ 5.26) which help does to produce more milk than local breed. The hypothetical heterosis of + 2.82 and + 9.38 on lactation yield in both farms showed an advantage of crossing local breed (Baladi or Barki) with Damascus to exploit lactation yield potential. Banda (2001) reported that between local and exotic goats, there was a quadratic response with Boer x local crossbreds to produce the highest yields, with 12% heterosis. In other meaning crossbreeding improves milk production trait in the local breed.

The hypothetical desirable heterosis of protein and fat percentages in Valley farm (+ 15.78 and + 7.69) and in Desert farm (+ 12.72 and + 2.98) and the real desirable heterosis of the same traits (+ 6.45, + 2.94 in Valley farm and + 6.89, + 2.85 in Desert farm, respectively) indicated the superiority of crossbred for milk composition over the pure parents. VanRaden and Sanders (2001) stated that estimates of general heterosis were 4.4 % for fat % and 4.1 % for protein % in cattle.

Table 2: Heterosis for economic traits of Damascus x local goats in the Desert farm.

Traits	Means \pm SE			Heterosis (%)	
	Local Barki (B)	Damascus (D)	DB	Hypothetical	Real
Litter size at birth	1.2 \pm 0.05	1.4 \pm 0.04	1.4 \pm 0.04	+ 7.69	0
Litter size at weaning	1.04 \pm .04	1.2 \pm 0.04	1.2 \pm 0.05	+ 7.14	0
Litter weight at birth (kg)	2.8 \pm 0.1	4.7 \pm 0.1	4.08 \pm 0.1	+ 8.8	- 13.19
Litter weight at weaning (kg)	14.1 \pm 0.5	23.9 \pm 0.9	20.8 \pm 0.5	+ 9.47	- 12.97
Lactation length (weeks)	16 \pm 1.2	22 \pm 2.3	20 \pm 2.1	+ 5.26	- 9.09
Lactation yield (kg)	86.8 \pm 0.9	155.1 \pm 4.1	132.3 \pm 1.3	+ 9.38	-14.7
Protein (%)	2.9 \pm 0.1	2.6 \pm 0.1	3.1 \pm 0.1	+ 12.72	+ 6.89
Fat (%)	3.2 \pm 0.1	3.5 \pm 0.1	3.6 \pm 0.1	+ 2.98	+ 2.85
Post kidding weight (kg)	23.05 \pm 0.5	42.51 \pm 0.8	32.9 \pm 0.4	+ 0.37	- 22.61

The positive hypothetical heterosis of post kidding weight reveals that the crossbred does were heavier than local breed in Valley and Desert farms indicating heavier weights of litter at birth and at weaning with higher mothering ability. Eissa (2003) found that native goats (Barki) were lighter post-kidding body weight than both exotic breed (Damascus) and the Damascus X Barki crossbred does.

From the present results it could be concluded that heterosis level is not the same for all traits. The hypothetical heterosis for lactation length, litter size at birth and post kidding weight showed a good prospect of crossbreeding amongst goats to achieve the main goal i.e. producing higher milk yield which had an important effect on mothering ability to get high litter size at weaning and heavier litter at weaning. This will increase the income of the goat's breeders. The positive real heterosis of a trait plays a vital part to show how this economic trait among crossbreds in desirable direction is inherited.

However, in spite of the two examined crossbreds (Damascus X local Baladi and Damascus X local Barki) under the two farms (Valley and Desert), the values of heterosis in the case of (Damascus X local Baladi) showed better results for most traits studied.

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قوة الهجين لبعض الصفات الاقتصادية للماعز المحلية والدمشقية وخليطها في منطقتين مختلفتين في مصر

محمد عيسى^١ - مجدى عبد السلام^٢ - محمد حسن حمود^١ و زينب خليفة^١

^١ معهد بحوث الإنتاج الحيوانى - وزارة الزراعة - الدقى - القاهرة

^٢ قسم الإنتاج الحيوانى - كلية الزراعة - جامعة الإسكندرية - الإسكندرية

استخدم في هذه الدراسة ٥٣٢ سجل لـ ١٥٠ عنزة مربية بمزرعة الوادى وكذلك ٣٨٢ عنزة مربية بالمزرعة الصحراوية خلال الفترة من ١٩٩٩ - ٢٠٠٣ وذلك بغرض تقدير قوة الهجين النظرية والحقيقية لبعض الصفات الاقتصادية تحت ظروف المزرعتين. وكانت التراكيب الوراثية التي درست هي الماعز المحلية (البلدى أو البرقى) والدمشقى والخليط الأول.

أعطت العنزات الخليط أعلى حجم خلفه وأثقلها وزنا عند الميلاد والقطام وأعلى كمية لبن عن السلالة المحلية في المزرعتين كما احتوى لبنها على أكبر نسبة دهن وبروتين. وفي مزرعة الوادى حلبت الماعز الخليط لأطول فترة حيث بلغت ٢٤ أسبوع. وكانت جميع قيم قوة الهجين النظرية موجبة في المزرعتين وتراوحت تلك القيم من + ٢,٨٢ إلى + ٢٣,٠٧ في مزرعة الوادى بينما تراوحت تلك القيم من + ٠,٣٧ إلى + ١٢,٧٢ في المزرعة الصحراوية. أما القيم الموجبة لقوة الهجين الحقيقية فقد كانت لنسب البروتين والدهن في المزرعتين وقد ظهرت في مزرعة الوادى لحجم الخلفة عند القطام (+ ١٦,٦٦) وطول موسم الحليب (+ ٤,٣٤) فقط. وقد أوضحت النتائج حدوث خلط جيد بين الماعز للوصول إلى إنتاج لبن على ولمدة طويلة من موسم الحليب مما ينعكس بدوره على نمو الجداء.