FACTORS AFFECTING THE MILK PRODUCTION OF ASSAF DAIRY SHEEP IN ISRAEL

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INTRODUCTION

The Assaf (originated from Awassi X East Friesian) was developed in Israel during the 1950s and 1960s and replaced the improved Awassi as the main dairy breed in the country. Information on reproduction and production traits of the Assaf in its early stages has been documented by Epstein (1985) and Gootwine and Goot (1996). Currently, Assaf ewes are kept under intensive management where ewes are milked from the 1st day of the lactation while lambs are removed at birth to artificial rearing units. This type of milking regime, unique in dairy sheep, allows the study of the complete lactation. Up-to-date information of the performance of the Assaf under intensive management is lacking. The aims of the present study therefore, were to study the complete lactation curve of the Assaf using a biological moded (Pollott 2000) and to analyze the factors which affect milk production and lactation curve parameters.

MATERIAL AND METHODS

The data used for this study were derived from the Assaf flocks of Kibbutz Dalia and Kibbutz Nachshon and include records of all ewes (n=2,837) that lambed and milked in those flocks in the period 1993 - 2000. The intensive management of the flocks and their performances recording systems are similar to those described for the improved Awassi (Gootwine and Pollott, 2000) with the main exception that the reproductive management includes hormonal synchronization and mating of all ewes about 90 days after lambing. Ewes were milked twice daily from the day of lambing until their milk yield dropped to about 0.5l/d or until they had to be dried off before lambing.

The average daily milk yields in weeks 1 to 40 of lactation for each of the Assaf flocks were obtained by analysis of all individual daily milk records using least squares methods for unbalanced data. The following model was fitted to the data using the GLM procedure (SAS 1989 and 1997): $M_{ijkmnp} = \mu + E_i + LN_j + W_k + MR_m + LS_n + e_{ijkmnp}$ Where M_{ijkmnp} was a daily milk record from the E_ith ewe in its LN_jth lactation in the W_kth week of that lactation. The records were taken in the MR_mth month/year combination with LS_n lambs born to the ewe. e_{ijkmnp} was the randomly distributed error term. The Pollott multiplicative function (Pollott, 2000) was then fitted to the lactation curves derived from the weekly least-squares means, using a least-squares non-linear curve fitting procedure, NLIN in SAS.

In the second stage of the study, the reduced Pollott multiplicative function (Pollott, 2000) was fitted to records of 5.462 lactation with >4 test-day records from both farms. Total milk yield

from each lactation (TMY) and other calculated parameters (Gootwine and Pollott, 2000) were analysed by the GLM procedure (SAS, 1997) using the following model:
$P_{ijklmnp} = \mu + E_i + LN_j + LS_k + M_l + MOC_m + F_n + e_{ijklmnp}$. $P_{ijklmnp}$ was a lactation trait (Table 1) of the E_ith ewe in its LN_jth lactation. LS_k was the number of lambs born to the ewe at the start of the lactation, M_l was the month/year when the ewe lambed, MOC_m was the month of the lactation in which conception occurred, F_n was the farm and eijklmnp was the randomly distributed error term. MOC_n was calculated by subtracting 146 days (the average gestation length of the Assaf) from the date of the following lambing. An estimate of heritability was made by adding sire (n= 141) to the above model.

RESULTS AND DISCUSSION

Lactation curves for the two Assaf flocks with their fitted curves using the Pollott (2000) multiplicative model are shown in Figure 1. The parameters of the overall curves and the calculated values up to 291 days are shown in Table 1 along with similar data obtained for the Improved Awassi breed of the Ein Harod flock (Pollott and Gootwine, 2000).

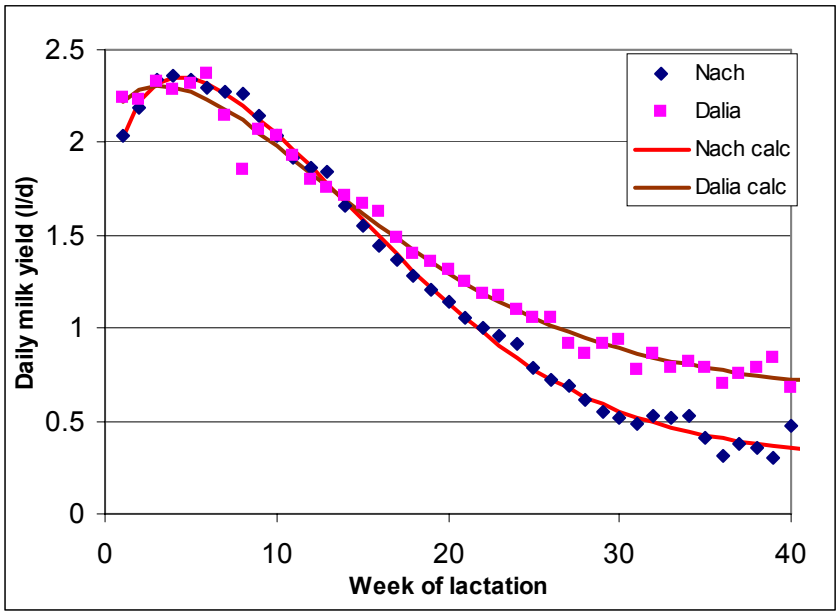

Figure 1. Weekly average milk yields and "Typical lactation curves" calculated using Pollott model for Nachshon and Dalia dairy sheep flocks

The two Assaf lactation curves were similar in nature and deviate markedly from the published Awassi lactation curve parameters mainly in MS, PY and CTMY values. Whereas the difference are genetic based or environmental driven can not be sorted out here as both breeds has not been managed under the same conditions. Nevertheless, it is interesting to note that the

differences are mainly in parameters affected the early part of the lactation curve where secretory cell proliferation, differentiation and increase in secretary activity take place rather in parameters affected by udder cell death and loss of secretory activity.

Table 1. Parameters and calculated values for Assaf and Awassi typical lactation curves

Trait	Abbre-viation	Nachshon flock	Dalia flock	Improved Awassi*
Maximum secretion potential (l)	MS	2.62	2.66	3.75
Relative growth rate in milk production	GR	0.0865	0.0523	0.1207
Relative decline rate in milk production	DR	0.0207	0.0165	0.0184
Peak yield (l)	PY	2.36	2.30	3.31
Day of peak yield (d)	DP	27	20	25
Daily increase in milk production midway between lambing and peak yield (g/d)	GM	22	14	24
Daily loss of milk production midway between peak and end of lactation (g/d)	DM	12	8	15
Calculated total milk yield to 291days (l)	CTMY	351	401	543 (280d)

*(Pollott and Gootwine, 2000).

Table 2: Means and SD for 13 calculated values and parameters derived from 5,462 Assaf lactations and summary of analysis of variance for the influence of fixed effects

Trait	Mean	SD	Ewe	LN	LS	Month	MOC	Farm	R^2	Rep*
TMY (l)	353	137	***	***	***	***	***	*	0.75	0.39
CTMY (l)	327	126	***	***	**	***	***	***	0.74	0.37
CTMY90 (l)	194	68	***	***	**	***		***	0.72	0.26
CTMY120 (l)	250	83	***	***	**	***		***	0.72	0.29
LI (d)	269	69	***	***		***	-		0.65	0.37
MS (l)	2.97	0.989	***	***	***	***	***	***	0.74	0.32
GR	0.20	0.04	***	***		***	***		0.62	0.09
DR	0.003	0.001	***	***		***	***	***	0.73	0.35
LL (d)	176	38.1	***			***	***	***	0.78	0.47
PY (l)	2.65	0.855	***	***	***	***	*	***	0.74	0.33
DP	29	9.64	***	***		***	**	**	0.64	0.12
GM (g/d)	80.4	52.7	***	***		***	***		0.63	0.13
DM (g/d)	11.2	6.17	***	***		***	***	***	0.72	0.30

* Repeatability, LI - Lambing interval, LL - Lactation length

The means for 13 calculated values and parameters for 5,462 lactations and the results of analysis of variance for those parameters are present in Table 2. The lactations were recorded

from ewes with a mean litter size of 1.52 lambs born per ewe lambing and with average total milk yield of 353 l for lactations of 176 days in length.

All fixed effects included in the model significantly affected most traits under investigation. Least squares means for the major effects are tabulated in Table 3.

Table 3. Effect of lactation number (LN) and litter size (LS) on selected lactation traits

Effect	Level	TMY	MS	GR	DR	PY	DP	GM	DM	LINT
LN	1	331	2.44	0.2053	0.002493	2.21	31	62	8	271[a]
	2	393[a]	3.05[a]	0.1910[a]	0.002781	2.76[a]	26[a]	75[a]	11[a]	270[a]
	3	390[a]	3.11[a]	0.1915[a]	0.002959	2.80[a]	26[a]	76[a]	12[a]	265
LS	1	365[b]	2.84[b]			2.56[b]				
	2	382[a]	2.97[a]			2.67[a]				
	3	378[a]	2.93[a]			2.65[a]				
	4	360[b]	2.74[b]			2.48[b]				

The repeatabilites shown in Table 2 varied from 0.47 (ll) to 0.09 (GR) and were similar to those quoted by Pollott and Gootwine (2001) for the Improved Awassi. The heritability of TMY was calculated to be 0.09, a low value for milk yield but similar to that for the Awassi (Pollott and Gootwine, 2001).

CONCLUSION

Our results show that Assaf lactation curves differ from that of the Improved Awassi mainly in parameters relating to the early lactation stage. Similar to the improved Awassi (Gootwine and Pollott, 2000), lactation number, litter size, month of lambing and month of lactation in which conception occurred had significant effects on the Assaf total milk production and other lactation cure parameters. The level of additive variance for milk yield was low despite a moderate repeatability.

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