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اَلْجُمْهُورِيَّةُ اللُّبْنَانِيَّةُ
مَكْتَبُ وَزِيْرِ الدَّوْلَةِ لَشُؤُوْنِ التَّمِيَّةِ الْاِدَارِيَّةِ
مَرْكَزُ مَشَارِيْعِ وَدَّرَاسَاتِ الْقَطَاعِ الْعَامِ

COOPERATIVE SHEEP IMPROVEMENT PROJECT

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

The Arid Lands Agricultural Development Program

of

The Ford Foundation

and

Terbol Livestock Research Station

of

The Lebanese Agricultural Research Institute

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S U M M A R Y

1. During the first four years of production, from 2 to 6 years of age, there has not been a significant difference for percent of ewes lambing between the local Awassi and the imported Chios. For Awassi the average was from 91 to 97% and for Chios from 89 to 100%.
2. The Chios ewes have had a significantly higher lambing rate (number of lambs born per ewe lambing) than the Awassi for each of the four years. The respective rates for the four years have averaged 2.08 and 1.10.
3. The percent of ewes conceiving from mating at the first recorded estrus, after July 15, has averaged from 78 to 86%.
4. Conception at the first recorded estrus, after July 15, has resulted in a higher percentage for multiple births than when conception occurs at either the second or third. The respective figures were 27%, 10% and 8% for percent of multiple births during the mating period of 1973.
5. The Awassi breed has a fat tail and therefore it has been necessary to employ artificial insemination for crossing Chios rams with Awassi ewes.
6. The crossing of Awassi ewes with Chios rams has produced a F-1 cross-bred female which has shown a significantly higher lambing rate than the Awassi. For ewes lambing at two years of age the lambing rates have varied from 1.30 to 1.41 for F-1 ewes and from 1.00 to 1.08 for Awassi ewes.

7. For their first lactation (2 years of age) the F-1 ewe produce about 10% more milk than the Awassi Control.

8. The F-1 ewes have weaned more kilograms of lamb weight per ewe exposed than the Awassi. For one environment, three years old F-1 ewes (second year of production) weaned 40.4 kg. of lamb per ewe exposed as compared with 28.3 kg for the Awassi. This represents a 43% increase in production. For a different environment, the three year old F-1 ewes weaned 31.8 kg per ewe exposed as compared with 25.7 kg for the Awassi, a 24% increase in production.

For two year old ewes the kilograms of lamb weaned per ewe exposed were 22.7 kg and 15.2 kg for the respective F-1 and Awassi, a 49% increase in production.

9. The use of individual production and pedigree records in combination with progeny testing have been employed to increase milk production within one selected line of Awassi sheep. Two year old daughters from certain Awassi rams have averaged 253 kg of milk during their initial lactation.

10. Growth and carcass results for ram lambs slaughtered at 50 kg live weight and representing a backcross generation (Awassi x F-1) were as follows:

- a. the respective age at slaughter and daily gain from birth to slaughter was 175 days and 296 g. per day.
- b. dressing percent, external fat thickness and rib-eye area were 51.8%, 4.7 mm and 12.8 sq. cm. respectively,
- c. the respective carcass length and cannon bone length was 59.8 cm. and 11.6 cm.
- d. the weight of the fat tail make up 10% of the chilled carcass weight. This figure may be compared with 15% for Awassi and 7.5% for F-1 ram lambs slaughtered at 50 kg. live weight.

COOPERATIVE SHEEP IMPROVEMENT PROJECT

By

Carroll W. Fox ^{1/}

Introduction

The Arid Lands Agricultural Development (ALAD) Program is a cooperative research program between the Agricultural Research Institute, the Government of Lebanon, and the Ford Foundation. One project in this cooperative program has been the intergation of forage production with sheep improvement. The major work on this project has been conducted on the Terbol Research Station and also in cooperation with members of the station staff.

This report will summarize only the major results concerning the sheep phase since a separate report will present the results for the production of forages.

The project was started during 1968-69 and the major objectives could be summarized as:

1. To research methods for improving crop-sheep systems for increasing meat production with emphasis to improve reproductive efficiency and also to improve sheep husbandry practices. Two methods are being used for improving reproductive efficiency. They are: (1) Crossing the local Awassi with the Chios which is a prolific breed and also noted for being a milking sheep as is the Awassi, and (2) Selecting for an increase in the percentage of multiple births within the Awassi breed.
2. The use of individual selection and progeny testing for increasing milk production within the Awassi breed.
3. Maintain a random breeding control line of pure Awassi, against which the results from selection or crossbreeding can be measured.

1/ The following professional staff are also involved with this research project:

Dr. C. W. Fox,	ALAD Program, The Ford Foundation
Dr. W. A. Hardison,	ALAD Program, The Ford Foundation
Dr. E. Choueiri,	Director, Terbol Research Station
Dr. M. Maalouf,	Terbol Research Station
Mr. R. Chaaban,	Terbol Research Station
Mr. K. Khalil,	Terbol Research Station
Dr. E. Schwulst,	Faculty of Agriculture, American University of Beirut.

A more detailed explanation of the project and also the results through 1970 have been presented in the MAGON publication No. 36, March 1971.

Percent of Ewes Lambing and Lambing Rates

There has been no significant difference between Awassi and Chios for percent of ewes lambing during each of the past four years. The results presented in table 1 also indicate these points. They are: (1) from two to five years of age there has been an annual increase for number of lambs born per ewe exposed and per ewe lambing for the Awassi, (2) a high conception rate (91 to 97%) has been obtained from mating Awassi ewes during the months of July, August and September, and (3) the original hypothesis that the Chios breed would exhibit a high lambing rate (number of lambs born per ewe exposed) has been tested for a period of four years. Each year it has been significantly higher than for the Awassi breed. The Awassi ewes have averaged 1.04 lambs born per ewe exposed and 1.10 lambs born per ewe lambing for these four years. For the same period of time the Chios ewes have averaged 1.95 and 2.08 respectively.

Table 1. Lambing Rates for Breed and for Age of Ewe

Breed	Year Lambing	Age 1/	Ewes Lambing 2/	No. of lambs born per ewe Exposed	Lambing
Awassi	1970	2	.91	0.93	1.03
"	1971	3	.97	1.05	1.09
"	1972	4	.96	1.12	1.17
"	1973	5	.96	1.15	1.20
Chios	1970	2	.89	1.63	1.83
"	1971	3	.93	2.22	2.40
"	1972	4	1.00	2.07	2.07
"	1973	5	1.00	1.90	1.90

1/ Age of ewe at lambing

2/ Number of ewes lambing per ewe exposed

Our data have shown consistently a higher percentage of multiple births result when conception occurs during the first estrus recorded after July 14 than when conception occurs during either the second or the third periods of estrus. Last year 27.0 percent of the conceptions which occurred during the first recorded estrus produced multiple births as compared with only 10.0% and 8.0% when conception occurred during the second and third respective periods of recorded estrus. Since the mating program started in the middle of July we have no information about estrus or conception prior to this date. It would be of biological interest and also of economic importance to determine the ovulation rate at each estrus occurring between May to December.

Our data have not shown any significant differences for either percent of ewes lambing or for lambing rates in comparing natural mating with artificial insemination. Also, each year, a small number, 0.5 to 1.5 percent, of the ewes have not shown a detectable estrus. In general, the highest percentage of ewes not showing estrus has been the yearling ewes and being mated for the first time.

Comparisons Between F-1 and the Awassi Lines

One objective for this research project was to determine how the F-1 ewes (Awassi x Chios) would compare with the random control Awassi Line for total productivity. The oldest F-1 ewes (born in 1970) have completed only two years of production (1972 and 1973) and they will complete their third year in May 1974. For 1972 and also 1973 there were no significant differences between F-1 and the Awassi Control and Twin lines for percent of ewes lambing. However, the data presented in table 2 indicate a much higher lambing rate for F-1 ewes than for the Awassi.

Table 2. Lambing Rates for Ewes Born in 1970. 1/

Year lambing	1972	1973	1974 2/
Age at lambing	2 yr.	3 yr.	4 yr.
Control	1.07	1.16	1.11
Twin	1.15	1.15	1.60
F-1	1.41	1.36	1.80

1/ Lambing rate - number of lambs born per ewe lambing

2/ Through January 15, 1974.

These differences for lambing rates have been significant for both years between F-1 and Awassi lines, the Control and the Twin. The data for 1974 have yet to be analyzed statistically.

The data in table 2 also indicate a consistency for the F-1 ewes to exhibit a high lambing rate for each of the three years. The high lambing rate in 1974 for the Awassi Twin Line represents only five ewes which had completed lambing by January 15.

Lambing Rates for Ewes Born in 1971

The data for ewes born in 1971 and presented in table 3 again substantiate a higher lambing rate for F-1 ewes as compared with the two Awassi lines.

Table 3. Lambing Rates for Ewes Born in 1971. 1/

Year Lambing	1973	1974 2/
Age at Lambing	2 yrs	3 yrs
Control	1.00	1.00
Twin	1.08	1.12
F-1	1.30	1.55

1/ Lambing rate - number of lambs born per ewe lambing

2/ Through January 15, 1974.

The Chi square tests indicated a significant difference between F-1 and either Awassi Control or Twin lines for lambing rate. In general, our data have shown a slightly higher lambing rate for the second parturition than for the first lambing.

Cooperative Research Studies Between the American University of Beirut (AUB) and the ALAD Program

Twenty five F-1 ewes were loaned to the Department of Animal Production and Protection (AUB) to assist in evaluating the reproductive performance for these ewes in a different environmental regime from the Terbol station and also for obtaining carcass quality evaluations for the lambs. These lambs were a backcross generation (BCA) and resulted from crossing these F-1 ewes with an Awassi ram.

Table 4. Lambing Rates for Ewes at A.U.B. 1/

Year Lambing	1973	1974 2/
Age at Lambing	3 yrs.	4 yrs.
F-1	1.52	1.70
Awassi (all ages)	1.24	1.08

1/ Lambing rates - number of lambs born per ewe lambing

2/ Through January 15, 1974.

The data for lambing rates for ewes in the A.U.B. station are given in table 4. The lambing rate figures of 1.52 and 1.70 illustrate the potentials which exist among F-1 ewes in comparison with 1.24 and 1.08 for Awassi ewes. The survival rate from birth to 90 days of age was 100% for the BCA lambs in 1973 and should be considered an unusual event.

The Quantity of Lambs Weaned per Ewe Exposed.

The data from both research stations, A.U.B. and Terbol, indicated a higher lambing rate for the F-1 ewes in comparison with Awassi. However, fecundity in the ewe must also be accompanied with the ability for producing more kilograms of lamb meat in comparison with ewes lacking in fecund. The figures in table 5 give some estimation about the quantity of lamb weaned per ewe exposed for both F-1 and Awassi. The results for 1973 from both A.U.B. and Terbol stations suggest a sizeable increase for the kilograms of lamb weaned per F-1 ewe exposed in comparison with the Awassi.

Table 5. Average Kilograms of Lamb Weaned per Ewe Exposed

Ewe Line	Year Born	1 9 7 3	
		Terbol 1/	A.U.B. 1/
F-1	1970	31.8 kg. (23.7%)	40.4 kg. (42.7%)
Awassi	all ages	25.7 kg.	28.3 kg. 2/
F-1	1971	22.7 kg. (49.0%)	
Awassi Control	1971	15.2 kg.	

1. Lambs weaned at 90 days of age

2. Awassi ewes of all ages.

The 1973 results for the AUB station indicate the 3 year old F-1 ewes averaged 40.4 kg of lamb weaned per ewe exposed. This figure represents a 43% increase in lamb production as compared with 28.3 kg of Awassi ewes. One factor for this large difference on the AUB station was that no death loss resulted between birth and weaning for the BCA lambs. In the first year of production at the Terbol station these F-1 ewes averaged 30.3 kg of lamb weaned per ewe exposed.

For the Terbol station the 3 year old F-1 ewes produced only 23% more kg. of lamb per ewe exposed than did the Awassi Control Line. The differences for lamb production between the two stations may have resulted from two different systems of management.

The average amount of lamb weaned per ewe exposed for the respective 2 year old F-1 and Control ewes was 22.7 and 15.2 kg. This difference of 7.5 kg of lamb weaned per ewes exposed represents a 49% increase for production for the F-1 ewes at the Terbol Station. Also, noteworthy is the increase in lamb production between two and three years of age for both F-1 and Awassi ewes. Not only age of ewe but also genetic and environmental factors have contributed to a difference of almost 10 kg per ewe.

Estimation of Heterosis For Contemporary F-1 and F-2 Ewes

This is the first year (1974) that a comparison could be made between F-1 and F-2 ewes for reproductive performance. One reason for making this comparison was to obtain an estimation of heterosis for lambing rates and also for other characteristics of importance.

The F-1 and F-2 ewes were born during the lambing season of 1971/72 and then mated at a yearling age during the summer and fall of 1973. To help reduce the variations which could be caused by sire effects equal numbers of F-1 and F-2 ewes were mated to the same Awassi ram.

These F-1 and F-2 ewes are just now completing their first parturition at two years of age. Therefore, the data presented in table 6 are complete only through January 15, 1974.

Table 6: Lambing Rates for Two Year Old Ewes

<u>Ewe Line</u>	<u>Rate for 1974 ^{1/}</u>
Control	1.00
Twin	1.15
F-1	1.32
F-2	1.24

1/ Number of Lambs born per ewe lambing, through January 15, 1974.

The difference between 1.32 and 1.24 is not very great for the respective lambing rates for F-1 and F-2 ewes. However, the figures do suggest some heterosis for the F-1 ewes. Until all the 1974 data for reproductive performance have been obtained and analyzed no definite statement can be given regarding the degrees of heterosis for F-1 ewes. The lambing rates for both F-1 and F-2 ewes are much higher than for the Awassi Control line and again emphasize the fecund for F-1 ewes.

Selection For Increased Milk Production

In the Terbol Station an Animal Breeding Program has been in progress for a number of years for increasing milk production within the Awassi breed. Single trait selection is being used to increase milk production within this line of Awassi sheep. Selection is based upon pedigree records and individual production of the ewes. A minimum culling level has been established for two years old ewes which requires an average of one kilogram of milk per day during her initial lactation period. Ewes which do not attain this level are culled at the end of their first lactation period.

In table 7 the results are given for the average milk production in 1973 for daughters from 8 Awassi sires. The top average daily production was 1.48 kg. of milk for the 5 daughters of sire number 69-160. The sire for ram number 69-160 was 67-066 and his 10 daughters were the next six best for production, 1.22 kg. of milk per day.

Table 7. Milk Yields for 1973 from Two Year Old Awassi Ewes - Progeny Test Date

Sire No.	No. of daughters in production	Average milk yield for daughters	Lactation period
	<u>N</u>	<u>kg.</u>	<u>days</u>
69-160	5	253	171
67-066	10	229	188
69-118	10	168	170
69-010	4	174	180
65-168	3	159	177
67-053	3	133	170
66-053	2	94	139
65-199	3	99	139

Carcass Evaluation for Ram Lambs from the AUB Research Station

Earlier in this report it was stated that the F-1 ewes were mated to an Awassi ram at the AUB Station. Therefore, the lambs from this mating were a backcross generation (BCA). The lambs were weighed each fortnight and were weaned and weighed at 90 days of age.

Following weaning the ram lambs were fed in one group and were slaughtered upon reaching a live weight of approximately 50 kg. The lambs were not shorn before slaughtering and the weight of the pelt (skin plus wool) averaged 9.96% of the slaughter weight. Also, there was an average loss of 2.3% in carcass weight between the warm and chilled weights.

The data in Tables 8 and 9 relate to the major characteristics evaluated. The carcass results were classified into lambs born and raised as singles and twins and they indicate the following points: (1) singles were younger of age when slaughtered 161 vs. 183 days and also exhibited a higher daily gain in body weight from birth to slaughter 326 vs. 281 g., (2) singles were longer in carcass length 61 vs. 59 cm., (3) singles had a higher dressing percent 52 vs. 51% and also were considered to contain more finish as indicated by percent of kidney fat 1.9 vs. 1.7, and thickness of external fat 5.8 vs. 4.1 mm and also by specific gravity values of 1.058 vs. 1.060, and (4) singles had a large Rib-eye area 13.2 vs. 12.5 cm².

The weight of the fat-tail accounted for about 10% of the carcass weight. This figure compares with 15% for Awassi and 7.5% for F-1 ram lambs which were slaughtered at a live weight of 50 kg at the Terbol station.

Table 8. Mean Carcass Values for Backcross Ram Lambs, AUB 1/

N u m b e r	Born and raised	
	Single	Twin
	6	10
Slaughter age, days	160.8	183.1
Daily gain, kg	0.326	0.281
Slaughter weight, <u>2/</u> kg	52.4	51.4
Chilled carcass wt. <u>2/</u> kg	28.2	26.3
Dressing percent,	52.8	51.2
Carcass length, <u>2/</u> cm	60.8	59.1
Cannon bone length, cm	11.6	11.6

1/ F-1 ewes with Awassi rams, 1973 lambing

2/ Slaughter weight following 12 hours no feed - chilled weight following 48 hours in 34°F cooler; carcass length from anterior of first rib to pubic (aitch) bone.

Table 9. Mean Carcass Value for Backcross Ram Lambs, A.U.B. 1/

		Born & raised Single	Born & raised Twin
Number		6	10
Dressing percent		53.6	51.2
Kidney + Kidney fat	kg	0.532 (1.9%)	0.444 (1.7%)
Fat-tail,	kg	3.10 (11.0%)	2.44 (9.3%)
Fat thickness 2/	mm	5.8	4.1
Rib-eye area, 2/	cm ²	13.2	12.5
Specific gravity, 2/		1.0576	1.0607

1/ F-1 ewes mated with Awassi ram, 1973 lambing.

2/ Fat-thickness at 12th rib; rib-eye area 12th rib,
S.G. on 7 rib rack, meat and water temperature 34° F.

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