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Strategies of small ruminant production under intensive and subtropical climate conditions in the East Mediterranean region

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SUMMARY – Studies on small ruminants at the Research Farm Unit of Çukurova University have focused on the modernization of husbandry methods (improved nutrition and housing and machine milking) and genetic improvement of local Awassi sheep and Hair (Black) goat in intensive and subtropical climate conditions. Over a period of 20 years, new synthetic sheep and goat genotypes have been developed. Our organization has a capacity to handle 1000 head of goat and 500 head of sheep. The genetic improvement methods used, methods relevant to modernization of husbandry, the present situation from technology transfer point of view and the possible improvements to be achieved in the near future will be dealt with in this paper.

Key words: Strategies, small ruminant, production, East Mediterranean, subtropic.

RESUME – "Stratégies de la production de petits ruminants dans des conditions intensives et subtropicales dans la région est de la Méditerranée". Les travaux menés sur les petits ruminants au sein de l'unité de recherche de l'Université de Çukurova dans des conditions climatiques subtropicales, ont été axés sur la modernisation de méthodes d'élevage (nutrition, soins, utilisation de trayeuses). Ces études ont porté essentiellement sur le suivi génétique de la race locale de brebis "Awassi" et la race noire de chèvres "Hair". Durant une période de 20 ans, de nouveaux génotypes de brebis et de chèvres ont été développés dans notre unité d'élevage qui a une capacité de 1 000 têtes de chèvres et 500 têtes de brebis. Les méthodes génétiques utilisées sont décrites ainsi que les méthodes relevant de la modernisation de l'élevage et la situation présente du point de vue du transfert de technologie sans oublier les travaux futurs.

Mots-clés : Stratégies, petits ruminants, production, est Méditerranéen, subtropicale.

Introduction

Turkey is one of leading countries in Europe, in terms of the number of sheep and with about 52 million heads of small ruminants (SR). On the contrary, sheep production performance is rather low. SR could for various reasons play an important role for the country since they do not require costly inputs. Their meat, milk and converted dairy products are valuable goods in Turkey. Other SR products such as wool, skin are considered of secondary importance because of economic reasons. Particularly, goat meat and goat milk are the main sources of animal origin protein for inhabitants in mountainous regions. A large part of SR is raised under extensive conditions. Most of the breeds kept are native ones with low producing capacity.

This paper deals with the present situation of small ruminants production at Çukurova University. In addition to this, the results of our research (Güney and Özcan, 1983; Güney, 1984; Güney *et al.*, 1984; Güney and Biçer, 1986; Çayan and Güney, 1987a; Çayan and Güney, 1987b; Güney *et al.*, 1987; Güney *et al.*, 1989; Güney, 1990; Kor, 1991; Biçer *et al.*, 1992a; Biçer *et al.*, 1992b; Güney *et al.*, 1992; Okan *et al.*, 1992; Koçak, 1995; Çelik *et al.*, 1997; Koluman Darcan and Güney, 1997) which were presented to national and international meetings are summarized.

Environment

East Mediterranean region, namely Çukurova, is situated in southern part of Turkey. Çukurova is on 27° North latitude and 35° East longitude. In this region, summer is hot and humidity is rather high; winter is warm and rainy. The wind usually blow from south in summer and from north in winter.

Average temperature and humidity mainly range between 23-25°C and 70% in summer; 11-13°C and 65% in winter, respectively. January is the coldest month (9°C) where August is the hottest (28°C). Annual precipitation is 646 mm.

Animal material

In Çukurova, we can meet two goat types. Kilis goat in lowlands and Hair goat in mountainous area. Some European origin dairy goat breeds have been used to improve the milk yield of native Hair goat. The principal breed used in these mentioned studies was Saanen which is a well-known breed. In addition to this, a co-operative goat project was conducted by University of Çukurova, Faculty of Agriculture and the University of Hohenheim, West Germany. Using the German Fawn bucks as sire breed was programmed in this project. Also, Damascus goat was imported from Cyprus.

As regards the sheep production some crossbreeding experiments have been done for improving performance of native Awassi and Chios sheep where the exotic breeds such as Ile de France, Rambouillet and East-Friesian have been used.

Management

A large part of small ruminant is raised under extensive conditions in the Mediterranean region of Turkey. They are mainly kept on permanent grazing land and dry steppe areas with poor nutritive values in an extensive production system. Goat and sheep flocks are managed in transhumant and nomadic system with a flock size of 50-300 animals. Generally this area is hilly and mountainous.

The flocks at Research Farm of Çukurova University are housed in semi-open shed under semi intensive conditions. Only the southern part of the shed is open. Ewes and does graze 6-7 months in a year. Ewes are being milked by hand, does are by machine. All animals are group fed on concentrate (12% crude protein and 2300 kcal/kg ME), corn silage, alfalfa hay and oats.

Natural mating is practised in breeding season which is August onwards. Does are milked approximately 7 months. Ewes are not milked, lambs suckle all milk.

Our organization has a capacity to handle 1000 heads of goat and 500 heads of sheep.

The research activities

Genetic improvement studies

Improvement studies on goat

Three exotic breeds were imported for improving milk performances of native Hair and Kilis goat. Saanen was used for obtaining Taurus (62.5% Saanen + 25% Hair + 9.5% Kilis) and Çukurova (65.5% Saanen + 34.5% Kilis) dairy prototypes. German Fawn was used for improving the second dairy goat breed (75% German Fawn + 25% Hair). Damascus was used for improving the last dairy prototype (50% Damascus + 22% Saanen + 16% Kilis + 12% Hair). The first purpose of these crossing studies is to improve milk performance of native breeds. Besides, improving meat performance and litter size of the mentioned genotypes are the other two aims of our studies. The research activities on fattening performances, milk yield and litter size are given below.

Table 1 shows the highest milk yield has been obtained from Kilis breed among native goat breeds. As expected, the Hair goat has shown the lowest performance in term of milk production. Taurus and German Fawn x Hair crossbred types have highest lactation yield among new syntethic types. Taurus Type is especially adapted to lowlands, where, German Fawn x Hair crossbred Type is adapted to highlands and mountainous area.

Hair and Kilis goats are raised in extensive system. Therefore, the litter size performance of them should not be expected to be high. When Table 1 is examined, we observe that, crossbreeding of native breeds with some exotic breeds has developed litter size of crossbred genotypes.

Table 1. The lactation milk yield, lactation length and litter size of pure and crossbred goat types

Genotypes	Lactation yield (kg)	Lactation length (day)	Litter size (kid/does)	Ref.
Hair	80-130	170-200	0.6-1.0	Güney <i>et al.</i> (1989)
Kilis	205-248	260-300	1.1-1.2	Güney <i>et al.</i> (1989)
Taurus	495	271	1.4-1.6	Güney <i>et al.</i> (1992)
Çukurova	384	278	1.4-1.6	Güney <i>et al.</i> (1992)
German Fawn x Hair	350-450	230-240	1.3-1.6	Güney <i>et al.</i> (1989)
Crossbred of Damascus	300-400	230-240	1.4-1.5	Güney <i>et al.</i> (1989)

Fattening performances and carcass characteristics of native and new syntetic kids are given in Table 2. The kids of all studies were fed *ad-lib*. As seen in Table above, the daily weight gain of all types of kids vary between 90-198 g; concentrate consumption for 1 kg live weight gain of kids vary between 3.5-6.8 kg. Native Hair goat has higher fattening performances with respect to the new syntetic types. The fat content of Hair goat is higher than other types and each doe give single kid at birth. For this reason the kids of this group grow up faster and show better fattening performance.

Table 2. Fattening performances and carcass characteristics of pure Hair and new syntetic types[†]

Genotypes	A	B	C	D	E	F	G	H	I	J	K	Ref.
S x Hair (B1) ^{††}	Male	30.3	14.2	82	173	4.0	12.4	41.8	26.1	57.5	14.1	Güney <i>et al.</i> (1984)
	Cast. ^{††††}	27.9	10.7	82	130	5.5	14.3	46.1	22.3	53.7	21.3	Güney <i>et al.</i> (1984)
S x Kilis (B1)	Male	22.4	7.1	–	127	4.3	10.9	42.5	27.1	54.7	54.4	Güney (1984)
GF x Hair (F1) ^{†††}	Male	30.0	11.6	56	198	3.5	14.6	48.1	22.7	51.4	14.0	Çayan and Güney (1987b)
	Male	30.0	15.0	127	119	6.4	15.4	51.0	20.2	56.4	22.3	Koçak (1995)
GF x Hair (B1)	Cast	29.2	15.4	148	90	6.8	14.6	46.0	23.4	59.6	15.6	Koçak (1995)
	Male	19.5	18.9	63	130	4.5	15.9	54	–	–	–	Çelik <i>et al.</i> (1997)
Hair	Male	29.2	10.5	119	183	3.7	12.5	44.9	28.5	49.5	14.9	Çayan and Güney (1987a)
Damascus	Male	25.1	11.7	–	119	6.0	11.7	46.2	22.1	54.5	9.1	Biçer <i>et al.</i> (1992b)
Dam x Hair (F1) ^{††††}	Male	25.9	9.6	63	153	4.2	12.8	46.2	23.5	53.1	14.2	Kor (1991)

[†]A: Sex; B: Slaughter weight (kg); C: Live weight gain (kg); D: Fattening period (day); E: Daily weight gain (g); F: Feed conversion; G: Cold carcass weight (kg); H: Dressing (%); I: Bone weight (kg); J: Muscle weight (kg); K: Fat weight (kg).

^{††}S: Saanen; ^{†††}GF: German Fawn; ^{††††}Dam: Damascus; ^{†††††}Cast: Castrated.

Improvement studies on sheep

Three breeds were imported for improving performances of sheep breeds. East-Frisien and Chios breeds were used for improving milk performance of native Awassi sheep. At the end of this study we have obtained Çukurova Assaf Type (75% Awassi + 25% East-Friesian) and Çukurova Dairy Sheep (50% Awassi + 50% Chios).

Ile de France and Rambouillet were imported for improving meat performance of local Awassi breed. We have obtained two meat type breeds (12.5% Awassi + 12.5% Chios + 75% Ile de France and 12.5% Awassi + 12.5% Chios + 75% Rambouillet).

In Table 3, we observe that, the highest milk yield has been obtained from Çukurova Assaf types breed among all crossbred sheep types. Also, litter size of the exotic breeds are higher than native breeds. The syntetic meat type breeds are not milked, and as a result, there is no data according to their milk performances.

Table 3. The lactation milk yield, lactation length and litter size of pure and crossbred sheep types

Genotypes	Lactation yield (kg)	Lactation length (day)	Litter size (lamb/ewe)	Ref.
Awassi	80	150	0.8	Sönmez and Kaymakçi (1992)
Awassi	134	163	1.0	Koluman and Güney (1997)
Chios	150	150-170	0.9	Sönmez and Kaymakçi (1992)
Çukurova milk type	150	100-120	1.4-1.5	Unpublished
Çukurova assaf type	174	148	1.2	Koluman and Güney (1997)
Crossbred of Ile de France	116	148	1.2-1.3	Unpublished
Crossbred of Rambouillet	125	151	1.3-1.6	Unpublished

According to Table 4, C x Aw (F1), Ram x Aw (F1) and IF x Aw (F1) types have shown the highest performance on daily weight gain and feed conversion which are very important two characteristics as an indication of fattening performances. Another interesting result of these studies is the fattening performances of native Awassi Type. Awassi is the well known dairy breed of East Mediterranean area. According to results obtained, Awassi breed can be successfully used for slaughter lamb production. However, Awassi carcasses have the highest subcutaneous fat content. Due to this fact, the docked Awassi lambs should have been used in future fattening studies.

Table 4. Fattening performances and carcass characteristics of pure Awassi and new syntethic types[†]

Genotypes	A	B	C	D	E	F	G	H	I	J	K	L	Ref.
Awassi (Aw)	5.0	17.9	12	40.3	266	3.8	19.7	48.6	17.2	47.2	9.7	21.0	Biçer <i>et al.</i> (92a)
	4.4	18.2	12	43.0	301	3.8	18.7	45.2	20.3	54.6	7.4	15.5	Güney and Biçer (86)
	–	24.1	9	40.6	262	5.0	19.8	49.5	14.7	42.7	6.7	14.9	Güney <i>et al.</i> (87)
	4.5	18.9	8	40.0	281	3.7	19.1	46.6	19.5	54.3	6.6	16.6	Güney (90)
	4.8	19.1	8	40.9	382	3.4	18.1	46.6	20.0	53.3	6.7	16.7	Güney and Özcan (83)
	4.7	19.6	10	41.0	298	3.9	19.0	47.3	18.3	50.4	7.4	16.9	Average
Aw	5.1	23.6	9	40.0	255	4.7	–	–	–	–	–	–	Okan <i>et al.</i> (92)
Ç. Assaf	–	24.2	8	40.1	283	4.0	18.1	46.8	18.2	57.5	7.4	10.2	Güney <i>et al.</i> (87)
If x Aw (f1) ^{††}	5.2	16.9	12	44.6	338	3.3	19.9	47.6	18.6	53.7	10.2	15.7	Güney and Biçer (86)
If x C x Aw ^{†††}	4.9	21.0	8	40.0	311	3.8	20.7	50.3	18.8	54.9	10.5	12.4	Güney (90)
R x C x Aw	4.4	19.9	8	40.0	253	4.2	19.2	46.7	19.5	53.4	9.5	14.2	Güney (90)
R x Aw (F1)	5.4	19.4	8	40.8	416	3.3	20.0	49.7	19.3	51.6	8.3	18.0	Güney and Özcan (83)
Ram ^{††††}	4.3	17.3	8	40.0	226	5.4	18.6	48.2	19.5	54.1	10.6	11.7	Güney (90)
C x Aw (F1)	4.7	17.7	8	39.3	421	3.1	19.6	49.2	20.9	50.1	6.9	20.3	Güney and Özcan (83)
C x Aw (B1)	4.1	16.5	8	41.1	300	3.7	19.8	47.1	20.1	53.2	8.5	15.8	Güney and Biçer (86)

[†]A: Birth weight (kg); B: Weaning weight (kg); C: Fattening period (week); D: Slaughter weight (kg); E: Daily weight gain (g); F: Feed conversion (%); G: Cold carcass weight (kg); H: Dressing (%); I: Bone weight (kg); J: Muscle weight (kg); K: Intramuscular fat (kg); L: Subcutaneous fat (kg).

^{††}If: Ile de France; ^{†††}C: Chios; ^{††††}Ram: Rambouillet.

Economic analyses

Table 5 summarizes the result of economic analyses of the improvement studies in goat. According to result obtained, if the ratio of Hair group is considered as zero, Taurus and GF x Hair crossbred groups were more profitable than others. Besides, other two genotypes have shown better performances Hair does.

Differences between outcomes and incomes of crossbred genotypes according to native Awassi ewes were given in Table 6. Çukurova Milk and Assaf groups have the higher profit than others. All crossbred genotypes have higher incomes than Awassi.

Table 5. Differences between outcomes and incomes of crossbred does according to Hair does

Traits	Hair	Taurus	Çukurova	DM	GF x Hair
Milked extra milk (kg/doe/lact.)	0	+390	+279	+245	+295
Extra live weight gain (kg/kid)	0	+3.7	-3.4	-0.9	+8.4
Milk incomes (US \$/doe) [†]	0	+234	+167.4	+147	+177
Live weight income (US \$/kid) ^{††}	0	+6.3	-5.8	-1.5	+14.3
Profit for per doe (US \$/doe)	0	+240.3	+161.6	+145.5	+191.3

[†]The price of 1 kg live weight 1.7 US \$.

^{††}The price of 1 kg milk 0.6 US \$.

Table 6. Differences between outcomes and incomes of crossbred ewes according to Awassi does

Traits	Awassi	Ç. Milk	Ç. Assaf	Cross. of Ile de France	Cross. of Rambouillet
Milked extra milk (kg/ewe/lact.)	0	+16	+40	-18	-9
Extra live weight gain (kg/lamb)	0	+9	-0.4	+11	+6
Milk incomes (US \$/ewe) [†]	0	+12.8	+32.0	-14.4	-7.2
Live weight income (US\$/lamb) ^{††}	0	+24.3	-1.0	+29.7	+16.2
Profit for per ewe (US \$/ewe)	0	+37.1	+31.0	+15.3	+9

[†]The price of 1 kg live weight 2.7 US \$.

^{††}The price of 1 kg milk 0.8 US \$.

Genetic selection programme

Progeny test study at goat unit

In the last decades, the increasing demand for breeding animal with high milk production has been popular within farmers in highlands and plain areas of Çukurova region in Turkey. The only source of breeding animals for these farmers is the dairy flock raised at Çukurova University, Research Farm of Agriculture Faculty. To provide high production breeding animals to goat keepers, it becomes a necessity to start a genetic selection programme for increased milk yield and multiply the breeding stock. So far, a genetic improvement programme has conducted at the Research Farm of the University since 1994. The German Fawn x Hair crossbred goats are the animal material of the project.

Present and future work

(i) Developing, Awassi dependent, Assaf Type sheep to a syntethic Type by improving their meat properties. Main purpose in sheep breeding is developing a new syntethic Type by using Ile de France x Awassi crossbred.

(ii) First aim in dairy goat breeding is introducing crossbred dairy goat as dominant in the region, by increasing the German Fawn x Kil (native goat Type) crossbred line and by combining artificial insemination into progeny-test studies conducted in Faculty Farm on German Fawn x Kil crossbred. Target here is obtaining a line with 500 litres milk yield and 100% twining rate. Besides, studies on developing management and physiological studies will be a current issue.

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