Egyptian J. Anim. Prod. 35, Suppl. Issue, Dec. (1998):359-370.

SMALL RUMINANT PRODUCTION SYSTEMS IN EGYPT

A. A. Younis

Desert Research Center , Mataria, Cairo, Egypt.

Climatic factors, especially annual rainfall and ambient temperature do not only affect the distribution of sheep and goats all over the world but also affects the system (s) of production prevailing in a specific area.

As early as 1965, Epstein discussed in details the effect of different environmental factors on the distribution of sheep in the world with especial reference to climatic factors (Epstein 1965) .

The study of production systems in different regions gives better understanding about the relationship between environment and livestock on one side and in the same time provides means for increasing production.

DEFINITIONS .

Farming System (FS) .

Farming system was defined by Ruthenberg (1980) as " groups of farms which have a similar structure and function and can be expected to produce on similar production functions"

Livestock production system (LPS) .

Livestock production system usually refers to " a subset of the farming systems, including cases in which livestock contribute more than 10 percent to total farm output in value terms" (Sere and Steinfeld, 1996).

LIVESTOCK PRODUCTION SYSTEMS .

According to Sere and Steinfeld (1996) different systems were classified as follows:

Solely Livestock System (L) .

Livestock systems in which more then 90 percent of dry matter fed to animals comes from rangelands, pastures, annual forages and purchased feeds and less than 10 percent of the total value of production comes from non-livestock farming activities.

Landless Livestock Production System (LL) .

A subset of the solely livestock systems in which less than 10 percent of the dry matter fed to animals is farm product and in which annual average stocking rates are above ten livestock units (LU) per hectare of agricultural land. The following additional differentiation is made :

Landless monogastric systems (LLM) .

A subset of LL in which the value of production of the pig / poultry enterprise is higher than that of the ruminant enterprises.

Landless ruminant systems (LLR) .

A subset of LL in which the value of production of the ruminant enterprises is higher than that of the pig / poultry enterprise.

Grassland Based Systems (LG) .

A subset of solely livestock systems in which more than 10 percent of the dry matter fed to animals is farm produced and in which annual average stocking rates are less than ten LU per hectare of agricultural land. This system includes different ecosystems (e.g. temperate and tropical highland, humid / sub- humid tropics and sub-tropics and arid / semi- arid tropics and sub-tropics .

Mixed Farming Systems (M) .

Livestock systems in which more than 10 percent of the dry matter fed to animals comes from crop by - products, stubble or more than 10 percent of the total value of production comes from non-livestock farming activities.

Rainfed Mixed Farming Systems (MIR) .

A subset of the mixed system in which more then 90 percent of the value of non - livestock farm production comes from rainfed land use, including temperate and tropical highland, humid / sub-humid tropics and sub - tropics and arid / semi-arid tropics and sub- tropics.

Irrigated Mixed Farming Systems (MI) .

A subset of the mixed systems in which more than 10 percent of the value of non-livestock farm production comes from irrigated land use, including temperate and tropical highland, humid / sub-humid tropics and sub-tropics and arid / semi-arid tropics and sub-tropics .

Characterization of Small Ruminant Production Systems in Egypt

In Egypt there are almost 3.1 and 4.2 million head of goat s and sheep, respectively.

Sheep belong to the fat-tailed coarse-wooled type and consumers show a special preference to their meat while wool clip represents a secondary income. Productivity in terms of fertility and growth rate ranges from low to medium according to environmental conditions.

With the exception of Zaraibi, milk production in other breeds of goats (Barki and Baladi) is considered to be low.

Spedding (1990) discussing the role of small ruminants in agricultural systems in developing countries pinpointed to the fact that they are easy to raise and house, prolific, use marginal land or live on crop residues, require little labour, provide manure, find a ready market, produce skins, wool, fiber, milk and meat. On the other hand they have some disadvantages e. g. damaging to the environment if uncontrolled, susceptible to diseases, not capable of providing power for cultivations, susceptible to predators, easily stolen, ...etc.

Due to the wide ecological range under which small ruminants can survive one would find considerable variations in the systems of production and methods of keeping small ruminants. Intensive housed and fed system occur at one extreme and extensive herded flocks are also found. The precise role of small ruminants varies between these systems but, in general, they are used in developing countries to utilise resources that might otherwise be wasted (Spedding, 1990).

Shehata, (1996a) classified production systems of sheep in Egypt in four categories i.e. village system, new reclaimed areas system, commercial flocks system and coastal zones system. In fact, and apart from the coastal zone system there is much overlap among the other systems. It may be of more biological meaning to classify systems according to intensity rather than locality, as in the following classification :

1- Extensive system (Desert System) .

Sheep and goats are scattered in the Egyptian desert in mixed flocks. The goat to sheep ratio in such system increases with aridity. Also numbers and intensity depends on the amount of rainfall and consequently on the available natural vegetation. This system of production is an extensive system and represents the grassland based systems defined perviously by Sere and Steinfeld (1996). The most distinguishable example is observed in the north western coastal area where Barki sheep and goats are maintained. With rainfall ranging from 150-180 ml the grazing season is limited (December to March) and supplementary feeding is necessary during the long summer (El – Serafy et al.1992). Sheep and goats are maintained in mixed flocks with a ratio of about 3:1. This is probably the only area in which large flocks may be observed (up to 1000 head and more). Bedouins usually move with their flocks searching for feed. Two types of movements are observed in the region i.e.

within and outside the region. In years where rainfall is about average the within movements are observed where sheep and goats move from dry areas to wet areas where natural vegetation is available and /or to the north part of the region to market some of their animals. In dry years, however, flocks of sheep and goats move to adjacent provinces (e.g. Alexandria, Behaira and Fayoum) where irrigated fodder and crop residues are available. These flocks return back to the desert after the long dry summer.

Productivity of sheep and goats in this system is low and twinning in sheep is not a desirable trait. It looks that there is a certain equilibrium between the animal and its environment and such low productivity is considered a main component of this equilibrium. However, part of this production (animals) is exported and the rest is consumed locally. Financial analysis for this system seems to be lacking and knowledge about its actual contribution to the prevailing rainfed farming system is necessary.

In good seasons where natural vegetation is available bedouins tend to keep their animals. Accordingly number of animals exceeds the available feeding resources which may cause overgrazing leading to a great damage to the plant population, which is considered one of the main problems of this region. In this system natural vegetation plus small amounts of concentrates may be enough during the long dry summer to maintain the breeding stock but not enough to promote high growth rate for weaned lambs and kids and transferring such young animals to fattening centers where irrigated fodder and / or concentrates are available will help to reduce pressure on land and to improve biological efficiency of such system. Also human interference through expansion of cropping may cause a reduction in the sustainability of the system and whenever cropping is practiced it should be interwoven with the livestock element e.g. cultivating barley in the north western coastal area.

2- Semi- Intensive system:

Most animals in this system are raised in the Delta and the Nile Valley. With latitude ranging from about 22° south to 31° north different breeds of sheep and goats are scattered in different regions. While Rahmani sheep spreads in the north, Ossimi is maintained in the middle and Ebeidi and Seidi in the south. Baladi goats are scattered in different areas while Nubian is dominant in the south.

Even with this classification there is a certain degree of overlap among different breeds in different regions.

In this system sheep and goats are kept in small numbers and raised on crop residues and agricultural by- products and represents to some extent the irrigated mixed farming systems. Eighty four percent of farmers flocks in Egyptian villages contain less than 10 adult females (Metawi and Sheheta, 1996). Large flocks, however, may be composed from animals belonging to a number of farmers and allocated to one or more of the shepherds or bedouins

living in adjacent areas for breeding at certain terms. Such flocks are usually observed grazing the hedges of canals and fields among different villages and some times in the fringes of cities.

In this system inputs are limited, mainly represented in supplementary feeding, and productivity of animals is of medium nature. Metawi and Shehata (1996) found that under such system annual kilograms of lambs produced per ewe was 25.6. Corresponding value for goats was only 18.8 Kg.

3- Intensive system:

This system has emerged quite recently on small scale in different parts of valley and newly reclaimed areas and is characterized by high inputs. These high inputs are represented in high value of feeding, exotic breeds and equipments. The following examples illustrate this type of production:

a. Fattening male lambs and kids on high concentrate diets in different centers scattered in different regions.

Animals are fattened mainly on grains plus a source of protein. The system is characterized by high daily gain and better efficiency of feed conversion which is reflected in high economic returns where economic estimation reveals a yearly interest around 37 % (Shehata, 1997). This system is most suitable for desert lambs where they can be transferred from desert to adjacent provinces where irrigated fodder and cereals are available. This will reduce the burden of these animals on the scarce vegetation available in the desert.

b. Units of pure exotic breeds .

Small and medium units of pure exotic breeds are maintained in different areas. A good example of that is the breeding of pure breeds of goats for milk production. To maximize profitability milk produced is processed on the farm and different types of milk products is available now in the market in big cities at high prices.

c. Large flocks:

Large flocks, especially of sheep, are maintained in different parts of the country especially in newly reclaimed areas. Most of these flocks are owned by private sector (Agricultural Companies) and constitute a main component in the agriculture pattern dominant in the area. These flocks are run on intensive basis and fat lamb production represents the main source of income. Animals are mainly fed on irrigated fodder plus concentrate. There are a small number of flocks, however, maintained in different experimental farms which belongs to scientific institutions and universities which may be classified under this system.

Increasing Productivity Through Modification of Prevailing Systems.

Many trials have been carried out to find out methods for increasing productivity through modification of prevailing systems. These efforts included managerial and breeding approaches and suggested proposals may be summarized in the following:

1. Improving environmental conditions:

Environmental conditions affect both health and productivity of animals. Supplementary feeding is necessary at certain times especially for animals raised in the desert where feed shortage occurs during the long dry summer months. Under such condition animals must be supplemented by feeds, the level of which, is just enough to get them over the dry season without any health problems. Excessive use of grains and / or concentrates may encourage Bedouins to keep stock above the capacity of the available resources which may lead to damaging to the ecosystem. Maintaining animals from within the system would help its sustainability. In other words rehabilitation of range lands with proper shrubs, perennial grasses, forbs and trees can considerably add to feed resources of animals (El - Shaer, 1995) and considered far better than the excessive use of grains. Processing of unpalatable or less palatable shrubs and semi - shrubs to produce improved feeds and up grade their palatability and feeding value (El - Shaer, 1995) is another avenue to increase overall biomass. Work is going on at the moment at the Desert Research Center to assess the beneficial effects of the use of these shrubs along with barley grains in fettening diets for lambs and kids (Younis and others - unpublished). Preliminary results indicated that feeding Barki lambs on Acacia (ad libtum) plus barley grains resulted in reasonable daily gain and good carcass quality.

Sheltering of animals provides protection against climatic hazards and improves their general performance. Shading desert sheep during hot summer months led to an improvement in ewes fertility (Mokhtar et. al. 1984) and lamb performance (Azamel, et. al. , 1987) . Natural shading by the use of shade trees proved to be the best type of shade compared to other artificial materials (Azamel et al., 1994).

Also protection of newly born lambs and kids from cold stress would help to cut down on high mortality rate and more work is needed in this area to provide practical means to reduce reproductive and productive wastage.

2- Selection for reproductive and productive traits:

With the exception of experimental flocks no recording system is practised which is the key for any selection programme. Accordingly bedouins and farmers select their own sires on phenotypic basis which does not lead to any genetic improvement. Since meat is considered the primary product the selection for traits like fecundity, growth rate and efficiency of feed conversion is of utmost importance.

Generally selection for reproductive and productive traits in livestock in Egypt has not received much attention. Aboul- Ela and Aboul- Naga (1987) reported on one of the trials for selection for litter size in Rahmani ewes either on their own performance or on their dam performance. Their preliminary results showed some improvement in the litter size of the second generation of the second selected group. Some evidence was also found of correlation between regular cycling activity of Rahmani ewes and their general reproductive performance (Aboul- Naga and Aboul- Ela 1986). Ewes differ in their ability to reproduce under continuous system of breeding (Younis, et al., 1996) (Figure 1) and selection for this trait deserves separate investigations.

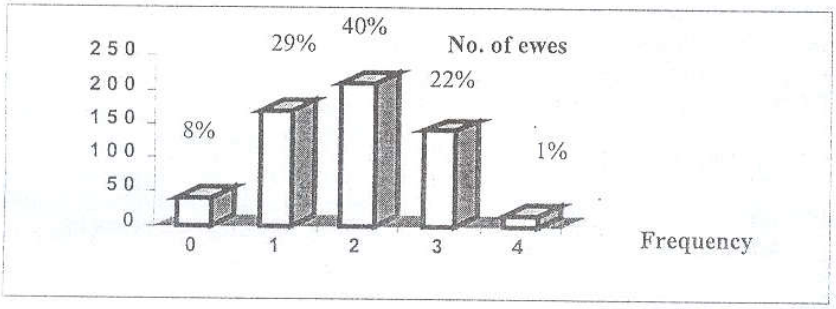

Figure 1. Frequency of lambing per two years

Large flocks (experimental and/or commercial) where recording is practised may serve as a stud sires (improved sires) producers. The following traits may be selected for:

a. High litter size (not for desert animals).
b. High daily gain in sheep and goats.
c. Better efficiency of feed conversion in sheep and goats.
d. Low kemp score in the fleece.
e. High milk yield in goats.

Selection may be practised at different levels depending on the facilities and resources (mass selection, progeny testing and selection indices).

Selection is adopted in Barki sheep flock at Maryout experimental station which belongs to the Desert Research Center. Criteria used are daily gain and kemp score. Genetic progress over the last few years is being evaluated at present.

3- Increasing Lambing Frequency:

Younis, (1977) discussed in details different possibilities for increasing sheep productivity in Arab countries with special reference to Egyptian conditions. Rebreeding is considered one of the main avenues suggested for increasing productivity and improving production efficiency in local sheep. This is based on the fact that in Egypt ewes exhibit oestrous all year round with significant monthly variation (Younis, 1977 and Aboul-Naga and Aboul Ela, 1986). Three lambings in 2 years is feasible under local condition and could increase efficiency of meat production. However, frequent breeding is also expected to increase feed costs which represent a substantial item of expenditure in sheep production under local condition. Mokhtar, et al., (1991) focused on this point and their results are shown in table 1. They reported that accelerating lamb production by using a system of 3 lambings / 2 years caused an increment in DMI by 29.5% while, resulting in 43.4% increment in kg marketed lambs per ewe joined. In view of the fact that the value of unit weight of feed is below that of live body weight of lambs. So, accelerating lambing is considered an effective method of improving efficiency of meat production in local sheep.

Table 1. Comparison between 3 lambings Vs. two lambings per 2 years in Barki Sheep

Traits	A	B	% increment
No. of ewes	54	57	-
Lambs born/ ewe joined	2.8	1.8	55.5
Lambs weaned/ ewe joined	2.6	1.7	52.9
Lambs marketed/ ewe joined	2.5	1.6	56.3
kg weaned lambs/ ewe joined	38.8	32.0	21.3
kg marketed lambs/ ewe joined	92.2	64.3	43.4
kg DMI (ewe + lambs)	1246.8	963.0	29.5

A, 3 lambings in 2 yrs; B, 2 lambings in 2 yrs. (after Mokhtar et al. 1991).

4- Stratification

Galal, (1990) proposed different models for stratification systems for meat and milk production.

Stratification systems involve the utilization of more than one breed (ranging from low to high productive) and more than one environment (ranging from unfavourable to favouable) in one production system. The basic idea is that low productive ewes well adapted to unfavourable conditions like Barki ones in the north western coastal desert area are mated to rams of high producing breeds. The crossbred lambs produced are transferred to better environments where abundant feed is available in adjacent areas most likely irrigated fodder, on the desert fringes (e.g. Nubaria District) where they could

be fattened. The system should be planned in such a way to ensure the production of replacements for the basic stock. The system may include 2 steps through crossing ewes of the basic stock with rams from a prolific breed most preferably subtropical breeds (Chios and D'man) rather than temperate breeds (Finish Landrace and Romanov). F1 ewes would be transferred to favourable conditions where they may be crossed by terminal sires of meat breed (e.g. Suffolk) and the resulting crossbred lambs are then fattened and slaughtered at younger age.

Finnish Landrace sheep was used in a crossing programme at the Ministry of Agriculture during the period from 1982 to 1996. Shehata (1996b) indicated that this project succeeded in producing a new crossbreed of better litter size, prolonged reproduction activity plus better carcass quality and slightly better growth performance.

Crossing local dams with prolific sire breeds suggested in the case of sheep is considered not to be necessary in the case of goats since fecundity is relatively high in the latter compared to the former. Galal et al., (1993) formed different systems of production, two actual (case 1&2) and six simulated through change of frequency of lambing (one lambing in 8 months and one lambing in 12 months) and number of breeds involved (one breed, two breeds crossing and three breeds crossing). Main results of their work are shown in Table 2. Applying improved management techniques, culling nonproductive stocks, improving ewe / ram ratio during mating and better feeding, had a favorable impact on biological and financial performance of the flock (case 1 vs. 2). In the six production systems where theoretical requirements, especially feed, are accounted for, the biological performance improved as the level of inputs increased through more frequent lambing or crossbreeding. All systems performed biologically better than the flock under improved management. However, while the financial performance of the system improved as lambing became more frequent and as more breeds were used in the system. IRR and gross income did not excel those of the flock under improved management except when ewes were mated once over 8 months and crossing was employed. Introducing genes for better growth and / or large litter size into the system was essential to make intensification of lamb production from Barki sheep financially viable.

Table 2. Annual biological and financial performance of two actual and six simulated production systems

Trait	Case / system[2]							
	case1	case2	1-12	2-12	3-12	1-8	2-8	3-8
Lambs marketed/ ewe joined (kg)	7.5	14.0	17.6	19.5	25.0	23.0	25.8	34.5
Live-weight marketed/ewe joined (kg)	11.8	18.0	24.6	26.4	32.0	31.7	34.6	43.3
Lambs marketed/ kg of ewe joined (kg)	0.2	0.4	0.4	0.5	0.6	0.5	0.6	0.8
Live-weight marketed/kg of ewe joined	0.4	0.5	0.6	0.6	0.8	0.8	0.8	1.0
Gross income per ewe (LE)	15.79	21.77	1	19.75	33.25	27.98	34.85	57.64
IRR[1]	12.4	15.1	8.7	11.1	14.2	14.9	17.8	21.9

1 Internal rate of return.
case 1, pure Barki, commercial .
case 2, pure Barki, improved.
case 1 –12 , pure Barki , one lambing / one year
case 2 –12 , (Suffolk x Barki) , one lambing / one year
case 3 – 12 , Suffolk (Finn X Barki), one lambing / one year.
case 1 –8 , pure Barki , three lambings / two years
case 2 –8 , (Suffolk x Barki) , three lambings / two years
case 3 –8 , Suffolk (Finn X Barki), three lambings / two year.
(after Galal et al. ,1993).

REFERENCES

Aboul-Ela M. B. and A.M. Aboul-Naga, 1987. "Improving fecundity in subtropical fat- taild sheep' In New Techniques in sheep production Editors Marai I. F. and Owen J. B. Butterworth, London. 163-171.

Aboul-Naga A. M. and M.B. Aboul-Ela, 1986. Performance of subtropical Egyptian sheep breeds. European breeds and their crosses I. Egyptian sheep breeds. World Review of Animal production.

Azamel, A. A., A.A.Younis and M.M. Mokhtar, 1987. Effect of Shading, shearing and breed type on heat tolerance and performance of lambs under semi - arid conditions. Indian J. of Animal Sciences, Vol. 57, No. 10: 1132 -1137.

Azamel, A.A., N.A. El-Sayed and M.A. El-Sherif, 1994. Heat tolerance and fertility of crossbred ewes as affected by natural sheltering and thirst under semi-arid conditions. In Proceedings of 8th conference of the Egyptian Society of Animal Production, Cairo, Egypt. 14 - 16 Nov., 1994. pp. 347 - 360.

El- Serafy, A. M., A. M. Aboul-Naga and E. S. E.Galal, 1992. Cereal grain input in the small ruminant production system in the coastal Zone of western desert of Egypt. Proceeding of the joint ANPA –EAAP – ICAMAS symposium, Rebat, Morocco, 7 –10 Oct. (EAAP Publication No. 49) Pudoc Scientific Publishers Wageningen pp 61 – 66.

El-Shaer, 1995." Utilization of the rangelands as feed resources in the goats of Egypt" In Systems of sheep and goat production " Proceedings of a meeting held within the Technical Consultation of FAO - CIHEAM Network on cooperative sheep and goat research, Greece 19 -22 June 1994 Edited by P. Morand - Fehr, R. Rubino, A. Bourbouze and A. El- Aich FAO, Rome, 1995.

Epstein, H., 1965. Regionalization and stratification in livestock breeding, with special reference to the Mongolian People's Republic (Outer Mongolia). Anim. Breed. Abst., 33: 169-181.

Galal, E.S.E., 1990. Stratification of small ruminants production systems. In small ruminants research and development in near east Proceeding of a workshop held in Cairo, Egypt. 2-4 Nov. 1988, IDRC, Editor A. M. Aboul–Naga.

Galal, E.S.E., A.M. Ahmed, A.I. Abdel-Aziz and A.A.Younis, 1993. Effect of increasing lambing frequency and crossbreeding on performance of sheep production systems in semi- arid environments. Small Ruminant Research, 10, 143-152.

Metawi, H.R.M. and E.I. Shehata, 1996. A study on small ruminant production system in Egyptian villages. Egyptian J. Anim. Prod. 34 (11): 71-80.

Mokhtar, M. M; Younis A. A. and El-Fouly (1984). Fertility of ewes under semi-arid condition as affected by Shearing and shading. World Rev. of Anim. Prod. Vol. XIX, No. 4 : 69-76.

Mokhtar, M.M., H.T. Abdel Bary, A.A. Younis, M.S. Mabrouk and H. Abdel Aziz, 1991. Comparative study of two systems of production in Barki sheep. Egyptian J. Anim. Prod. 28 (1): 21-30.

Ruthenberg, H., 1980. Farming system in the Tropic, Clarendon Perss, Oxford, 424 p.

Sere, C. and H. Steinfeld, 1996. World livestock production systems, Current status, issues and trends, FAO Animal Production and Health paper 127.

Shehata, E.I., 1996a. Production systems of sheep in Egypt. Symposium on use of exotic breeds in improving sheep production, Finnsheep as a case study. Egypt, April 22- 23, 1996 Edited by E. I. Shehata pp 3-8.

Shehata, E.I., 1996b. Egyptian-Finnish sheep breeding project an approach to improve sheep production in Egypt. Symposium on use of exotic breeds in improving sheep production, Finnsheep as a case study. Egypt, April 22-23, 1996 Edited by E. I. Shehata pp. 9-13.

Shehata, E.I., 1997. Report on a new approach for more economic lambs fattening system. Egyptian J. Anim. Prod. 34 (2): 115-123.

Spedding, C.R.W., 1990. The role of small ruminants in agricultural systems in developing countries. In small ruminants research and development of a workshop held in Cairo, Egypt, 2 -4 Nov. 1988, IDRC, Editor A. M. Aboul - Naga.

Younis A. A., 1977. Increasing ewe fertility in Arab countries. World Review of animal production, XIII, No. 4: 31 –36.

Younis, A. A., Nayera Z. Bedier and Mokhtar, M. M., (1996). Reproductive and productive performance of Harri sheep bred continuously under arid conditions. Egyptian J. Anim. Prod. 33 (11): 49-59.