

## Genetic improvement objectives of sheep and goats in Tunisia. Lessons learned

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**SUMMARY** – Tunisia has invested for more than four decades in sheep and goat breeding programmes. Many lessons can be learned today from this experience. Besides having 65,000 ewes currently recorded for the four native sheep breeds (3 meat breeds and one dairy), their productivity remained low even in well managed flocks. This poor productivity could be attributed to limitations of operational and technical nature of the current breeding scheme established and executed by the "State". This paper shows that these limitations are mainly due to: (i) costs of recording and selection of animals which the government can no longer support by itself; (ii) a lack of linkages between the state agency conducting the breeding programme and research/teaching institutions where the know how in animal breeding could be found; and (iii) a lack of farmer involvement in the breeding scheme which led to constant changes in breeding objectives of sheep and goat breeds in the country. The absence of a real breeding structure among flocks (one tier, two tiers, etc.) represents in itself a major constraint for genetic progress dissemination. The need of having a real organization of different stakeholders (farmers, research, marketing, government) is now more than essential in order for the current sheep and goat breeding strategy to be successful and to make better use of the country's animal genetic resources.

**Key words:** Breeding, sheep, goats, selection, strategy.

**RESUME** – "Objectifs de l'amélioration génétique des ovins et caprins en Tunisie. Leçons apprises". La Tunisie a investi durant quatre décennies dans des programmes d'amélioration génétique des ovins et caprins. Quoique l'effectif du cheptel contrôlé soit de l'ordre de 65 000 brebis appartenant à quatre races autochtones (3 races à viande et 1 laitière), leur productivité reste relativement faible même dans les troupeaux où la conduite est maîtrisée. Ces faibles résultats pourraient être attribués au fait que le programme national d'amélioration génétique des ovins et caprins a été toujours établi et réalisé par "l'état". Cette étude montre que les limites de ce programme sont dues essentiellement aux : (i) coûts élevés des opérations de contrôle de performances et de sélection d'animaux que l'état n'est plus en mesure de les supporter ; (ii) à la séparation du savoir-faire en amélioration génétique, rencontré souvent dans les instituts de recherche et d'enseignement, du programme national d'amélioration génétique géré par une agence de développement ; et (iii) au manque de participation réelle des éleveurs dans la définition des objectifs de sélection de leurs races, à la prise de décisions et à la mise en ouvre des composantes du schéma de sélection. La dissémination de la supériorité génétique est souvent limitée par l'absence d'une structure adéquate des élevages (sélectionneurs, multiplicateurs et autres). Toutes ces faiblesses montrent le besoin urgent d'associer les éleveurs, les chercheurs, et les industriels à cet effort gouvernemental pour mieux répartir les responsabilités et les coûts et pour mieux définir les objectifs de sélection des races ovines et caprines en Tunisie.

**Mots-clés :** Ovin, caprin, sélection, génétique, élevage.

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### Introduction

There is no doubt that on the eve of the 21<sup>st</sup> century most of the world will be prepared, at least mentally, to enter a new era of challenges mostly dictated by the "globalization phenomenon". Winning these challenges will depend on future strategies to cope with this new phenomenon and also on lessons learned from our own experience during the previous century and the way of taking advantages of them. This holds true for agriculture in general and livestock in particular.

During the 20<sup>th</sup> century many success stories can be told about the tremendous improvement of animal outputs especially in some North European and North American countries. On the other hand, failures in livestock improvement programmes (national and international projects) did happen in most developing countries where animal productivity remained poor. Besides health, nutrition and management constraints encountered in these countries the poor producing ability of livestock in general is real. Consultations and studies in the field of livestock improvement in West Asia and North

Africa (WANA), for example, showed that the important reservoir of native breeds of sheep and goats met in this region is, mostly, a result of natural selection and adaptation and not a product of selection schemes. Even though considerable research and development efforts have been invested in WANA by both national and international institutions into a variety of production systems, little progress has been achieved at the productivity level. However, an increase of production was realized (FAO, 1987a,b; MED AGRI, 1994, 1999; Cahiers Options Méditerr., 1995).

The poor producing ability of WANA livestock, in comparison with livestock in developed countries, could be explained by the way the two types of livestock are genetically managed in relation to their specific environment. While cattle, sheep and goats breeding strategies are well established in developed countries, the situation is completely different in WANA or other developing countries. As a matter of fact, some countries still do not have any breeding strategies, others are at the level of experimental research flocks and a few countries are at a relative more advanced level in the fields of recording and farmers organizations.

The objectives of this paper are: (i) to present sheep and goats breeds in Tunisia; (ii) to describe the current sheep and goats breeding situation; and (iii) to identify some lessons learned during four decades in the field of breeding small ruminants with a special emphasis on breeding objectives.

## Sheep breeds

### Barbarin

Of the 3,943,000 breeding ewes in Tunisia (SIAMAT, 1999), approximately 60% are fat tailed Barbarin breed which is the oldest in the country. Physically, the Barbarin breed has an open face and is bare legged. Its points may be black, brown, or red. Face structure and length of ear closely resemble the Suffolk breed of England and America. Mature weight of rams varies from 60 to 70 kg. Females weigh from 30 to 60 kg and there can be as much as 5-8 kg fat stored in her tail. For the latter reason, rams are very often assisted at mating by the shepherd. Ewes exhibit two distinct periods of oestrus activity in spring and autumn, but are capable of breeding practically year round (Khaldi, 1984). The Barbarin breed is the origin of Tunis breed in USA (Djemali *et al.*, 1994). In 1966, Palian reported that the Barbarin breed is not a specialized breed but it seems to have a large reservoir of genes for selection in any given direction. At that time Palian advised to differentiate animals with black face from those with brown face and suggest wool and yearling weight to be selection objectives for the Barbarin. After that period and since the seventies selection has been entirely for meat production with wool traits being ignored. A typical Barbarin lamb weighs 3.42, 9, 15.4, and 17.75 kg at birth, 30, 70, and 90 d, respectively (Djemali *et al.*, 1994).

### Algerian thin tail

The Algerian thin tail, a white face breed found mostly in west central Tunisia, is actually gaining the Centre of the country. It is a relatively hardy breed and is adapted to harsh dry conditions. However, it is not as well adapted to heat as the Barbarin. At 36°C, the Barbarin will graze an hour longer according to grazing study results in Tunisia (Sachse, 1977). Mature weight of rams varies from 65 to 80 kg. Its origin is from the Ouled Djellal, Tadmit and Rembi breeds of the Algerian Plateau. In mid sixties, selection was for normal wool and large body capacity and in a second phase of selection growth rate of lambs before weaning was retained as a selection goal (Palian, 1966). Since the seventies, selection has been entirely for meat production.

### Black Thibar

This breed was developed by crossing native Algerian thin tail sheep with the French Merinos. This work was carried out by the Catholic Monks in Beja region in the northern part of Tunisia. Selection in the development stages was placed primarily upon colour. The breed now breeds true for black colour which makes the breed resistant to photosensitization. In northern Tunisia, a weed (hypericum) found

in abundance in association with cereal crops, has been a serious cause of Photosensitization. The latter is still a major problem of the other white face breeds. The Black Thibar breed, which has a high resistance to Photosensitization, appears to be a heavier boned, and more muscular than the Barbarin. Mature weight of rams varies from 70 to 80 kg. Performance data indicate 5, 8, 14, and 17.4 kg at 10, 30, 70 and 90 days respectively. Average daily gains show 150, 155, and 144 g/d between 10-30, 30-70, and 30-90 days respectively (Chalah, 1996). Besides looking for uniformity of the colour in the breed, selection in mid sixties was for wool and lamb growth rate and, later on, fertility and prolificacy were chosen as selection goals (Palian, 1966). After that period, selection has been entirely for meat production.

### Sicilian or Sicilo-Sarde

Palian (1966) reported that this breed was not fixed yet, but it has dairy characteristics. A variety of colours are met in the breed. The Sicilian was a result of the Sarde breed and a Sicilian breed imported from Sicily. It is actually the milk producing sheep breed in Tunisia. The breed is less adapted to harsh conditions and consequently is found mostly in the North with some in the upper central region of the country. There are approximately 25,000 breeding ewes mostly owned by cooperatives or state farms. Their number is decreasing due to the transfer of cooperatives into private production units.

In the sixties selection was for unification of the colour (red head and white fleece, without horns) with the introduction of East Friesian blood (Palian, 1966). Later on, selection has been strictly on milk production. Lambs do have slower growth rate than the Barabrin breed. Average daily gains were reported to be 130 and 100 g/d between 10-30 and 30-70 d respectively (Djemali and Ben M'Sallem, 1995). Some Sicilian owners practice crossing with other meat breeds to improve lamb growth. Suckling period is around 114 d and days in milk after weaning are 124 d showing an average milk production of 72 kg (Djemali and Ben M'Sallem, 1995). The milk is used mostly for cheese manufacturing.

### Other breeds

The Tunisian sheep industry has been slowly trying the exploitation of other breeds of sheep which possibly could transmit desirable traits to the existing sheep population. Flocks of exotic breeds that can be met in the country are Sardi and Dman breeds from Morocco, Lacaune from France and Comisana from Italy.

### Goat breeds

Goat population is approximately 1 million and 300 thousand heads of which 750,000 breeding females. The majority is located in southern regions of Tunisia. About 95% of this population is native with black coat, horns and long drooping ears. Average adult weights are 40 and 60 kg for females and males respectively. They are hardy animals with a good ability to walk long distances and a good tolerance for salt in water (3.5 g/l) (Sellen and Steinbach, 1984). Native goat breed is known as "ARBI" breed. Imported breeds like Maltaise, Alpine, Boer, Saanen, Murciana, Damasquine and others have been used in various crossbreeding trials.

## Current sheep and goats breeding situation

### Recording

Examining current breeding strategies of sheep and goats in Tunisia shows that essential elements needed for a breeding strategy like identification, recording, evaluation, and selection of animals are encountered for the four sheep breeds. Crossbreeding of native goats with exotic breeds especially the Alpine breed is now a common practice under oasis production systems. Figures in Table 1

indicate the trend of recorded animals from 1990 to 1995. Numbers show that in 1995 out of a total of 3,777,000 female units of sheep breeds in Tunisia there are 61,577 female units of meat breeds and 3681 female units of the dairy breed recorded, respectively. Approximately 70% of the recorded animals are Barbarin, 15% are Black Thibar, 9% are Algerian Thin Tail, and, 8% are Sicilian. These recorded animals are raised in 253 flocks. Most of the recorded flocks belong to state, cooperative and large private enterprises.

Table 1. Recorded sheep population

| Year                      | 1990  | 1991  | 1992  | 1993  | 1994  | 1995  |
|---------------------------|-------|-------|-------|-------|-------|-------|
| Total female units (1000) | 3242  | 3312  | 3336  | 3541  | 3529  | 3777  |
| Recorded                  |       |       |       |       |       |       |
| Meat                      | 46984 | 50693 | 56791 | 60550 | 65364 | 61577 |
| Milk                      | 2198  | 2254  | 2197  | 2049  | 2242  | 3681  |
| Selected                  |       |       |       |       |       |       |
| Males                     | 1020  | 1400  | 1176  | 1286  | 1238  | 882   |
| Females                   | –     | –     | –     | 7923  | 8520  | 9897  |

Identification, recording and selection of young rams are done nationally by the "Office de l'Elevage et des Pâturages" which is a working body of the Ministry of agriculture. Two stages of selection are followed for males of meat breeds. Stage one uses weight at 90 d as a breeding goal and stage 2 uses lamb weights at 150-180 d of age. The number of selected males for meat and dairy breeds are reported in Table 1. Selected young rams were first gathered in a few centres, but due to raising lodging and feeding costs, compared to their market values (\$250), each type of farms started having its own lodging centre. This means that possibilities of choice of good rams is reduced because every type of farms is selecting only from its own flocks. By doing so, livestock owners in the country will not benefit fully from the national program because it is fragmented. In 1994, for example, 80% of selected young rams were used as follows: state farms (33%), cooperatives (29%) and private enterprises (28%). Small size flocks which raise approximately 80% of the total sheep population bought 175 young rams (14% of the total lambs sold).

## Evaluation

Only lambs from the Barbarin breed were evaluated based on an index (BLP) using weights at 10 days, 30 d, 70 d, growth rates 10-30 d and 30-70 d as predictors. Growth rate 10-30 d and weight at 90 d were chosen as breeding goals. All remaining breeds are evaluated and compared based on a subclass basis. Four subclasses are used: males born simple, males born multiple, females born simple and females born multiple. Evaluation procedures were developed mainly through students research work. Little emphasis was put on the field testing and evaluation of these procedures. The lack of defining roles of different stakeholders in sheep and goats breeding programmes in the country constitutes a major constraint for tuning up all the breeding components together. This indicates the need of appropriate legislation in order to define roles and clarify responsibilities among stakeholders at the national level.

Defining breeding objectives is an important key element in breeding animals. If weaning weights were chosen for the meat breeds, the reality is totally different for the unique dairy breed in the country. The Sicilian dairy breed has been managed for cheese production during many years in Tunisia. However, the lack of having breed owners as full partners in the breeding strategy is harming the breed itself. In fact, farmers are benefiting little from genetic progress that could be generated from selection of animals that respond best to their market demand. The proportion of the Sicilian sheep population recorded is very little. This situation has created a shift in the way of managing the breed. It is now managed as a meat breed with a suckling period length of 114 d. In some cases rams from the meat breeds are used in crossbreeding to improve Sicilian lambs growth performances.

Average growth performances in Table 2 show that the three sheep meat breeds are comparable and they do have a relatively poor growth records especially after been selected for more than three decades on weaning weight. This explains that the realized increase of small ruminants meat production was achieved in the country mainly by an increase of animal numbers and not productivity. There has been an increase of 165% and 323% in sheep and goat populations between the periods of 1961-62 and 1994-95, respectively (Snoussi, 1999). Small ruminants contribute by 50% of red meat and by 28.5% of total meat produced in the country. The average milk yield of the Sicilian breed was estimated to be 72 kg during 124 days in milk. The suckling period was 114 days. Milk produced is used for cheese making (Djemali *et al.*, 1994).

Table 2. Average growth performances of recorded sheep breeds

| Breed              | Ewes mated | Fertility | Prolificacy | Sex-type | W30 <sup>†</sup> | W70 <sup>†</sup> | ADG <sup>**</sup> 10-30 | ADG 30-70 |
|--------------------|------------|-----------|-------------|----------|------------------|------------------|-------------------------|-----------|
| Barbarin           | 22662      | 82.68     | 112.49      | MS       | 10               | 16               | 182                     | 160       |
|                    |            |           |             | MM       | 7                | 12               | 135                     | 134       |
|                    |            |           |             | FS       | 9                | 15               | 171                     | 174       |
|                    |            |           |             | FM       | 7                | 12               | 128                     | 126       |
| Algerian Thin Tail | 4758       | 83.67     | 118.16      | MS       | 9                | 16               | 169                     | 169       |
|                    |            |           |             | MM       | 7                | 13               | 122                     | 142       |
|                    |            |           |             | FS       | 9                | 15               | 161                     | 161       |
|                    |            |           |             | FM       | 7                | 12               | 115                     | 137       |
| Black Thibar       | 4858       | 81.21     | 130.47      | MS       | 9                | 15               | 156                     | 162       |
|                    |            |           |             | MM       | 7                | 13               | 130                     | 148       |
|                    |            |           |             | FS       | 8                | 14               | 144                     | 147       |
|                    |            |           |             | FM       | 7                | 12               | 122                     | 134       |
| Sicilian           | 1774       | 90.13     | 144         | MS       |                  |                  | 143                     |           |
|                    |            |           |             | MM       |                  |                  | 123                     |           |
|                    |            |           |             | FS       |                  |                  | 137                     |           |
|                    |            |           |             | FM       |                  |                  | 115                     |           |

<sup>†</sup>W30 = Weight at 30 days; W70 = Weight at 70 days.

<sup>\*\*</sup>ADG = Average daily gain.

## Lessons learned

Examining sheep and goats breeding programmes in Tunisia after four decades of existence shows that this country has invested heavily in animal identification, recording of performances and selection of young rams. These did not improve consequently small ruminants productivity which is still relatively low. This situation leads to ask the following questions: (i) are the outputs of small ruminants paying for different costs of these programmes? and (ii) are livestock holders making full profit from these programmes?

It is now becoming clear that the Tunisian experience in animal recording is a real one. The number of recorded animals is reaching more than 65,000 ewes. This is a plus when compared to other countries with no recording programmes. On the other hand, many lessons could be learned from this situation and this is at two different levels: organizational or operational and technical.

At the organizational level, national sheep and goats breeding programmes were mainly elaborated and executed by the "State". Livestock holders and research institutions have not been considered as real partners of this national breeding strategy. The only responsible for the programme is the "State". The lesson learned, today, shows that this approach has its short comings. In fact many limitations of the actual national sheep and goats breeding programme can be identified. At the financial level, the "State" is realizing that this programme is becoming too heavy in costs and management. Operational costs of identification, recording and selection of rams can not be supported only by the government. They can not be supported by livestock holders alone either. However, If these costs are supported by all stakeholders (farmers, milk and meat industries, government, etc.), the cost will be minimized and

risk assessment of such breeding programmes will encourage every body to invest and get the full benefit at the flock level or at the end product. If returns are not paying for these costs, no one will be willing to participate to a such effort.

Another limitation is linked to the "know how" level especially in animal breeding expertise. Most of the trained people in animal breeding are in research or teaching institutions and there are no strong linkages between them and the national breeding programme which is conducted by a development state agency.

At the farm level, farmers are happy to get information related to their flocks but they do not complain when it is not made available for them. "Doing to or for" principle is a limitation. It should be changed to "doing with" instead in order for farmers to feel a part of the national breeding strategy.

Limitations are observed at the lack of evaluation of all different components of the national breeding programme (identification, recording, genetic evaluation, dissemination of genes, farmers organization) because it is not easy to make an objective self evaluation even when it is done right.

In order to overcome these limitations, it is important to have livestock holders, research institutions and others like marketing channels associated with the government in the breeding strategy and this from the beginning (the conceptual stage). Doing so will help define selection goals on a reliable basis, encourage different partners of the programme to be fully involved in making decisions, selecting animals and evaluating all components of the programme. This approach is a real guarantee of the sustainability and the efficiency of any breeding strategy. Building it on a partnership principle will diminish risks of failures and will use fully the country's genetic resources which might be at risk of being lost other wise. Djemali and Alhdrami made the same remarks in 1997.

At the technical level the Tunisian experience has its positive points especially generating information aspects. Generated information from recording have been used in some of the flocks for management purposes and in various students research work especially in animal breeding. Without this type of information native breeds would not be accurately evaluated. On the other hand, weaknesses of the national sheep and goats breeding programme at the technical level can be identified.

Selection objectives are still not soundly defined for all the breeds. Most of sheep breeding programmes are straitbreeding. The absence of real partners (livestock holders, research institution and marketing people) might be the major reason for not having breeding goals identified on a reliable basis. It is clear to stress that breeding goals are essential to any breeding scheme. They should be identified in common by the cited stakeholders according to the characteristics of the breed within its production system. If not so, little will be gained at the breed level. Meat breeds should have well defined breeding objectives that satisfy farmers, consumers and fit the genetic characteristics of the breed under given production systems.

The lack of real structure (one tier, two tiers, etc.) of flocks remains also a major constraint to disseminate genetic superiority within sheep and goat populations in the country. This shows that recording by itself is not enough when breeding strategies are concerned. The same remark goes for genetic evaluation tools. Tunisia has now human resources capable of running the most sophisticated genetic evaluation programmes, but their impact is limited because they are not considered as full partners of the national breeding strategy.

These are the points that countries like Tunisia should be aware of when establishing breeding programmes for their animal resources. Taking into account all points discussed will be a way to establish a complete breeding strategy for sheep and goats with little risks of failures. Breeding strategy is a national responsibility where all concerned stakeholders should be considered. This strategy should be evaluated nationally, genetically and economically, on a periodical basis.

## Conclusion

Small breeding strategies is the responsibility of different partners (farmers, government, research, marketing channels, etc.). Lessons learned from the Tunisian experience show that it is essential to have these partners involved from the beginning in any given animal breeding strategy. By doing so,

selection objectives will be well defined and compatible with breed characteristics and farmers interest. Having the indicated partners working together will reduce risks of failure and increase chances for making genetic progress by using fully the country's animal genetic resources.

## References

- Chalah, A. (1996). *Caractérisation génétique de la race ovine tunisienne "Noire de Thibar" sur la base des caractères pondéraux et approche d'indexation des futurs reproducteurs pour une meilleure croissance*. PhD Thesis in Génétique, Faculty of Sciences Tunis, University of Tunisia II.
- Djemali, M., Aloulou, R, and Ben Sassi, M. (1994). Adjustment factors and genetic and phenotypic parameters for growth traits of Barbarin lambs in Tunisia. *Small Ruminants Research*, 13: 41-47.
- Djemali, M. and Alhadrami, G. (1997). Considerations beyond breeding goals in breeding sheep and goats in relation to their environment. *Options Méditerranéennes, Series Cahiers*, 33: 171-174.
- Djemali, M. and Ben M'Sallem, I. (1995). Effets du mois, mode et âge d'agnelage sur la production laitière des brebis sicilo-sarde en Tunisie. *Options Méditerranéennes, Series Cahiers*, 6: 111-117.
- FAO (1987a). Small Ruminants in the Near East. *FAO Animal Production and Health*, Paper 54.
- FAO (1987b). Animal Genetic Resources. Strategies for Improvement Use and Conservation. *FAO Animal Production and Health*, Paper 66.
- Khaldi, G. (1984). *Variations saisonnières de l'activité ovarienne, du comportement d'oestrus et de la durée de l'anoestrus post-partum des femelles ovines de race barbarine. Influence du niveau alimentaire et de la présence du mâle*. PhD Theses, Academy of Montpellier, University of Sciences and Techniques of Languedoc, INRAT, Tunisia.
- MED AGRI (1994). *Yearbook of agricultural and food economies in the Mediterranean and Arab countries*. CIHEAM, Mediterranean Agronomic Institute of Montpellier, France.
- MED AGRI (1999). *Yearbook of agricultural and food economies in the Mediterranean and Arab countries*. CIHEAM, Mediterranean Agronomic Institute of Montpellier, France.
- Palian, B. (1966). Principes de sélection ovine en troupeaux améliorés. *Bulletin de l'Ecole Nationale Supérieure d'Agriculture de Tunis*, 12: 27-51.
- Sachse, J.M. (1977). *A study of sheep production in Tunisia, sponsored by the US Agency for International development in cooperation with the Tunisian Office de l'Élevage et des Pâturages*. Library of INAT, Tunis, Tunisia.
- Sellen, S. and Steinbach, J. (1984). *Etude portant sur la tolérance au sel des chèvres*. Séminaire de la recherche caprine, Tunis 22 octobre 1984 (OEP/GTZ), pp. 148-164.
- SIAMAT (1999). *Catalogue officiel du 6<sup>ème</sup> Salon International de l'Agriculture et du Machinisme agricole*. UTAP, Tunisia, pp. 30-36.
- Snoussi, S. (1999). *Bilan des recherches sur les systèmes d'élevage. Atelier de travail sur le bilan des recherches sur les petits ruminants*. Bibliothèque IRESA, Tunis, pp. 59-77.