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Kid's Growth of Pure Breeds and Crossed Caprine Genotypes in the Coastal Oases of Southern Tunisia

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Abstract: A data issued from 16 years performances schedule of local goat, Alpine, Damascus, Murciana and crossed groups was used to study the genotypes productive behaviour under Tunisian oases conditions. The aim is to evaluate the possibilities of local goat productivity improvement by cross breeding in intensive mode and also, to choose the better improving breed and the propice crossing level. So, data of periodic individual weighing was used to estimates kid's weight at some standard ages of studied genetic goats groups. Statistical analysis of about 11500 kid's weights shows that, the cross breeding allows to improve the growth performances since the first generation with respect to local population production. ANOVA test shows an important effect of genotypes and environment upon kids weights ($p<0.01$). The kid's weight averages at birth and at 120 days age were about 3.49 and 15.78 kg, respectively. The cross breeding second generation allows the better improvement of local goat potentialities kid's weight at 120 days reaches 16.19 kg for Damascus x local genotype. All imported breeds registered low performances than those known in their original regions.

Key words: Local goat, cross breeding, kid's growth, daily average gain, oases, Tunisia

INTRODUCTION

The *Capra hircus* is considered being the oldest domesticated animal among livestock species. Its husbandry goes up to more than 10000 years before J.C. (Fabre-nys, 2000). During this long breeding period, goat has varied its breeds and products to which explain its actual large distribution in the major environments and production systems in the world (Alexandre *et al*., 1997). Nowadays, goat breeding knows an increasing interest because of the high caprine productivity and the quality of goat products.

In Tunisia, the national caprine herd is estimated at approximately 1,300,000 reproductive females and more than 60% of the national herd is raised on the arid rangelands of the country (DGPA, 2002; Najari *et al*., 2006). Since centuries, local goat population has been valorizing the arid pastures with scarce resources and harsh climatic environment. The lactated kid's meat is the main product for this breeding mode and contributes with about 75% in the regional meat production (Najari *et al*., 2007).

The Tunisian local goat population shows a large morphological and productive variability with a particular adaptation capacity to difficult natural conditions (Najari *et al*., 2006). In the Tunisian arid regions, local goat is essentially raised in pastoral and agropastoral modes and is often considered able to reproduce during all the years, as well as for other caprine rustic populations (Chemineau *et al*., 1991; Alexandre *et al*., 1997; Delgadillo *et al*., 1997; Arbi, 2004).

Under oasian conditions, the goat husbandry plays a key role by its significant various contributions in the farmer's incomes (D'Aquino *et al*., 1995; Jamali and Villemeot, 1996). Goat benefits from an intensified breeding mode under low climatic risks which characterize the arid area (Morand-Fehr and Doreau, 2001). Contrary to pastoral mode, the main goat oasian production of reduced herds is milk.

Regardless of the production objective, goat productivity success remains largely assessed by reproductive performances and kids survival. It is well known that the heat peaks and climatic stress affect reproduction, both of the male and the female, for caprine as well as for all the mammalies species (Williams and Helliwell, 1993; Arbi, 2004). In addition, the environmental stress decreases the oestrus duration the fecundation rates and increase foetal mortality (Le Gal and Planchenault, 1993).

The confirmed local goat low productivity in pastoral system can be attributed to natural and technical resources scarcity (Caruolo, 1974; Pasquini *et al*., 1994).

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The extensive breeding mode can be considered as a factor reducing goat productivity. In some cases, the local goat population genetic capacities represents a serious restriction to improve goat production, especially for milk, knowing that local goat is traditionally raised to produce kid's meat (Najari *et al*., 2007).

To improve caprine productivity and to optimize oases resources valorisation, a crossing plan of the local goat was adopted as a solution to resolve this genetic problem. Thus, a crossing program to substitute local goat by more productive caprine crossed genotypes was carried out by the Institute of the Arid Areas (Médenine Tunisia). To meet this goal, some performant breeds (Alpine, Damascus and Murciana) were imported and the crossing program was conducted in the experimental station in Chenchou (Gabès).

Based on a large data base issued from 16 years (1981 to 1996) animal survey of pure breeds and crossed genotypes performances, several studies was realised to evaluate genotypes productivities (Najari and Ben, 1996; Najari, 2003; Hatmi *et al*., 1998; Gaddour, 2005). Despite of dairy production importance in oases, the kid's meat production contributes in the family incomes each flow. Considering this caprine meat importance for regional demand satisfaction, improving slaughtered kid's weight represent one of major direct crossing scheme objective. Thus the study focuses on the kid's growth potentialities of pure and crossed genotypes used in this project. The aim is to evaluate the improvement possibilities by local goat cross breeding and the choice the propice imported breed and the cross level to allow better valorisation of oases intensive resources.

MATERIALS AND METHODS

Study area: The crossing program was conducted in the Institute of the Arid Areas of Medenine at the station of Chenchou (Gabès, southern Tunisia). The station is located in the lower arid bioclimatic stage; with an average annual rainfall of 188 mm. January is the coldest month of the year, with an average temperature of 10.7°C, whereas August is the hottest month with about 27.3°C average (Ouled Belgacem, 2006).

Animal material

Local goat: The indigenous goat population shows a large variability both in morphology and performances (Najari *et al*., 2007). The local goat population is characterised by its small size with an average height of 76 cm for the male and 60 cm for the female (Ouni, 2006; Najari *et al*., 2007). It is distinguished by the ability to walk long distances, water shortage resistance and good kidding ability. The native goat is hairy and basically black coat colored with spots on the head horned and has bread and dewlap on the neck. Fertility rate is about 87% and prolificacy rate varies between 110 and 130% (Najari *et al*., 2006). Kidding season begins in October and continues till February with a concentration in November and December when 69.2% of kid's are born.

Table 1: Characteristics and performances of the ameliorative breeds

		Adult weight (kg)		Dairy production	
Breed	Origin	Male	Female	Total production (kg)	Lactation period (days)
Alpine	France	80	60	570	245
Murciana	Spain	70	50	500	210
Damascus	Cyprus	80	60	200	90

Ameliorative breeds: To cross local goat, three ameliorative breeds were used: Alpine, Damascus and Murciana breeds were imported, respectively from France, Cyprus and Spain since 1980. Table 1 shows the characteristics of the imported breeds (Najari, 2005).

Crossing scheme: To produce the first crossed generation, local goats are mated with bucks of ameliorative breeds. For later crossing stage, at each generation, the crossed females are mated with bucks of imported breeds as indicated in Fig. 1. So, the crossing scheme allows a progressive increase of the ameliorative percentage genes pool, during successive generations (Gaddour *et al*., 2006). Theorically, the crossing plan will be considered as achieved with reaching crossed genotypes performances similar to those of the ameliorative breeds.

Data base: During 16 years, the crossing scheme was applied and an individual periodical weighing control was continuously realized since the birth and till the kid's weaning in summer begning. So, about 1928 annual kid's data files are registered and used as the data base for this study. For each kid's the data include: Kid's and mother identification, birth data, sex, birth mode, genotype and control dates with respective observed weights. The data set was verified and individual kid's weight at standard ages was estimated by extra or intra polation (Gaddour *et al*., 2006a; Ouni, 2006). The considered standard ages are birth, 10, 30, 70, 90 and 120 days.

Daily Average Gain (DAG) was established as the daily linear weight increase between 2 dates; for example

$DAG_{10\text{-}30}$ = [weight at 30 days (kg)-weight at 10 days (kg)] * 1000 / (30-10)

$DAG_{30\text{-}70}$ = [weight at 70 days (kg)-weight at 30 days (kg)] * 1000/(70-30)

G1 **Females local goat x Bucks from ameliorative breeds**

↙↘ **(Alpine, Damascus, Murciana)**

G2 **Males kid's (slaughtered) Crossed Females x Bucks from ameliorative breeds**

↙↘ **(Alpine, Damascus, Murciana)**

G3 **Bucks from ameliorative breeds x Crossed Females Males kid's (slaughtered)**

(Alpine, Damascus, Murciana) ↙↘

G4 **Males kid's (slaughtered) Crossed Females x Bucks from ameliorative breeds**

(Alpine, Damascus, Murciana)

Gn ⇓

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Fig. 1: Local goat cross breeding diagram

$DAG_{70\text{-}90}$ = [weight at 90 days (kg)-weight at 70 days (kg)] * 1000 / (90-70)

Statistical analysis: After data verification a total of 1928 kid's weight at standard ages for various genetic groups: Alpine, Damascus, Murciana, local population and crossed genotypes was retained.

The individual quantitative performances were subjected to an Analysis of the Variance (ANOVA) to diagnose the effects of some variation factors. The models used are the following:

$$Y_{ijklm} = \mu + RA_i + AN_j + NS_k + MN_l + (RA\times AN)_{ij} + (RA\times NS)_{ik} + (RA\times MN)_{il} + (AN\times NS)_{jk} + (AN\times MN)_{jl} + (NS\times MN)_{kl} + \epsilon_{ijklm}$$

Where;

Y_{ijklm}	:	Kid's weight at birth, 10, 30, 70, 90, 120 days; Daily average gain between 10-30, 30-70 and 70-90.
μ	:	The general average
Ra_i	:	The genotype effect
An_j	:	The year effect
Ns_k	:	The sex of the kid's effect
Mn_l	:	The mode of birth effect
$(RA\times AN)_{ij}$	:	The interaction genotype×year effect
$(RA\times NS)_{ik}$	:	The interaction genotype×sex effect
$(RA\times MN)_{il}$	:	The interaction genotype×mode of birth effect
$(AN\times NS)_{jk}$	:	The interaction year×sex effect
$(AN\times MN)_{jl}$	:	The interaction year× mode of birth effect
$(NS\times MN)_{kl}$	:	The interaction sex× mode of birth effect
ϵ_{ijklm}	:	Residual error.

After the variance analysis, an SNK mean comparison test (α = 5%) was applied to identify homogeneous statistical groups for each variable by variation factors.

Statistical analysis was done by SPSS program (SPSS, 1998).

RESULTS AND DISCUSSION

Variance analysis of kid's growth performances: Table 2 resume the ANOVA results of the test significance relative to the model factors effects upon kid's weights and daily average gain.

The model determination coefficient (R^2) varied from 75 to 96% (Table 2). These values can be retained for a data relative to animal production and collected during 16 years. The ANOVA test shows that kid's weights at standard ages and Daily Average Gain (DAG) were essentually affected by year and genotype factors. Whearas, kid's sex and kidding mode affect partially some studied variables, with a significance probability ($p< 0.01$ or 0.05) at 30, 70 and 90 days ages. Concerning the interaction effects upon kid's growth. Table 2 shows that the genotypes x year interaction have a high significant ($p<0.01$) effect upon all variables. Also genotype× kidding mode acts significatively ($p<0.01$) upon kid's weights after one month age and $DAG_{30\text{-}70}$.

Several authors assigned an important effect of environmental and genetic factors upon caprine performances as animal quantitative traits (Chemineau *et al.*, 1991). The importance effect of the year factor on the studied variable wasn't being expected because of the intensification of the breeding mode. Tradionally, the year climatic conditions affect herd resources by forage variation in pastoral mode especially in arid lands (Ouled Belgacem, 2006). Whearas, under oasian mode, goat alimentation is sufficient and animal are correctly feeded by Alfa Alfa and concentrate. So, such year effect can be only justified by the variation of the climatic effects such as temperature, heat picks and humidity. Also, the herd genetic level, whose vary with cross breeding, can explain partialy such year effect.

As well as environmental factors, the genotype factor had also significative action upon all growth

Table 2: Results of variance analysis (ANOVA) of kid's weight (kg) at the standard ages and daily average gain (g d^{-1})

Factors	ddl	PN	P10	P30	P70	P90	P120	DAG $_{10-30}$	DAG $_{30-70}$	DAG $_{70-90}$
AN	14	**	**	**	**	**	**	**	**	**
RA	11	**	**	**	**	**	**	*	**	NS
NE	1	NS	*	*	**	**	*	NS	*	NS
MN	2	NS	NS	*	*	*	NS	NS	NS	NS
ANxRA	55	**	**	**	**	**	**	**	**	**
ANxNE	13	*	NS	*	*	*	NS	NS	NS	NS
ANxMN	21	*	NS	NS	**	NS	NS	*	NS	NS
RAxNE	11	*	NS	**	*	NS	*	*	NS	*
RAxMN	16	NS	NS	**	**	**	*	*	*	NS
NExMN	2	NS	**	NS	NS	NS	NS	NS	NS	NS
R^2 (%)	-	97	96	96	96	96	96	88	87	75

ddl: degree of freedom, **: highly significant (p<0.01); *: Significant (p<0.05); NS: Non Significant; AN: Year, RA: Genotype, NE: Sex, MN:Kidding mode; PN, 10, 30, 70, 90 and120: Kid's weight at birth, 10, 30, 70, 90 and 120 days, DAG_{10-30}, $_{30-70}$ and $_{70-90}$: Daily average gain between 10-30, 30-70 and 70-90 days

Table 3: Kid's weights (kg) means and homogenous groups (SNK test α = 5%) by studied genotypes

Genetic groups	N	PN	P10	P30	P70	P90	P120
Alpine (A)	767	3.6^{a}	5.41^{a}	8.11^{ab}	10.81^{ab}	13.13^{abc}	14.80^{ab}
Damascus (D)	169	3.66^{a}	5.49^{a}	8.16^{ab}	11.3^{bc}	14.51^{ab}	16.48^{a}
Murciana (M)	148	2.38^{j}	3.91^{b}	6.35^{d}	8.24^{f}	11.07^{d}	11.98^{c}
Local (Lo)	148	2.92^{def}	4.48^{b}	6.68^{cd}	9.12^{ef}	11.88^{cd}	12.85^{c}
A1	137	3.08^{cde}	5.87^{a}	8.14^{ab}	10.76^{bcd}	13.77^{abc}	15.03^{ab}
A2	176	3.37^{abc}	5.22^{a}	8.56^{ab}	12.21^{ab}	14.13^{ab}	15.78^{a}
A3	15	3.31^{bcd}	5.39^{a}	8.96^{a}	12.88^{a}	14.94^{a}	16.37^{a}
D1	49	3.55^{ab}	5.88^{a}	7.79^{abc}	13.13^{bc}	15.74^{ab}	16.42^{abc}
D2	28	3.44^{abc}	5.69^{a}	8.27^{ab}	11.71^{bc}	14.59^{ab}	16.19^{a}
D3	18	2.94^{cde}	5^{a}	7.07^{bcd}	10.1^{cde}	12.07^{bc}	13.56^{abc}
M1	15	2.61^{fj}	4.02^{b}	6.46^{d}	9.22^{ef}	11.75^{cd}	14.42^{abc}
M2	17	2.72^{ef}	4.29^{b}	7.21^{bcd}	9.24^{def}	11.99^{cd}	13.9^{abc}
General	1687	3.21	5.05	7.64	10.72	13.29	14.81

N: Observations; A1, A2 and A3: crossed Alpine×local; D1, D2 and D3: crossed Damascus×local; M1 and M2: Crossed Murciana×local; $^{a, b, c, d, e, f}$ and ^{j}: Homogenous groups; PN, 10, 30, 70, 90 and 120: Kid's weight at birth, 10, 30, 70, 90 and 120 days

performances. So, differences between genetic groups have to be considered to evaluate genotypes potentialities (Table 2).

Kid's growth performances means comparison by variation factors

The genotype and crossing level effect: To study the genotype effect and discriminate homogenous groups with respect to studied variables, a means comparison test SNK (α = 5%) was applied. The means comparison result was regrouped in Table 3.

At birth, the kid's of the Alpine and the Damascus breeds have a body weight in average of 3.66 and 3.61 kg, respectively. The local population kid's weight was only 2.92 kg at birth in average.

Figure 2 and 3 resume the kid's weights separately for pure breeds and crossed genotypes.

Among the crossed genotypes, the SNK test (α = 5%) shows that the heaviest group is composed by the crosses: A2 (A×Lo), A3 (A×Lo), D1 (D×Lo) and

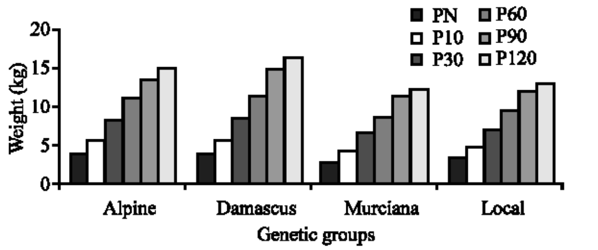

Fig. 2: Kid's weights at standard age for local population and ameliorative breeds

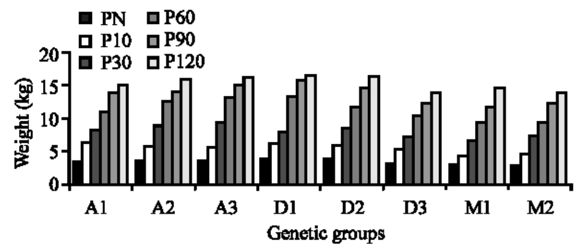

Fig. 3: Kid's weights at standard age for crossed breeds

D2 (D×Lo) with respective weights at the birth of 3.37, 3.31, 3.55 and 3.44 kg. The crosses D3 (D×Lo), M1 (M×Lo) and M2 (M×Lo) have 2.54, 2.61 and 2.72 kg as weights at the some age, respectively (Fig. 3).

Kid's weight at birth remain an important productive index due to it relation with meat production and also, with the kid's survival probability (Husain *et al*., 1995; Awemu *et al*., 1999; Anastazios and Ezzat, 2002).

After birth and at later standard ages, among the pure breed, the Damascus and the Alpine kid's, had the heaviest weights for all the considered ages. For example, we registered a 5.49 and 5.41 kg as kid's weight at 10 days days age, respectively for Damascus and Alpine. At 120 days age, the Damascus kids still the heaviest with a weight of 16.48 kg. The local population and the Murciana breed recorded the weakest weights with 12.85 and 11.98 kg, respectively at 120 days (Fig. 4).

Among the crossed genotypes, with respect to the kid's weights after birth, the SNK test (α = 5%) differenciated two groups relatively homogenous, the first group corresponding to the highest weights contains A2 (A×Lo), A3 (A×Lo), D1 (D×Lo) and D2 (D×Lo) genotypes. For example, the kid's of D1 (D×Lo) genotype weight about 3.55 kg at birth.

At the third crossing generation, the crossed (A×Lo) kid's had the highest weight at 30 days age (8.96 kg). The weight gain explained by the superiority of their mothers on the level of the dairy performances compared to the others crosses (Gaddour, 2005; Gaddour *et al*., 2006a). The weight of the Damascus crossed kid's at 120 days in the first generation is about 16.5 kg (Fig. 5).

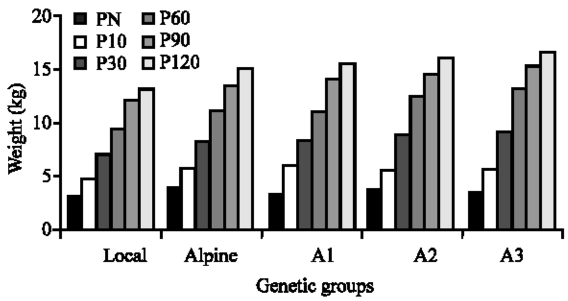

Fig. 4: Growth performances of local goat, breeds Alpine and its relative crossed at first, second and third generation

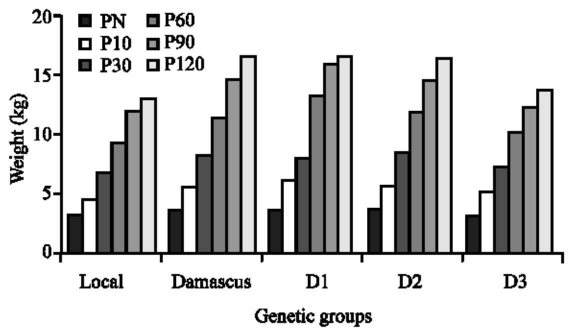

Fig. 5: Growth performances of local goat, breeds Damascus and its relative crossed at first, second and third generation

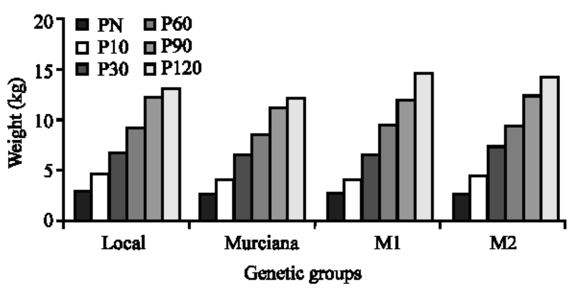

Fig. 6: Growth performances of local goat, breeds Murciana and its relative crossed at first and second generation

Figure 4-6 illustrate the kid's weight separately for Alpine, Damascus, Murciana and their respective crosses with local. Comparing several crossing generations with respect to their paternal breeds, there are no clear trend to improve kid's weights proportionally to cross breeding generation.

An important decrease at 120 days of cross Murciana weights can be noted (Table 3 and Fig. 6). Since the birth, the cross D3 (D×Lo) kid's weights are lower than those D2 and D1. Whereas, for the Alpine cross kid's, the weight increases with the degree of the local goat of substitution. Since 30 days ages, the cross kids (A×Lo) and (M×Lo) have higher weights than those of respective pure breeds, Alpine and Murciana kids. This can be explained by the heterosis effect or the hybrid vigor witch appear clear in the present case (Griffing and Zsiros, 1971).

The year effect upon kid's growth: Table 4 shows the test SNK (α = 5%) comparison results concerning the year effect, revealed highly significative effect of year upon kids weight ($p<0.01$) from birth and 120 days old.

During the control period, the best performances in average had been registered during 1987-1988, when the heaviest weight at 120 days was 17.22 kg.

Figure 7 illustrates a comparable growth speed during the first month of age for the 4 experimental years. It appears that until this early age, the low requirements of the young kid's could be met whatever the year; even when is reduced, the milk production of the mother would be enough to express the growth potential of the kid's of less than 1 month old. This aspect was concluded for other growing character such as kid's morphometry (Ouni, 2006) when the homogeneity of individual performances till one months age was confirmed.

This aspect underligne a relation between environment and genotype expression variability of the productive aptitudes and should be considered for the genetic improvement under the hot climates (Najari *et al.*, 2002).

Since one month age, the kid's growth becomes highly marked by the effect of the year. During favourable year growth curves are presented in S-shape and finish by an asymptote which tends towards an adult relatively heavy weight such is known for all mammaly species. Many authors registered direct and indirect effect of the year on the kid's growth. Witch is mainly explained by the reduction of the mother's milk and the rangeland resources (Alexandre *et al.*, 1997; Das *et al.*, 1996; Gipson and Wildeus, 1994).

As mentioned, year effect can be explained by indirect action of climatic conditions upon kid's and goat mother nutrition. But under oasian intensive conditions, the year effect is mainly due to some other factors such as temperature, heat, humidity..... Also, the herd genetic level improvement with the progressive cross scheme application can contribute to explain the year effect (Shredta and Fahmy, 2007).

The sex effect upon kid's growth: Table 5 presents the results of SNK test (α = 5%) of the effect of sex upon

Table 4: Year effect upon kid's weights since birth and till 120 days

Years	PN	P10	P30	P70	P90	P120
1980-1981	3.91^{b}	4.94^{de}	8.32^{bc}	11.9^{def}	13.69^{bc}	14.80^{bc}
1981-1982	3.06^{d}	5.5^{de}	7.04^{ef}	10.44^{j}	11.61^{ef}	13.19^{cd}
1982-1983	3.12^{d}	5.91^{c}	8.2^{bcd}	10.38^{j}	12.22^{de}	13.25^{cd}
1983-1984	3.32^{cd}	5.05^{de}	6.93^{f}	9.24^{h}	10.51^{f}	11.84^{d}
1984-1985	3.25^{cd}	5.27^{d}	9.33^{a}	13.03^{bc}	14.23^{bc}	15.58^{ab}
1985-1986	3.99^{b}	6.04^{c}	8.56^{b}	12.37^{cdef}	11.46^{ef}	-
1986-1987	-	7.85^{a}	9.95^{a}	15.07^{a}	16.27^{a}	-
1987-1988	4.63^{a}	6.83^{b}	9.67^{a}	13.65^{b}	15.28^{a}	17.22^{a}
1988-1989	3.85^{b}	6.72^{b}	7.51^{def}	12.58^{cde}	13.98^{bc}	14.61^{bc}
1989-1990	3.33^{cd}	4.50^{e}	6.88^{f}	11.24^{fj}	12.73^{cde}	14.69^{bc}
1990-1991	3.31^{cd}	5.02^{de}	7.87^{bcde}	11.71^{def}	13.08^{bcd}	14.78^{bc}
1991-1992	3.43^{cd}	4.87^{de}	7.33^{ef}	11.88^{def}	13.73^{bc}	15.95^{ab}
1992-1993	3.67^{bc}	5.14^{de}	7.31^{ef}	12.58^{cde}	14.44^{b}	16.46^{ab}
1993-1994	3.31^{cd}	4.85^{de}	7.41^{def}	11.71^{def}	13.08^{bcd}	14.61^{bc}
1994-1995	3.28^{cd}	4.82^{de}	7.67^{cdef}	12.77^{bcd}	14.35^{b}	15.50^{ab}
1995-1996	3.00^{d}	4.66^{de}	7.26^{ef}	11.51^{ef}	13.71^{bc}	16.45^{ab}
General	3.27	5.49	7.95	12.00	13.41	13.24

$^{a, b, c, d, e, f, j}$ and ^{h}: Homogeneous groups; PN, 10, 30, 70, 90 and120: Kid's weight at birth, 10, 30, 70, 90 and 120 days

Table 5: Kid's weight comparison (SNK $\alpha = 5\%$) by kid's sex

Sex	N	PN	P10	P30	P70	P90	P120
Male	746	2.44^{a}	3.85^{a}	5.77^{a}	8.87^{a}	11.88^{a}	14.74^{a}
Female	941	2.19^{b}	3.5^{b}	5.25^{b}	8.01^{b}	10.65^{b}	13.06^{b}
General	1687	2.31	3.67	5.51	8.44	11.26	13.90

N: Observations; $^{a, b}$ and ^{c}: Homogeneous groups; PN, 10, 30, 70, 90 and120: Kid's weight at birth, 10, 30, 70, 90 and 120 days

Table 6: Kid's weight comparison (SNK $\alpha = 5\%$) by birth mode

Birth mode	N	PN	P10	P30	P70	P90	P120
Single	834	3.42^{a}	5.32^{a}	7.91^{a}	11.92^{a}	13.62^{a}	15.23^{a}
Multiple	816	3.29^{a}	4.99^{b}	7.5^{b}	11.27^{b}	12.72^{b}	14.08^{b}
General	1650	3.35	5.15	7.70	11.60	13.17	14.65

N: Observations; ^{a} and ^{b}: Homogeneous groups; PN, 10, 30, 70, 90 and120: Kid's weight at birth, 10, 30, 70, 90 and 120 days

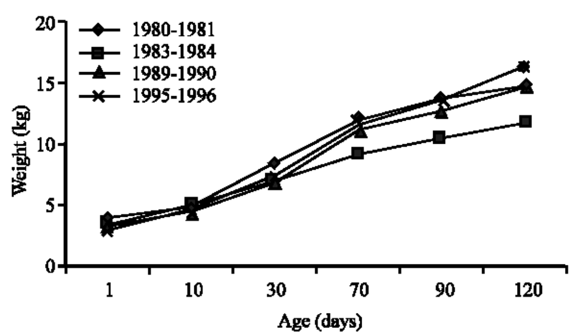

Fig. 7: Curve of growth of the kid's in relation to the year

kid's weights since birth and till 120 days age. Figure 8 illustrates the evolution of kid's weights by sex.

The difference between sexes performances seem appears statically remarkable since the birth Fig. 8. The weight at birth, estimated at 2.44 kg for the male and of 2.19 kg for the females, explains this early and clear superiority of the males kid's.

The male superiority becomes more and more clear with the age of the kid's. The effect of the sex on the shape and the parameters of the growth curve were

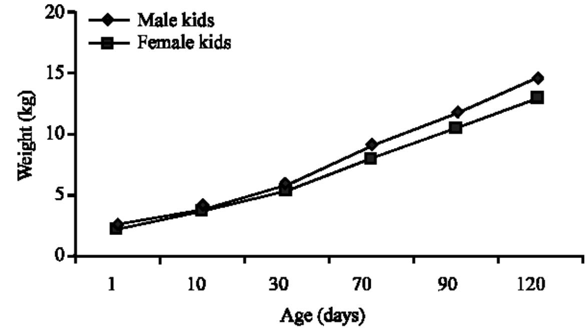

Fig. 8: Curve of growth of the kid's in relation to the sex

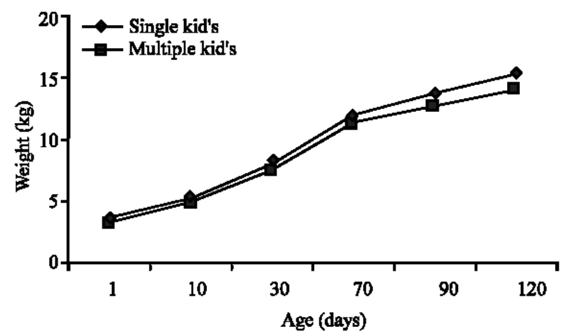

Fig. 9: Growth curve of the kid's in relation to the mode of birth

underlined by several authors (Anthony *et al.*, 1991a; Barbato and Vasilatos-Younken, 1991; Banda *et al.*, 1993; Bathaei and Leroy, 1996; Alexandre *et al.*, 1997). The difference in weight continues and permits to males to tend to a final weight higher than that of the females. This can allows females to reach more quickly, than males, the same stage of maturation. These differences in precocity between sexes are also observed between weights recorded at the standard ages for other domestics species (Barbato, 1996).

Birth mode effect growth kid's: Table 6 shows the results of SNK test ($\alpha = 5\%$) relative to the birth mode effect upon kid's weights since the birth and till 120 days ages. Figure 9 presents the weight evolution of single and multiple kids.

The birth mode is considered with a classic effect on kid's growth for other young mammely species before maturity. This effect is mainly explained by differences of birth weights and mother milk disponibilty witch, theorically are favorising single births. The single born heavy and find enough milk and food than the kids born multiple (Lyatuu *et al.*, 1992; Okello, 1993; Gromela *et al.*, 1998).

In our case kid's weights, at birth are statistically comparable and signle kid's superiority becomes significative after 10 days Fig. 9 the effects of mode birth on growth become clear and classic in this age.

It seems that goat mother milk production, representing main food of the young kid's, is enough to satisfy either single or multiple kid's demands and to exprime the 'single' growing superiority.

CONCLUSION

The comparison of the pure breeds and the genetic crosses group's performances shows that the kid's growth performances of local population remain weak although in intensive mode. Also, the crossed breeding scheme allows improving local goat meat production. Equally, the ameliorative breeds (Alpine, Damascus and Murciana) knew a serious decrease of their production compared to that known in their country of origin. Among the crossed genotypes, the Damascus/Alpine crossed with local goat showed the better growth potentialities since the birth and the lowest performances are relative to Murciana and it's crossed. Through the cross breeding generations, a relative hybrid vigor appears, especially, when Alpine and Murciana are used as parental breed for hybrids. However, we note a crossed performances decrease at the third generation. Rather than the genotype effect, kid's growth seems also varying under other factors effects such as environment, sex and birth mode. These factors act upon kid's birth weight, kid's and mother nutrition. Although under intensive oasian conditions the environment exerce a significative effect upon caprine performances.

In spite of their particular importance to evaluate the impact of the cross plan, the analysis of kid's growth remains insufficient to define the propice ameliorative breed and the favourable crossing step to improve goat productivity in Tunisian oases. The study of other productive and reproductive performances remains necessary to reach this aim.

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