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**LEBAS François , GACEM Malika, MEFTAH Ibtissem,
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**Comparison of reproduction performances
of a rabbit synthetic line and of rabbits of local populations in
Algeria, in 2 breeding locations
First results**

6 pages and 24 slides

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Animal Production Department
Faculty of Agriculture
Zagazig University
Zagazig, Egypt

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Prof. Mariam A.El Deeb, Ph.D
Chairman of Department Animal & Poultry
Production
College of Agriculture, Assiut University
Assiut 71516, Egypt

Comparison of reproduction performances of a rabbit synthetic line and of rabbits of local populations in Algeria, in 2 breeding locations - First results

**LEBAS François¹, GACEM Malika², MEFTAH Ibtissem³,
ZERROUKI Nacera⁴, BOLET Gérard⁵**

¹ - Cuniculture, 87A Chemin de Lasserre, 31450 Corronsac, France

² - Institut Technique des Elevages (Itelv) , BP 03, Baba Ali, Birtouta, Algeria

³ - Institut Technique des Elevages (Itelv), Unité de Lamtar, Sidi Bel Abbes, Algeria

⁴ - Université de Tizi Ouzou, BP 17 RP, Tizi-Ouzou, Algeria

⁵ - INRA, Station d'Amélioration Génétique des Animaux, BP 52627, 31326 Castanet Tolosan, France

Abstract

The aim of this study was to evaluate the production of a synthetic line (Syn) of rabbits, obtained from the crossbreeding of a well adapted local population (Loc) with a more productive French strain, in comparison with two local populations, one from familial farms (Loc), the other from a public cooperative, called "white" because of its albino phenotype (W). They were placed under the same experimental conditions in 2 rabbitries of ITELV. In Baba Ali (Algiers) 50 does of each genotype were raised during 18 months and In Lamtar (Sidi Bel Abbes), 30 does of the Syn line and Loc population were compared during 16 months. Natural mating was used 10-11 days after parturition. Kits were weaned at 33-35 days. Parameters of reproduction were measured at birth and weaning. In both situations the synthetic line's does were heavier than the other genotypes, (+355g or +421 g and +199g compared respectively with L and W does $P < 0.0001$). The observed litter sizes showed a superiority of the Syn line compared to Loc and W does (+2.5 or +2.15 and +1.9 born alive, $P < 0.0001$ and +1.7 or 1.6 and +1.0 weaned, respectively in comparison with Loc and W populations). There was no genotype x season interactions which changed the genotypes ranking. It means that the synthetic line is as well adapted as local populations to local climatic conditions. So, this comparison confirms the interest of this synthetic line to develop rabbit production in Algeria.

Key words : rabbit synthetic line – local population – reproduction - adaptation – hot climate .

Introduction

In Algeria a local population of rabbit is used since a long time for family production. This population is well adapted to the local conditions especially with a good aptitude to produce in hot conditions, but its adult weight and average productivity are too low (Zerrouki *et al.*, 2005). In order to promote rabbit production in the country, the technical institute for animal production (ITELV) based in Baba Ali near of Algiers, has created a synthetic rabbit line (Syn) since 2003. This line was created with females of the local population (Loc) adapted to produce all the year in the local conditions, and males of a French line heavier and more productive (Gacem and Bolet, 2005 ; Gacem *et al.*, 2008).

Before a large diffusion of this synthetic line to breeders, it was necessary to determine its real advantages if any, in comparison with the rabbit populations available in the country. For this reason a comparison of productivity of the synthetic line with that of the local populations was conducted during more than one year in the breeding facilities of Itelv in 2 localizations : in Baba Ali and in Lamtar. In addition, in Baba Ali centre, rabbits of the so called white population (W) also commercially available in the Tizi Ouzou area, were added in the comparison. This W population described by Zerrouki *et al.* in 2007 was issued from French commercial hybrid rabbits imported 25 year ago and maintained in a state cooperative with sometimes use of males of the Loc population..

The main objective of this communication is to present first results of these comparisons made to control if the synthetic line is effectively heavier and more prolific, and is able to produce all the year around. Some of the results obtained in Baba Ali were still presented during the French rabbit days in November 2009 (Gacem *et al.*, 2009)

Material and methods

The experiments were conducted with matings from November 2007 until May 2009 in Baba Ali and from June 2008 to September 2009 in Lamtar.

The animals

Rabbits of the Syn line were issued of the generation 0 of selection issued of 5 generations of intermingling corresponding to the creation of the line ((Gacem *et al.*, 2008). Rabbits of Loc and W populations were obtained from the state cooperative of Djebba (Tizi Ouzou).

Baba Ali : 50 does and 12 males of each of the 3 genotypes (Syn – Loc and W) were maintained in production during all the experiment with replacement of reproductive animals culled or dead.

Lamtar : 30 does and 8 males of the Syn line and of the Loc population were maintained in production in the same conditions than in Baba Ali.

Housing and feeding conditions

Both sexes were housed in wire mesh cages placed in conventional breeding buildings (mechanical ventilation, pad-cooling system in summer). Does were fed and watered *ad libitum*, but males received only 110 g of pelleted feed per day. Two buildings were used in Baba Ali and only one in Lamtar, but in all cases, number of reproducing animals of each genotype was identical in each building. All rabbits received the same commercial pelleted feed (16.5% proteins, 10.5% crude fibre, 0.6% calcium and 0.6% of phosphorus)

Breeding management

Natural matings were performed only one day each week. Does were first mated when 4.5 to 5 months old and then 10-11 days after each kindling. If a doe refuse the mating within the 5 min following its introduction in male's cage, it was declared non receptive, but stay until the next morning in the cage with the male. In case of negative gestation diagnostic at palpation, does were mated again 14 days after the infertile mating. Does were eliminated after 3 consecutive infertile matings Litter size was determine the day of parturition (born alive and still born) and litter weight was determined for those born alive and for kits leaved with their mother after conditional culling of supernumerary kits (litter size limited to 9 maximum whatever the genotype). Litters were weaned when 33-35 days old, and kits weight individually.

Definition of seasons

Three seasons of 4 month each were defined according to the temperatures observed during theses months

- Beginning of the year : from February until May
- Hot season : from June to September
- End of the year : from October to January.

Statistical analysis

Performances parameters were analysed by variance analysis with SAS statistical software, procedure GLM or Khi² test. Data obtained in Baba Ali were analysed with the fixed effects

of genotype, season of mating, building and does parity (8 levels: 1 to 7 and more than 7). Interactions were calculated for genotype and season. Data obtained in Lamtar were analysed with fixed effects of genotype and season of mating with interactions.

Results and discussion

Data obtained in Baba Ali (comparison of 3 genotypes) (table 1)

Only effects of genotype and season should be presented. The effect of breeding building is frequently significant, but a preliminary study demonstrated that the interaction with genotype was never significant. It means that results are repeatable in the 2 buildings.

Does characteristics

Females of the Syn line were significantly heavier than those of the 2 other genotypes : +355g and +199g in comparison with Loc and W populations ($P < 0.001$). Nevertheless, the difference between Syn and Loc genotypes is smaller than the 500g calculated by Gacem *et al.* (2008) for non contemporary does, as a consequence of a heavier weight of Loc population does in the present study.

Does of the Syn line were significantly less receptive when presented to a male than those of the W population, but receptivity was at the same level than that of the Loc population (64%). The proportion of parturitions for 100 presentations to the male was nevertheless similar for the 3 genotypes: 51.3% on average. In addition it should be pointed out that the proportion of parturitions was better for does which had accepted to mate within the 5 min after presentation *i.e* the receptive does : 74% of fertile matings, with no interaction with genotype.

Table1. Results of the variance analysis of reproduction performances observed in Baba Ali - Mean and (sem)

Parameters	Does characteristics			Litter size			Litter weights (g)		
	Receptivity (%)	Kindlings % of presentations	Does weight at mating (g)	Total born	Born alive ¹	Weaned ²	Individ. at birth	Litter at birth	Individ. at weaning
N° of data	2812	2622	2815	1242	1187	980	1182	1182	5818
Genotype	*	ns	***	***	***	***	***	****	**
Syn line	64,5 ^a (1,7)	51,0 (1,5)	3633 ^a (16)	9,50 ^a (0,14)	8,74 ^a (0,15 ^c)	7,08 ^c (0,12)	54 ^a (0,7)	459 ^a (70)	553 ^a (3)
W popul.	69,2 ^b (1,7)	52,0 (1,4)	3434 ^b (15)	7,42 ^b (0,13)	6,84 ^b (0,14)	6,09 ^b (0,11)	62 ^b (0,6)	409 ^b (7)	554 ^a (4)
Loc popul	64,0 ^a (1,6)	51,0 (1,4)	3278 ^c (14)	6,75 ^c (0,13)	6,23 ^c (0,13)	5,40 ^a (0,11)	61 ^b (0,6)	357 ^c (7)	565 ^b (2)
Mating Season	**	ns	***	ns	ns	ns	*	ns	***
Beginning	62,1 ^a (1,5)	51,4 (1,7)	3508 ^a (13)	8,09 (0,14)	7,30 (0,14)	6,13 (0,14)	58 ^a (0,6)	405 ^a (7)	565 ^a (2,3)
Hot season	66,3 ^{ab} (2,0)	55,0 (1,7)	3471 ^b (18)	7,78 (0,16)	7,21 0,16 (0)	6,22 (0,13)	59 ^{ab} (0,7)	401 ^b (28)	553 ^b (3)
End of year	69,3 ^b (1,0)	55,0 (1,0)	3365 ^c (15)	7,81 (0,14)	7,30 ^b 0,14	6,22± (0,12)	60 ^b (0,6)	418 ^c (7)	534 ^c (4)
Interaction	ns	ns	ns	ns	*	***	ns	**	ns
Parity	***	***	**	***	**	ns	***	***	-

¹ litters with at least 1 born alive

² litters with at least 1 weaned rabbit

* $P < 0,05$ ** $P < 0,01$ *** $P < 0,001$

These results of receptivity and kindling proportion are worse than those previously registered by Zerrouki *et al.* (2005) for the local population (77% and 73.5%) and by Zerrouki *et al.* (2009) for the white population, for receptivity and kindling percentage respectively.

A season effect was observed only for the receptivity level, but there was no significant effect of the season for the kindling proportion or for litter size, a situation which confirms the previous results described by Zerrouki for the 2 populations (2005 and 2009).

The receptivity level was the highest (69.3%) for matings proposed at the end of the year (from October to January), but at a level non significantly better than the 66.3% observed during the hot season (June to September). According to the variance analysis there is no interaction between genotype and season able to modify the genotypes ranking. The significant interactions correspond only to a modification of the amplitude of the differences between genotypes. In other words it means that the synthetic line presents the same adaptation to raising and climatic conditions that the 2 local populations Loc and W.

Litters characteristics

Prolificacy of Syn does is significantly higher than that of the 2 local populations at all stages of control : +2.1 and +2.8 total born, +1.9 and +2.5 born alive, +1.0 and +1.7 weaned in comparison with W and Loc populations respectively. Superiority of Syn does is smaller at weaning than at birth as a consequence of 2 additive factors : a higher mortality between birth and weaning (17% vs 10-11%) and to higher culling of supernumerary kits at birth for Syn litters (1.04/litter) than for W and Loc litters (0.13 and 0.23 respectively). It should be noticed that the rate of mortality between birth and weaning in W population (10%) is slightly higher than the 7% described by Zerrouki *et al.* (2008) for the same population raised in Djelba cooperative some year before.

Individual weight of kits was smaller at weaning for the Syn litters than for the Loc population, most probably in relation with the higher number of kits per litter. For W litters individual weight at weaning was similar to that of the Syn litters despite a smaller litter size.

Season of mating has no effect on litter size at birth or at weaning. A significant effect of season is observed on contrary for individual weight at weaning but hot season is not the worse.

Data obtained in Lamtar (comparison of Syn and Loc genotypes) (table 2)

General results observed in Lamtar were in good accordance with those observed on Baba Ali for the demonstration of higher does live weight and of higher productivity of the Syn line. Nevertheless it must be underlined that percentage of fertility was significantly higher for the Syn line than for the Loc population in Lamtar (table 2) but was similar for both genotypes in Baba Ali (table 1).

In the same line, average individual weight of kits at birth was significantly higher for the Syn genotype (+9% in comparison with Loc population) in Lamtar but the reverse was observed in Baba Ali (-11%).

As in Baba Ali the litter size at birth was more drastically reduced by culling supernumerary kits for the Syn line than for the Loc population : minus 0.64 kits/litter vs 0.05 for the Loc population.

Table 2. Results of the variance analysis of reproduction performances observed in Lamtar - Mean and (sem)

Parameters	Does characteristics			Litter size			Litter weights (g)		
	Receptivity (%)	Kindlings % of presentations	Does weight at mating (g)	Total born	Born alive ¹	Weaned ²	Individ. at birth	Litter at birth	Individ. at weaning
N° of data	503	503	503	275	250	131	250	250	1136
Genotype	ns	**	**	**	**	**	**	**	**
Syn line	67.7 (2,9)	61.9 (2,0)	3569 (25)	9.01 (0.26)	7.49 (0.28)	6.51 (0.21)	49.6 (0.9)	395 (11)	564 (9)
Loc popul	65.8 (3.0)	53.1 (2.9)	3148 (26)	6.48 (0.23)	5.34 (0,27)	4.92 (0.29)	45.4 (1,0)	273 (11)	622 (9)
Mating Season	**	**	**	**	**	**	*	*	**
Beginning	61.3a (4,5)	52.9a (3,7)	3350ab (37)	8.17ab (0.43)	7.37a (0.43)	6.35a (0.33)	48.5a (1.1)	384a (15)	614a (13)
Hot season	76.9b (2,8)	67.3b (3.9)	3424b (31)	7.42a (0.23)	6.12b (0.27)	5.52b (0.30)	48.4a (1.0)	326b (13)	619a (10)
End of year	56.1a (4,0)	47.1a (2,2)	3292a (36)	8.75b (0.42)	6.81c (0.44)	6.18a (0.30)	46.1b (1,1)	344ab (19)	519b (15)
Interaction	ns	**	**	ns	ns	ns	ns	*	*

In Lamtar, results obtained during the hot season were the best for receptivity, fertility and does weight. But they were the worse for prolificacy at birth as at weaning. The interactions, when significant, only underlined the variations of amplitude of the differences between the 2 genotypes, but in no cases it corresponded to an inversion of ranking.

Conclusions

These 2 experiments confirmed the interest of the synthetic line for rabbit production in Algeria. The target of the creation of a new rabbit line able to breed all the year long in Algeria and to be more productive than the populations locally available, was clearly reached, and diffusion of the line could be now recommended.

In the Lamtar conditions, the percentage of kindling was better than in Baba Ali for the synthetic line but not for the local population. This demonstrates that some improvement of these criteria is possible by control of the environment. It is not certain that the synthetic line has expressed all its possibilities due to non optimum experimental and environmental conditions. For example in both situations the number of kits leaved to the mother after birth was reduced artificially. In the future it could be interesting to increase the acceptable litter size above which the supernumerary kits should be culled or adopted by another doe. Nevertheless an improvement of results could be expected only if the general environment of rabbit does and kits could also be improved. One of the first improvements could be searched in the use of better balanced pellet feeds without calcium or fibre deficiency as it was observed in the commercial diet available during this study.

Acknowledgements

The authors wish the thanks the technical workers of the 2 experimental units for their valuable contribution to the experiment. They wish also to thank the director of the Djebbla cooperative for his valuable collaboration.

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Comparison of reproduction performances of a rabbit synthetic line and of rabbits of local populations in Algeria, in 2 breeding locations

First results

by

LEBAS François, Cuniculture Assoc. France
GACEM Malika, MEFTAH Ibtissem, ITELV Baba Ali & Lamtar Algeria
ZERROUKI Nacera, University Tizi-Ouzou Algeria
BOLET Gérard, INRA Toulouse France

THE SYNTHETIC LINE

According to the conclusions of the thesis work of Zerrouki on the local population available in Algeria (2006) this local population appears to be able

- to produce regularly all the year long
- but litter size and adult weight were too low (5-6 kits/ litter – 2.8-3.0 kg)

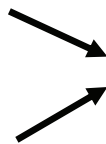
Then it was decided to improve rabbits available for breeders in Algeria through the **creation of synthetic line** made from a mix between the local population (*able to produce even in hot season*) and a selected line imported only once at the creation of the synthetic line (*higher prolificacy and heavier animals*)



Does of the local population



Semen of a French synthetic line (Inra 2066 x linea Verde)



Creation of an Algerian synthetic line – 5 generations for stabilization (Gacem *et al.*, 2008)

After the stage of stabilization of the synthetic line, it was decided to compare during more than one year, the reproductive performance of rabbits of this line (**SYN**) with performance of other rabbit populations available in Algeria,.

Two populations were identified

- The local population used for the creation of the synthetic line (**LOC**)
- A “white” albino population (**W**) issued of a mix between French hybrid rabbits imported in Algeria 25 year ago and some rabbits of the local population. This W population is maintained in a state cooperative in Djebba near of Tizi-Ouzou (100 km east of Algiers)

Both populations were known to be able to produced all the year long, including the hot season (Zerrouki *et al.*, 2008), as it was targeted for the SYN genotype

According to the ITELV experimental facilities available for the comparison,

- 3 genotypes were compared in Baba Ali : SYN – LOC and W
- 2 genotypes were compared in Lamtar : SYN and LOC

Location of the 2 experimental units

Baba Ali : 3 genotypes (SYN – LOC – W) does mating from Nov. 2007 to May 2009
Lamtar : 2 genotypes (SYN – LOC) does mating from June 2008 to Sept. 2009



Experimental general management

- Natural mating, only one day per week. First time at 4.5 -5.0 month of age
- Mating 10-11 days after kindling
- Weaning at 33-35 days
- Gestation diagnostic by palpation, new mating 14 days after an infertile one
- Culling of supernumerary kits above 9 alive at birth

- a commercial pelleted feed + water, both ad libitum
- rabbits in wire mesh cages placed in buildings
- buildings have a controlled ventilation and pad-cooling systems

- 50 does + 12 males / genotype in Baba Ali

- 30 does + 8 males / genotype in Lamtar

In both locations dead or culled does were replaced in order to maintain the experimental does number quite constant

Results obtained in Baba Ali with the 3 genotypes AVERAGE PERFORMANCES

Genotype	SYNthetic line	White population	LOCal population
Does weight g	3633 a	3434 b	3278 c
Receptivity (%)	64.5 b	69,2 a	64.0 b
Fertility (%)	51.0	52.0	51.0

**Results obtained in Baba Ali with the 3 genotypes
AVERAGE PERFORMANCES**

Genotype	SYNthetic line	White population	LOCal population
Does weight g	3633 a	3434 b	3278 c
Receptivity (%)	64.5 b	69,2 a	64.0 b
Fertility (%)	51.0	52.0	51.0
Total born / litter	9.50 a	7,42 b	6,75 c
Born alive / litter	8,74 a	6,84 b	6,23 c
Weaned /weaning	7,08 a	6,09 b	5,45 c

**Results obtained in Baba Ali with the 3 genotypes
AVERAGE PERFORMANCES**

Genotype	SYNthetic line	White population	LOCal population
Does weight g	3633 a	3434 b	3278 c
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Fertility (%)	51.0	52.0	51.0
Total born / litter	9.50 a	7,42 b	6,75 c
Born alive / litter	8,74 a	6,84 b	6,23 c
Weaned /weaning	7,08 a	6,09 b	5,45 c
Birth indiv. weight g	54 b	62 a	61 a
Weaning indiv.weight g	553 b	554 b	565 a

Results obtained in Baba Ali with the 3 genotypes

Effect of the season of mating

A year was arbitrary divided in 3 seasons of 4 month

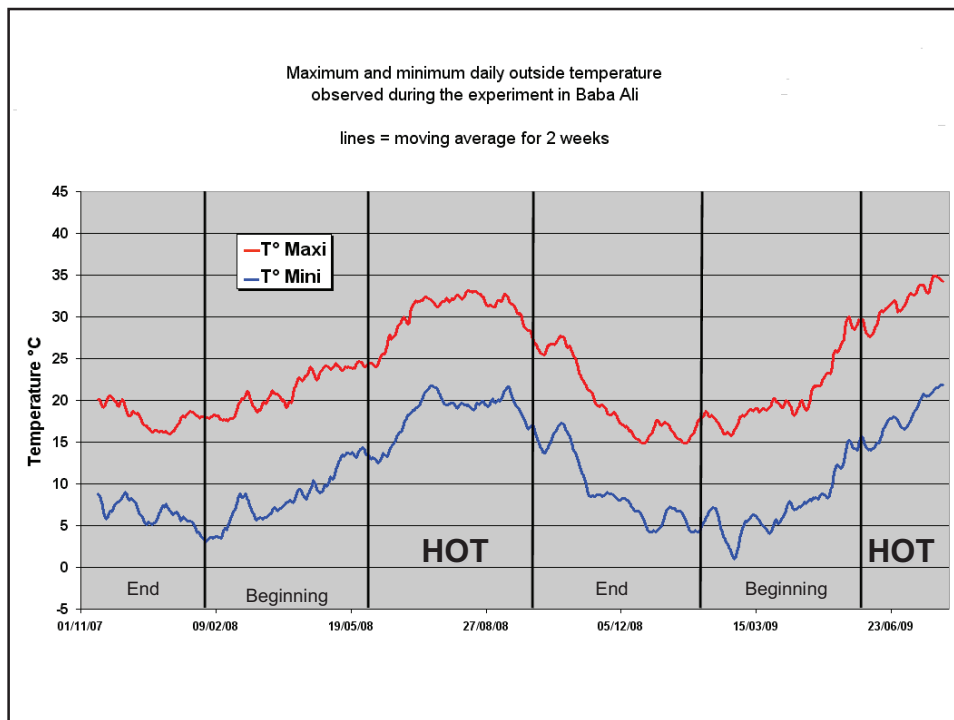
☐ February => May : **beginning of the year**

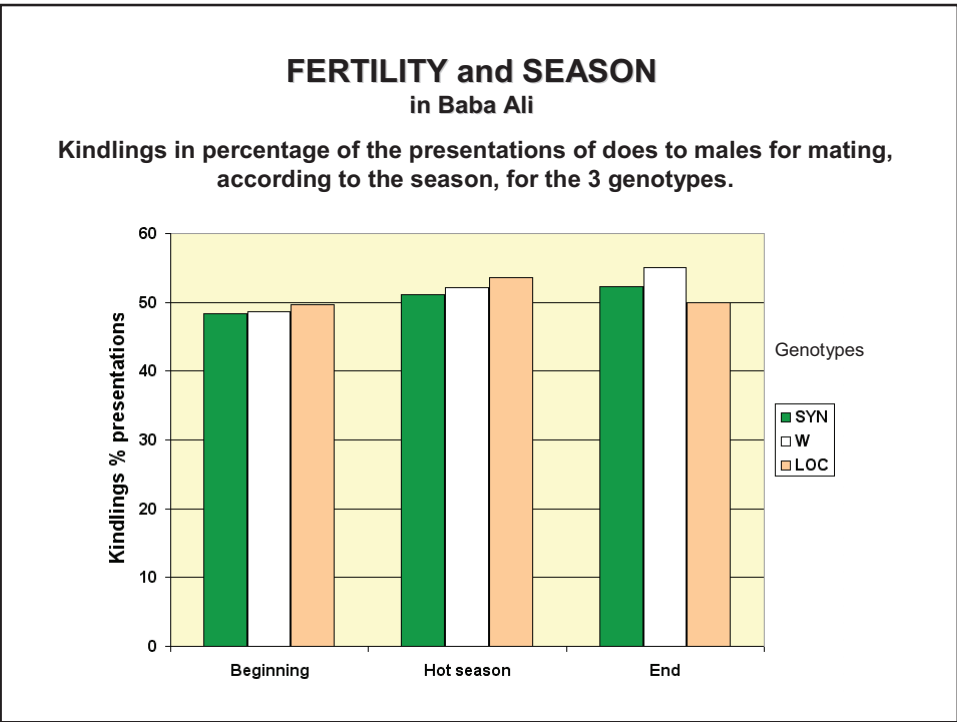
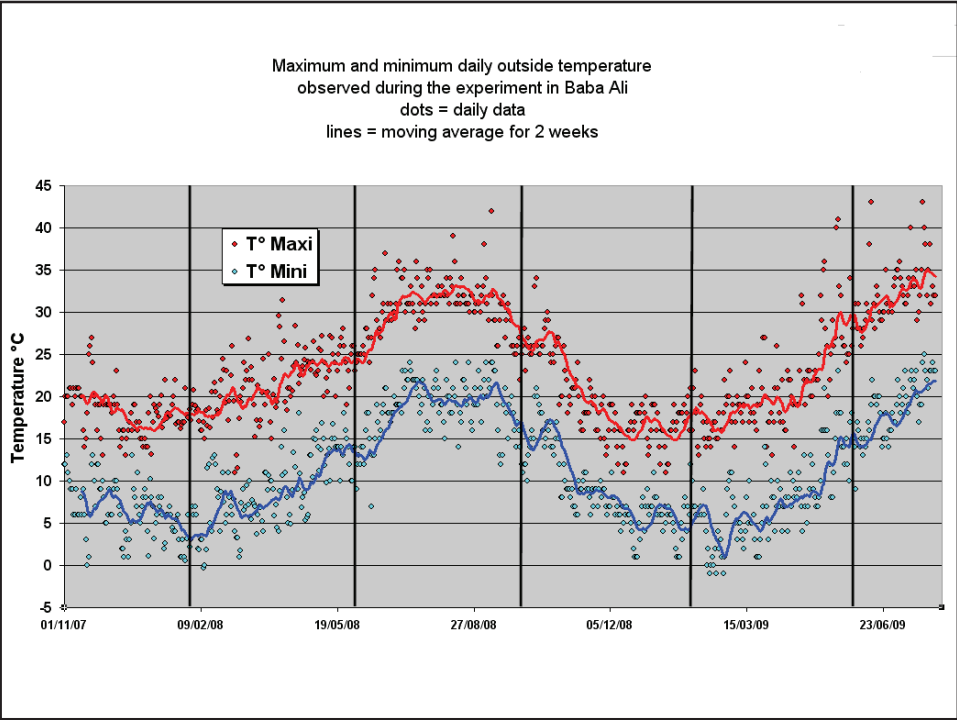
☐ June => September : **hot season**

☐ October => January : **end of the year**

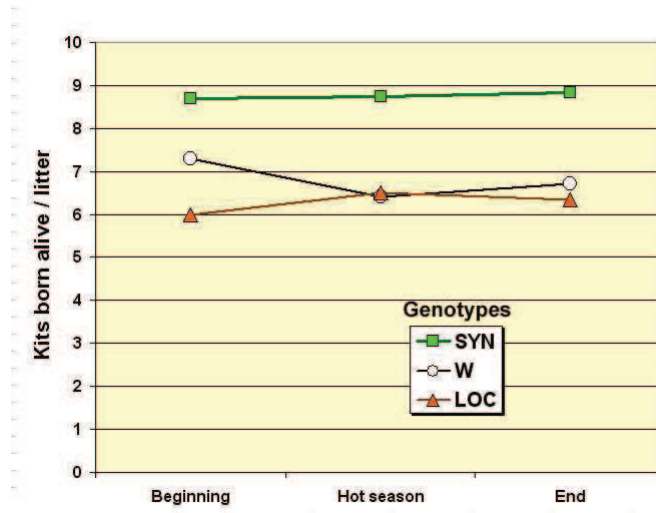
Temperatures observed in Baba Ali

Average temperature	Beginning of year	HOT season	End of year
Maxi (°C)	21.3	31.1	18.9
Mini (°C)	8.4	18.6	7.8

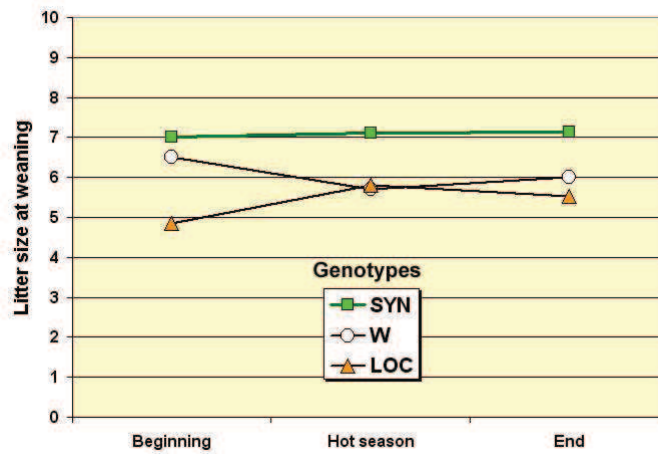




PROLIFICACY at birth and SEASON in Baba Ali



PROLIFICACY at weaning and SEASON in Baba Ali



**Results obtained in LAMTAR with the 2 genotypes
AVERAGE PERFORMANCES**

Genotype	SYNthetic line	LOCaI population
Does weight g	3569 a	3148 b
Receptivity (%)	67.7	65.8
Fertility (%)	61.9 a	53.1 b

**Results obtained in LAMTAR with the 2 genotypes
AVERAGE PERFORMANCES**

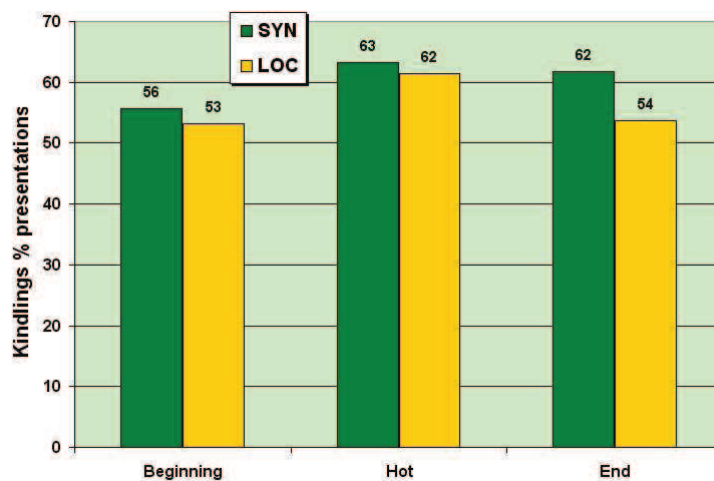
Genotype	SYNthetic line	LOCaI population
Does weight g	3569 a	3148 b
Receptivity (%)	67.7	65.8
Fertility (%)	61.9 a	53.1 b
Total born / litter	9.01 a	6,75 b
Born alive / litter	7.49 a	5.34 b
Weaned /weaning	6.51 a	4.92 b

**Results obtained in LAMTAR with the 2 genotypes
AVERAGE PERFORMANCES**

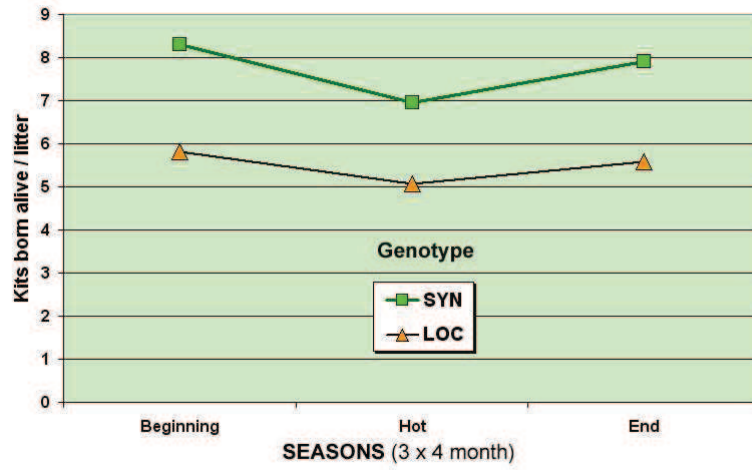
Genotype	SYNthetic line	LOCal population
Does weight g	3569 a	3148 b
Receptivity (%)	67.7	65.8
Fertility (%)	61.9 a	53.1 b
Total born / litter	9.01 a	6,75 b
Born alive / litter	7.49 a	5.34 b
Weaned /weaning	6.51 a	4.92 b
Birth indiv. weight g	49.6 a	45.4 b
Weaning indiv.weight g	564 b	622 a

**FERTILITY and SEASON
in Lamtar**

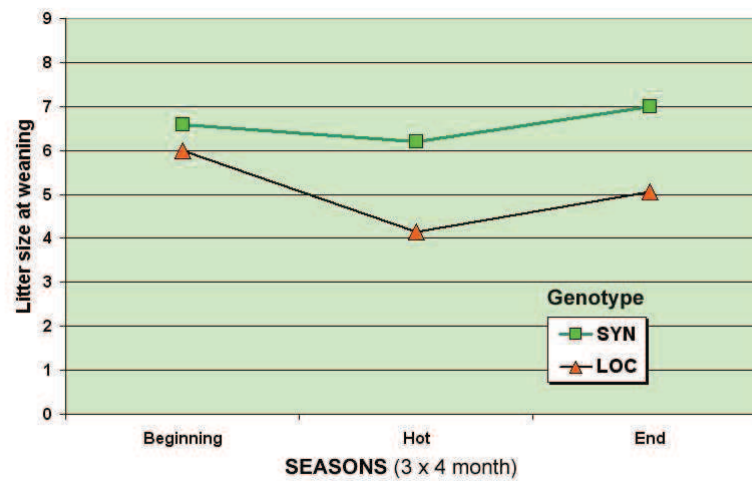
Kindlings in percentage of the presentations of does to males for mating,
according to the season, for the 2 genotypes.



PROLIFICACY at birth and SEASON in Lamtar



PROLIFICACY at weaning and SEASON in Lamtar



Conclusion

Performance registered of the 2 populations are in accordance with results previously published for these populations

As expected

- Rabbits of the synthetic line are heavier than rabbits of the 2 local populations
- Reproduction efficiency is not affected by the season more for the synthetic line than for the 2 other populations
- the synthetic line produces more rabbits per time unit than the 2 other genotypes, as result of a good combination fertility x prolificacy

Nevertheless, it must be pointed out that the comparisons were made in buildings with artificial ventilation and cooling system during the hot season.

*Thanks
for your attention*



Rabbits of the synthetic line

