

SOME ASPECTS OF THE DEMOGRAPHIC STRUCTURE  
OF THE FRENCH ANGORA RABBIT BREED

Rochambeau H. de (1), Thebault R.G. (2), Loyer G.(1)

- (1) INRA - SAGA - BP 27 - 31326 CASTANET TOLOSAN CEDEX, France.  
(2) INRA - URLAF - Le Magneraud BP 52 - 17700 SURGERES, France.

INTRODUCTION

World Angora rabbit wool production was around 9000 t in 1986. China was producing a great part of the amount. In France 200 t were produced by 2000 breeders in 1987. Further informations were given by Rougeot and Thebault (1984).

In 1956 a herd book was created in France, it is the only herd book we have for rabbit breeds. Its name is "Angora Rabbit Book de France" ! (ARBF). One year later a syndicate was created to manage the herd book ("Syndicat National Angora Qualité" : SNAQ). Technical assistance is given to breeders by the SNAQ. Number of breeders who were in the SNAQ increased very quickly after 1984 (1962 : 250 ; 1984 : 314 ; 1985 : 617 ; 1987 : 904). The SNAQ has also a commercial duty. Further informations were given by Rouiller and Rive (1983) and by Rougeot and Thebault (1984).

We have studied data collected by the herd book between 1980 and 1984.

COLLECTED DATA

For each litter, breeders send a litter registration to the herd book. Buck and doe numbers, birth date, numbers of young bucks and does kept alive at birth are collected on the birth registration. Before the 4th wool harvest rabbits are scored by a technician of the herd book. Rabbits which have a bad type, a low wool production, a bad wool quality are not scored. All scored rabbits are registered in the herd book. For rabbit type 20 points are given, for wool weight 40 points are given, for wool quality 40 points are given. As only good rabbits are scored, scoring mark goes from 80 to 87 (Rochais, 1985).

After each wool harvest, date of harvest, total wool weight are collected on a record card. On this card there are also rabbit number, dam and

sire numbers with their scoring marks and rabbit scoring mark. Twenty wool harvests could be registered on the record card. Each year rabbit numbers of rabbits which were sold or cased are registered on the herd inventory. Herd removal registrations are given by this inventory. 9172 litter registrations, 30501 score registrations, 27647 lines from record cards (in one line, there are four wool harvests), 38316 herd removal registrations were used. From these four data files, a new data file was made. There was one line for each rabbit with : rabbit number, herd number (or numbers if rabbit was sold), sex, birth date, sire number, dam number with their scoring marks, rabbit scoring mark (total and various marks), removal year, number of brothers and sisters in the litter. In this data file there was 24100 lines. Then our sample is made by 24100 scored rabbits. It is a skewed sample. In one herd you will find scored rabbits which produce wool, and which are used for breeding, and no scored rabbits, which are not cused for breeding. Percentage of scored rabbit in one herd is unknown.

#### HERD DESCRIPTION

Number of herds in the ARBF increased very quickly after 1983. There was 56 "working" herds in 1980, 176 in 1983 and 362 in 1984. One rabbit was at least scored per annum in a "working" herd. "Maine et Loire" department was the first department for Angora breeding in 1984 (Figure 1). Most of the herds are in the west part of France, but there is at least one herd of the ARBF in 53 departments.

In the same time herd activity increased. 2602 young does were registered at birth in 1980 ; 7132 young does were registered at birth in 1984 (Figure 2). One can see that spring is the first birth season. There are only a few births in the end of summer and the beginning of autumn.

In 1984, 9839 scored rabbits were registered at birth in 334 herds. 206 herds have used only sires and dams bred in another herd. Sires and dams of the 84's cohort came from 155 herds. In some of them no litter registration was made in 1984. 97 herds gave sires and dams, 2 gave only sires and 56 only dams. 47 herds gave more than 50 dams and/or 50 sires. In this sample, 31 herds have bought majority of their sires and some of their dams outside. 6 herds have bought majority of their sires and dams outside. 10 herds have bought nothing outside. As Robertson (1953), a numerical description of breed structure was done. Let N be number of herds which have

given sires and  $n_i$  be number of sires given by herd (i). Let  $C_S$  be probability that two rabbits randomly sampled have a sire which came from the same herd.

$$C_S = \frac{\sum_i \left( \frac{n_i (n_i - 1)}{2} \right)}{\frac{(\sum_i n_i) (\sum_i (n_i - 1))}{2}}$$

$H_S = \frac{1}{C_S}$  is the sire herd effective number.

Similarly,  $C_D$  and  $H_D$  are dam probability and dam herd effective number. From the 84'S cohort we have :  $C_S=0.031$   $H_S=32$   $C_D=0.023$   $H_D=44$ .

Thus contributions of various herds are greatly unequal. As often the breed structure was pyramidal. At the top, a few tens of herds sell bucks and does to the whole population. Between these herds, there was intensive exchanges of bucks. At the base, a lot of new herds had bought all their breeding rabbits. Further studies are needed to state the breed structure more precisely. 1984 was a year of great expansion. One can think that the breed structure is also going to change.

#### RABBIT POPULATION

Age structure and life table will not be presented for two reasons : (i) the population of scored rabbits is a skewed sample (cf Supra) (ii) removal registrations are not reliable.

We will describe the reproductive life of the rabbits bred in 1980.

French Angora does produce more wool than bucks (1.2 Kg per annum versus 0.85 Kg). Angora rabbit breeding is a specialized business. Breeders are not at all interested in meat production : all the bucks, except a few retained for reproduction or sale, are killed at birth. In a 100 rabbits herd, it is necessary to produce each year between 25 and 30 young rabbits. That is to say that in a stationary size herd, 10 does doing 2 litters per annum, with 1.5 rabbits per litter are sufficient. So the reproductive population is a small part of the herd. However between 1980 and 1984, French Angora breed size was increasing. Some old herds had more reproductive rabbits to produce rabbits for sale. Some new herds had more

reproductive rabbits to increase herd size. 98 bucks and 678 does of the 80's cohort have done at least one litter in a herd of the ARBF. 98 bucks that is to say 32 % of the scored bucks of the cohort. 678 does, that is to say 37% of the scored does of the cohort.

Reproductive life begun later for Angora rabbits than for meat rabbits. Mean age is around 19 months for bucks and 21 months for does (figure 3). However it is possible to go down. In the INRA experimental herd (Thebault et al., 1988) the mean age for does is around 12 months. In our sample, 12% of the does have begun their reproductive life before 12 months. Angora rabbits produce wool during 3 or 4 years.

Reproductive life is shorter than productive life. Mean reproductive life is 13 months for bucks and 8 for does (figure 4). For one rabbit, reproductive life is calculated from the birth date of its first litter to the birth date of its last litter. 20 % of reproductive bucks and 33 % of reproductive does have made only one litter. The mean litters number is 8.6 for reproductive bucks and 1.8 for reproductive does. The does mean number is 2.1 in the INRA experimental herd (Thebault et al., 1988). For does the mean birth interval is 8 months. 85% of intervals are less than 12 months.

Definition of some demographic parameters was given by Vu Tien Khang (1983). For an arbitrary number of rabbits (root of the table, often  $10^3$ ), we gave : numbers of young rabbits kept alive at birth between two anniversaries  $n'(x_{1x+1})$ , cumulated numbers of young rabbits ( $D'_x$ ), cumulated number of young does kept alive at birth. These parameters included mortality. As we cannot estimate mortality rate, it will not be possible to estimate reproductive rate.

We did not find such parameters in bibliography for Angora rabbits except in the paper of Thebault et al. (1988). Along the dam-dam way 26% of does are bred before 2 years and 70 % before 3 years. Along the sire-sire way, 13 % of bucks are bred before 2 years, 58 % before 3 years and 89 % before 4 years. Thus generation lengths are larger than those of meat rabbits (table 3). We estimate generation lengths along the four way as the mean age of reproductive of one sex at birth of the mean descendant. First estimation was given considering reproductive from 80's cohort and their descendants from 84's cohort and their sires and dams. The mean generation length was respectively 26.6 months and 21.7 months for the two estimations. Reduction of generation length between 1980 and 1984 indicate the speeding up of reproduction.

#### INBREEDING

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Inbreeding was estimated on a sample of 401 rabbits bred in 1984. Number of generations known for each rabbits was low (between 1 and 4). Inbreeding coefficient is defined as probability to have two identical gene at one locus. 89 % of inbreeding coefficients are equal to 0.3 % are between 0 and 0.0625. The mean value is 0.0108. 8 % of inbreeding coefficients are greater than 0.0625. Were it breeding errors or specific breeding strategies ?

#### CONCLUSIONS

ARBF is the only herd book we have in France for a rabbit breed. Between 1950 and 1980 wool weight produced per doe and per annum was multiplied by two (Rougeot and Thebault, 1984). French Angora rabbits have a specific kind of fleece with well differentiated guard hair (Rougeot 1986). Even if all this progress is not genetic, ARBF have done a good job since 1956. Today ARBF registrations give us picture of the Angora breed genetic structure. Others investigations are needed on these topics. From these results a new breeding strategy will be defined soon.

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Table 1 - Crude fecundity table of does bred in 1980  
(1838 scored does ; 678 reproductive does ; table root is 100)

Age (year)		1	2	3	4	5
1 0 0 S c o r e d o o s	Number of young rabbits kept alive at birth	0	39	65	39	11
	Cumulated number of young rabbits	0	39	104	143	154
	Number of young does kept alive at birth	0	33	55	30	7
	Cumulated number of young does kept alive at birth	0	33	88	118	125

Table 2 - Crude fecundity table of bucks in 1980  
(310 scored bucks ; 98 reproductive bucks ; table root is 100)

Age (year)		1	2	3	4	5
1 0 0 S c o r e d b u c k s	Number of young rabbits kept alive at birth	2	102	303	181	85
	Cumulated number of young rabbits	2	104	407	588	673
	Number of young bucks kept alive at birth	0	19	66	45	16
	Cumulated number of young bucks kept alive at birth	0	19	85	130	146

Table 3 - Generation lengths along the four ways estimated between sires and dams in 1980 and their lineage and between youngs rabbits bred in 1984 and theirs sires and dams.

Generation lengths in month	Sire		Dam		Mean
	Sire	Dam	Sire	Dam	
1980 cohort	27.0	26.6	27.8	25.1	26.6
1984 cohort	22.7	23.2	20.6	20.1	21.7

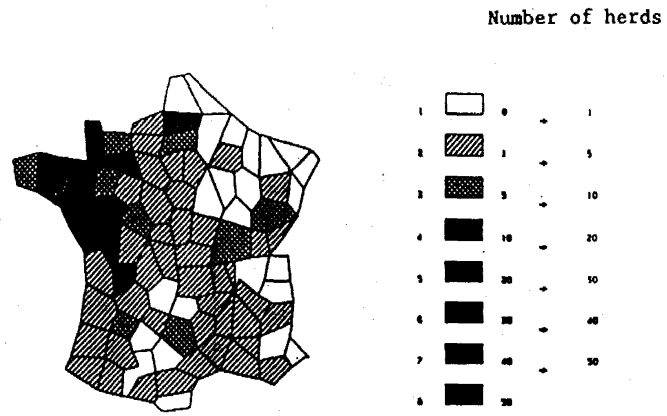
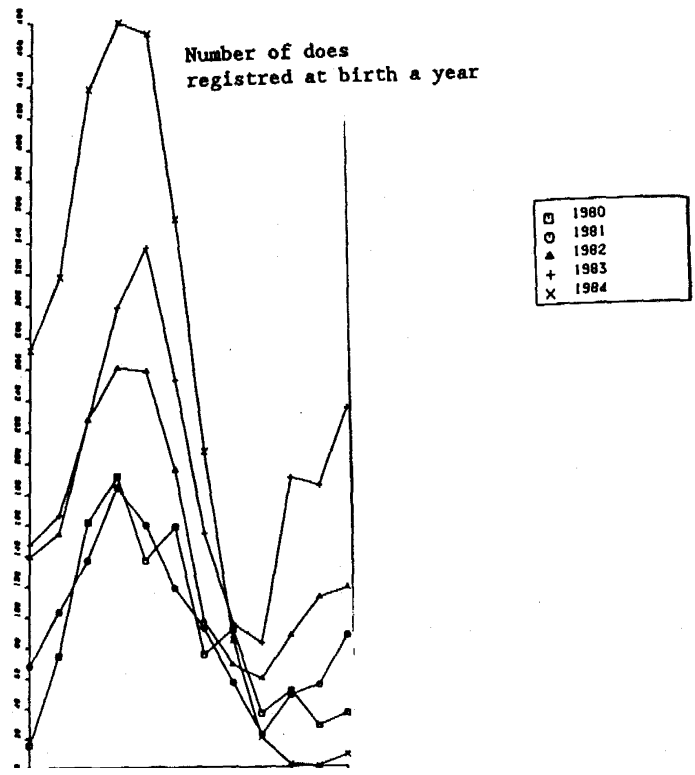


Figure 1 - Number of herds ARBF by department



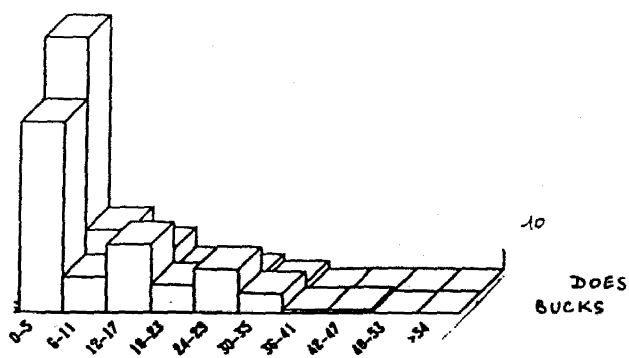


Figure 3 - Age at birth of the first litter of bucks and does born in 1984

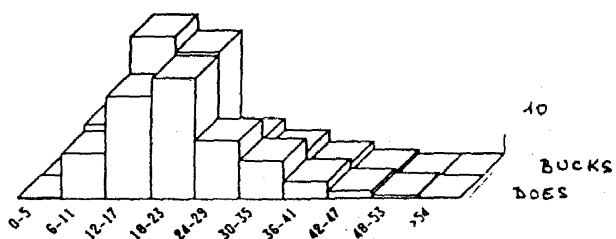


Figure 4 - Mean reproduction life of bucks and does born in 1984



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We studied all the data collected by the "Angora Rabbit Book de France" between 1980 and 1984. For each litter the breeder writes a birth registration. Just before the 4th wool yield, each rabbit is scored. The breeder collects the data of each wool yield on a record card. We studied the population of the scored rabbits. Between 1980 and 1984, the number of the working herds grows from 56 to 362. The fathers of the rabbits born in 1984 come from 99 herds. Nevertheless the herd effective number is only 32. We do a survey of the reproductive life of the scored rabbits bred in 1980. The mean age at the beginning of the reproduction life is 19 months for the bucks and 21 months for the does. 68 % of the scored bucks and 63 % of the scored does do not breed in the herds of our sample. The mean reproduction life is around 13 months for the bucks and 8 months for the does. 20 % of the bucks and 33 % of the does have only one litter. The mean number of litters during the reproduction life is 8,6 for the bucks and 1.8 for the does. The generation length between the rabbits bred in 1980 and their lineage is 27 months.

ELEMENTS DE DESCRIPTION DEMOGRAPHIQUE D'UNE  
POPULATION DE LAPINS ANGORA FRANCAIS

Le fichier comprend l'ensemble des informations recueillies par l'"Angora Rabbit Book de France" entre 1980 et 1984. Lors de la naissance d'une portée l'éleveur établit une déclaration de mise bas. Chaque lapin est ensuite pointé au moment de la 4ème récolte. L'éleveur note enfin chaque récolte sur la fiche animal. La population que nous avons étudiée est celle des lapins pointés. Entre 1980 et 1984, le nombre d'élevages actifs est passé de 56 à 362. Les pères des animaux nés en 1984 sont issus de 99 élevages. Le nombre efficace d'élevages qui ont fourni des pères est seulement de 32. Nous décrivons ensuite la carrière reproductive des animaux nés en 1980 et pointés. L'âge moyen à la mise à la reproduction est de 19 mois pour les mâles et de 21 mois pour les femelles. Cependant 68 % des mâles et 63 % des femelles ne reproduisent pas dans les élevages de notre échantillon. La vie reproductive dure en moyenne 13 mois pour les mâles et 8 mois pour les femelles. Si 20 % des mâles et 33 % des femelles ne font qu'une portée, les mâles et les femelles qui ont reproduit font en moyenne respectivement 8,6 et 1,8 portées. L'intervalle de générations calculé entre les parents de la cohorte 1980 et leurs descendants est de 27 mois.

