

PRODUCTION SYSTEM AND TECHNICAL IMPROVEMENT OF RABBIT BREEDING IN CUBA

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Abstract - Rabbit Breeding in Cuba has diversified its productive sectors at expense of the state specialized enterprise with remarkable increase of private farmer and family producers. The specialized sector counts with 10000 dams and productions of 500 metric tons/year. A minimum of 502,230 rabbits is estimated as total population. A semi-intensive reproduction system is commonly practised, while final live weight of 1.7-2.0 kg at 90-110 days is obtained in combined feeding systems. Selection for growth traits is practised in genetic units and F1 are used for meat production and to reproduce hybrid dams. In 1993 the Hemoragic Viral Disease of Rabbits appeared in three provinces which was eradicated in 1994.

INTRODUCTION

Thirty years ago the rabbit was only used in backyard rearing at a limited extent and it was not included in the consumption habits of the population. However, after 1965 with the beginning of a state development of specialized enterprises at a national scale this situation changed.

At this moment rabbit rearing in Cuba is beginning to be considered as an important alternative to overcome protein deficit for human nutrition. This conception is based on the facilities of its rearing including urban and suburban conditions, taking into account its high biological potential for reproduction, limited vital space, easiness and utility of recycling manure and its ample nutritional spectrum.

The availability of rabbit meat as a nutritional alternative in inexpensive restaurants also propitiated a favourable attitude towards consumption habits and it is now a well accepted dish by the different sectors of the population.

A brief review of the production system and applied research work in Cuba for the last thirty years will be the aim of this paper.

PRODUCTION LEVEL AND ORGANISATION

Parallel with the small and disseminated backyard rearing, large units of 600 to 4000 does were created in 1965 in different regions of the country for the specialized enterprises, first at a national and afterwards with a provincial organization. More recently (1983-1985), different types of state enterprises are being incorporated to this massive production as agricultural enterprises, military farms and sugar cane enterprises.

This great concentration of animals showed various drawbacks, but allowed the development of specialized technical staff as well as the factibility of organizing genetic projects and preventive and therapeutical health programs at a large scale, which could be considered as a modest contribution to rabbit breeding in tropical countries.

Special period conditions (1992-1993) imposed the need of decentralizing the large specialized enterprises subordinating the majority of the individual commercial units to the territorial state government and reserving only the genetic and multiplication strata. This step consequently altered the feeding system of commercial units from conventional pelletized-concentrates to non conventional locally produced rations.

Remaining as a subutilized species with productions of the specialized sector of 500 metric tons per year, a rapid expansion of the species is taking place with the characteristic of a substantial reduction in the specialized

sector from 25000 to 10000 does and an increase in other state sectors as well as in co-operatives of private farmers and independent farmers. More recently (1991) a phenomenon due to the special period is the rapid proliferation of urban and suburban rearings which is taking place. Hence, after a census applied for the control of the Viral Hemorrhagic Disease of the Rabbit in 1993, a total of 23,558 rabbits were shown to be raised by families in the urban territories of the Havana City Province in which almost 4000 owners were involved as informed by veterinary authorities (Alfonso Pers. comm). A total of 502,258 rabbits were controlled in the country during the disease (TOLEDO *et al.*, 1995) which could be a minimum estimate of the rabbit population. It is becoming strictly necessary to include this species in the periodical census undertaken by the Ministry of Agriculture and to include some information of the production attained in order to appreciate the real contribution of the species to the economical development of the country.

Since 1995 a new form of production is being generated after which the Rabbit Enterprise of Havana contracts part of the private production and offers producers facilities for acquiring concentrates, breeding stock, rearing utensils and veterinary assistance. Hence, private production is stimulated which in turn is considered more efficient in food conversion and mortality than state producers. In this way production would more rapidly meet with the demands of the tourist industry. Only in two provinces a total of 284 private producers are enrolled 2005 with does in the first semester of execution of the contracts, which presumably would be extended to other provinces during the present year.

In addition different projects are been accomplished by the territorial government (municipalities and provinces) throughout the country with the co-operation of technicians of the Ministry of Agriculture and research workers, to give an impulse to the integrated rearing of diverse animal species in small and medium

scale by private and state owners. The objective is, in first place to cover the requirement of the worker's restaurant and to reanimate the sales of animal protein in the territories.

REPRODUCTION SYSTEMS

Extensive reproduction systems with weaning at 45 days of age and the following mating a week later were employed during the 60'S. Here only 3.5-4 kindlings and 8 animals/doe/year were obtained in commercial units. Afterwards (1975-1992) weaning at 35 days and mating 12 days after kindling were put into practice with success, attaining 6-6.2 kindling/doe/year.

Difficulties due to the special period related with the availability of concentrates lead to slight variations of this system by which does with litters larger than 5 animals would be bred after the 25th day post-partum and weaning will be done at 45 days. Hence a reduction of mortality at the post-weaning stage has been attained due to the increase in individual weight in large litters (more than 750 g) which is necessary to resist stress and frequent feed variations.

Each two months fertility of the males is analysed to eliminate those of inferior performances which generally have less than 50-55 % fertility. Does which do not get pregnant for three consecutive matings are also culled.

At the same time studies in reproductive traits of the males are studied at the "Centro de Investigacion para el Mejoramiento Animal". Characterization of semen traits in the Semigiant White breed and variation due to season and age (RODRIGUEZ, DUVERGER, ELIAS, RODRIGUEZ, MILANES, BARBA, 1990) have allowed to organize a sire evaluation system having as selection criterium live spermatic concentration, considering as apt for use those with 1×10^6 sp/eyaculate. This is met by 70-75 % of the males tested while 9 % are considered on the border line and 20 % are definitively culled and do not pass to the reproduction category. These studies area now in progress aiming to analyse all breeds and to include artificial insemination as a routine task to magnify the genetic improvement in the selection for growth and prolificacy.

FEEDING

A combined concentrate : forage (40:60) feeding system is utilized in the specialized enterprises which does not meet with rabbit requirements. The concentrate is pelletized with a protein content of 16-17 %, 10-11 % of crude fiber and estimates of 9.5-9.8 M) of digestible energy. This concentrate is rationed to 70-90 g/animal/day

during fattening and to 150-200 g/doe/day while lactating. These low levels of consumption could explain the poor performance indicators obtained in reproduction and growth traits.

Different forages are used by commercial producers. Up to the 70's, alfalfa (*Medicago sativa*) and ramié (*Bohemeria nivea*) were extensively used but posteriorly searching for more production/ha king grass (*Pennisetum prupureum*) and bermuda grass (*Cynodon dactylon*) were introduced in state rabbitries with suboptimal results. Much better performances have been obtained with the legume glycine (*Neonotonia wightii*) which is the plant preferred by small holden rabbit producers.

Non conventional rations produced with local products and presented as dry meals or pastes using mixtures with 30-40 % of molasses are prepared in most rabbitries as pelletized food is of access only for the specialized enterprise and contracted breeders. For this purpose sugar cane and its by products are playing an important role in rabbit production.

Research work in nutritional aspects started at the Institute of Animal Science between 1967-1973 searching for complete diets with inclusion of tropical dehydrated grasses or legume forages (ANON, 1970, 1972).

The utilization of saccharina (solid state fermentation of ground sugar cane) by rabbits in diets presented in different physical formes is described by MARTINEZ (1990), and PONCE DE LEON *et al.* (1995). The use of molasses, sugar cane juice and sugar cane chunks is referred to by PEREZ (1990).

Different potential feeding products of regional or local access are the object of research and extension programs as dehydrated citrus pulp, rice bran, soybean meal, diverse legumes plants used as beans and forages, as well as some fibrous by products, which are included in projects subject to financial support.

A computer program to determine the nutritional balance of rations including dry products and forages for non conventional diets is now in progress which would aid to solve the complexities of the combined feeding system.

GENETIC IMPROVEMENT

Genetic improvement requires of large scale projects to be effective, so special reference to the breeding program of the state enterprise will be made. This enterprise has a pyramidal structure with a genetic unit with a total capacity of 2 500 dams where selection and maintenance of pure breeds, as well as some research work is done.

At a multiplication level, expansion of maternal lines and production of F1 dams takes place. The commercial level now is supported by private and non specialized state farms which work either with pure-breeds of their preference or with high producing hybrids which are obtained from the superior strata. Individual controls exist in all the specialized units which include genealogical and productive data (reproductive and growth traits).

A group of pure breeds are maintained in the genetic units which are : California, New Zealand White, Chinchilla, Semigiant White, Caoba and White Giant. The name Semigiant was adopted for the descendants of an importation of White Giant (1965) which after some generations in Cuba showed a reduction in size to 3.5-4 kg of adult weight. For many years 90 % the genetic stock corresponded to this breed and it now constitutes the initial maternal line for crossbreeding. The Caoba breed is a synthetic line of recent formation (PONCE DE LEON, GUZMAN, LOPEZ, PUBILLONES, 1992 a) obtained by absorption of New Zealand Red females to the Flemish Giant (Sandy coloration). A very attractive reddish-sandy coloration was fixed in this breed with size and performance similar to other medium size breeds. Reproduction and growth performance of pure breeds in restricted rations appear in Table 1. To avoid inbreeding, a rotational mating system of four subpopulations of each breed is practised.

Genetic improvement from abroad and a renewal in variability is also achieved by small but periodical importations by which Giant Whites, N.Zealands and California were acquired in 1984, and recently (1994), Chinchilla and Flemish Giant were introduced by the action of the Church Council. For these breeds special projects of multiplication and introduction to the "native" stocks were prepared.

Table 1 : Performance of pure breeds in genetic units of the rabbit interprise

	Fertility %	Number born alive	Number weaned	Daily gain, g/day	Final weight, g
Semigiant	82 ± 3	5.7 ± 0.2	3.7 ± 0.1	19.3 ± 0.1	1722 ± 9
New Zealand	74 ± 3	5.9 ± 0.2	3.4 ± 0.2	17.5 ± 0.1	1625 ± 10
Chinchilla	76 ± 4	5.6 ± 0.2	3.0 ± 0.2	19.2 ± 0.2	1742 ± 11
California	72 ± 4	5.2 ± 0.3	3.0 ± 0.2	16.5 ± 0.1	1595 ± 9
White Giant	86 ± 5	5.6 ± 0.3	3.6 ± 0.2	21.0 ± 0.2	1893 ± 13
Caoba	64 ± 5	5.5 ± 0.3	3.6 ± 0.2	21.1 ± 0.2	1893 ± 12

Selection for growth traits

Since 1972 performance tests for growth traits were introduced to the genetic unit of the specialized enterprise after 5 years of experience in experimental selection at the Institute of Animal Science. These actually constitute the basic element for selecting breeders from all pure breeds. Between 1983-1986, for example, 25 000 animals of both sexes were tested annually (PONCE DE LEON, 1989). Selection is based on the deviation of the batch (weekly) mean in daily gain between 35 and 90 days of age for each breed, sex and subpopulation. The methodology for selection for growing performance was complemented with technical aspects related to a preselection phase and to the fate of candidates according to the percentage of superiority from the mean.

Commercial performance test information has greatly contributed to scientific studies which allowed the study of environmental factors as well as genetic parameters, and genetic tendencies. Also the pure breed comparative studies with more than 30 000 weaners has indicated similar possibilities to almost all these breeds in the combined feeding system in the tropics. (PONCE DE LEON, GUZMAN, 1993; PONCE DE LEON *et al.*, 1989ab; PONCE DE LEON, GUZMAN, LOPEZ, PYBILLONES, 1992ab).

Integration of all these items was possible in a computer program which considers both pre and post weaning growth with the previous adjustment for factors that affect each phase. Genetic value of the animal is weighted along with that of the sire after which a final estimated is attained (PONCE DE LEON, GUZMAN, 1995).

Selection for prolificacy

In rabbits, more important than growth traits are all the traits related to numerical productivity. Its complexity makes it necessary to separate it in its components to undertake some selection effort. In that direction three lines of the Semigiant breed were selected for long term prolificacy and elected dams and bucks (250 breeders) constitute the base generation of the Elite line. A computer program taking into account age at first breeding, number and month of kindling, and the buck was used to calculate the genetic value of does with more than two kindling, intergrating information of number born alive and weaned. Progeny of the selected dams (25 % of the stock) and of the 10-15 % of the bucks (selected for litter weight at weaning) form the breeding stock the following generation. Heritability estimates of prolificacy traits for the Semigiant and for the Caoba breed (PONCE DE LEON *et al.*, 1992b) are used in these analysis.

A contribution to prolificacy improvement is made in selecting pure breeds for growth traits as litters of less than four animals do not enter performance test, measure which also tends to reduce the influence of some of the environmental pre-test effects.

Improvement by crossbreeding

From the beginning of the specialized enterprise crossbreeding was practised (RAICHEV, 1968) which was continued at the Institute of Animal Science by PONCE DE LEONE (1977), the combinabilities between the main breeds were described. This study and the results of the performance of 8 lines of Semigiant and its F1 crosses (PONCE DE LEON, RIBAS, CERVANTES, 1974 not published) allowed to propose the first commercial crossbreeding scheme in 1975 which was done in practice between 1975 and 1983 in the Havana Rabbit Enterprise. Previously only pure breeds were used in rabbit production.

Subsequent studies (1990-1992) utilised the Elite line of Semigiant as an initial maternal line in order to evaluate F1 and triple crosses evaluating California, White Giant, New Zealand, Chinchilla and Caoba breed (PONCE DE LEON, GUZMAN, LOPEZ, PUBILLONES, 1992b). The best F1s were from Chinchilla and

Caoba bucks with advantages of 25-37 % above the mean of all F1 crosses. The best F1 does were those with California and Caoba bucks which were 25 % superior to the purebred Semigiant in kilograms of live weight at sacrifice per 100 kindlings. The best paternal terminal breeds for triple crosses were Chinchilla and New Zealand. This information was used to produce the second crossbreeding scheme which is now being introduced.

HEALTH SYSTEM

State enterprises and co-operatives are centrally supervised by the National Veterinary Institute. Veterinary clinics are also in operation for small private producers and special veterinary assistance is offered to private rabbit producers with contracts with the Rabbit enterprise.

The specialized enterprise has established a preventive system that includes vaccination against "hemorrhagic septicaemia", the use of coccidiostats and periodic check-ups and treatments against scabs parallel to disinfection plans.

However there is no effective control of coccidia and in the pre-weaning stage this pathology as well as colibacillosis are the mayor causes of death (74 %). Mortality at this stage is of 25 - 32 % of the live born animals but is much reduced in small rearings. In the fattening period coccidiosis produces 77 % of the deaths.

In April 1993 the Rabbit Viral Hemorrhagic Disease was diagnosed and confirmed in Havana City in May, but some previous cases were known since late 1992. In two months it affected other two provinces with a total of 132 foci detected (TOLEDO *et al.*, 1995).

Of these 64 % were private units which suffered 67 % of the death of their stock, while the state units lost by death only 18 % of the animals. Epizotiological performance was similar to that reported in other countries. A series of measures were taken including sacrifice in focal and perifocal zones, isolation, placing centinels and repopulation of the stock which culminated with the declaration of state free of RHVD in 1994. Direct losses were calculated in 25 % of the population, but for other factors a 40 % reduction of the mass was attained.

In assistance to the health system different research work is done for the veterinary discipline in state institutions (LABIOFAM, CENPALAB, CENSA) developing coccidiostats, vaccines and updating laboratory technics for exotic diseases.

GENERAL ASPECTS

Many aspects should be taken into account to consolidate the expansion of a domestic species in addition to the referred organization adjustments to the production system, among those are :

1. educational labour including training courses and interchanges among breeders, technicians and research workers
2. rapid application of science and technical results
3. develop a permanent technical group that could co-ordinate and enhance the integral projection for the expansion of the species

In this last aspect the Cuban Rabbit Rearers Society is playing an important role. Its National Ejeutive was elected in 1992, but its possibility of work began after the recovery from the RHVD. There are three provinces already organized working through local clubs as base organisms. It has been useful to co-ordinate the breeders to produce for contracts, to aid in promotion of the species for technical training, mutual aid for commercialization and participation in projects for state or NGO (Secours Francaise, Church Council) financial assistance.

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Resumen - La cunicultura cubana ha diversificado sus sectores de producción a expensas de las empresas especializadas con un incremento notable en las producciones privadas de campesinos y crianza familiar en zonas urbanas y suburbanas. Las empresas especializadas cuentan con alrededor de 10,000 reproductoras (estrato genético y de multiplicación) con producciones de 500 TM/año. Se hace un estimado mínimo de 502,230 conejos en el país. El sistema de reproducción mas generalizado es el semi-intencioso con obtencion de 6-6.2 partos/años y promedio de 6 nacidos vivos/parto. El peso al sacrificio es de 1.7-2.0 kg a 90-110 días en sistemas de alimentación mixta concentrado peletizado : forraje (40:60) en unidades especializadas, pero la alimentación no convencional es la mas generalizada. Se hace selección por crecimiento en pruebas de comportamiento en seis razas puras. La producción de F-1 se utiliza para la producción de carne y de reproductoras híbridas que manifiestan ventajas de 25-37 % sobre las puras. En 1993 se presentó la Enfermedad Hemorragica Viral del Conejo que fue erradicada en 1994. Se trabaja conjuntamente por instancia estatal y por la Sociedad de Criadores de Conejos de Cuba, para propiciar la expansión de la especie.
