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ZOOTECHNICAL AND SANITARY SURVEY OF BROILER REPRODUCERS IN THE WEST OF ALGERIA

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ABSTRACT

This study aimed to assess the mastery level of poultry farming for broiler reproducers, through the evaluation of the sanitary and zootechnical performances obtained at the level of Commercial Poultry Farms in Tiaret region (the west of Algeria). The results obtained showed that the zootechnical parameters didn't follow the entirely international standards. Hygrometry and temperature were not controlled. The average mortality rate of males was higher (42.92%) than that of females (8.84%), ($P<0.05$). Concerning production, the spawning performance was generally within the norms. The onset of laying was around the 24th week and the peak was late; it happened around the 30th week in the farm. The temperature of egg storage (15-18°C) was timidly respected as well as the duration of storage (2 weeks). According to this study devoted to the monitoring of breeding hens, the results showed a variable level of compliance with standards as well as production.

Keywords: Reproducers; hens; Zootechnical; sanitary; performance.

INTRODUCTION

Poultry today constitute one of a few savings opportunities [1]. Since 1960, overall chicken production has considerably grown more than that of any other type of meat in both developed and developing countries [2]. In African countries, eggs and chicken are progressively and significantly contributing to relief protein deficiency in food [3]. Most countries have experienced tremendous development in the production and consumption of poultry meat, which can be explained in part by changing dietary habits and the moderate consumer price of poultry products. It also indirectly reflects the considerable improvement in growth and reproduction performance. Controlling reproduction, in particular, is the consequence of a research strategy in which zootechnics, physiology, genetics and nutrition programs are involved [4]. Faced with the known constraints in the field of breeding hens, despite the capacity of breeding centers and the sector's adjustment policies (Subsidiary of the

regional offices of poultry and creation of group), the zootechnical results obtained in Algeria remain weak [5]. In this country, the conditions of poultry farming are precarious with an extensive breeding system that has primitive characteristics without any real animal feed and care. This leads to poor production performance of the reproducers chickens. It therefore appears necessary to improve the breeding conditions in order to define standards for sustainable and economically profitable exploitations and thus contribute to food security [6].

Thus, further investigations are necessary to acquire more knowledge about this type of farming. The current work aimed to perform a full follow-up of a breeding in order to control the sanitary and zootechnical parameters of the hens according to the universal standards. This study allowed us to collect information on the situation of breeding hens, and to assess the aptitudes of breeders to improve their production. It allowed also to apprehend any errors and to make corrections in order to improve farming conditions to obtain better products and minimize economic losses.

MATERIALS AND METHODS

Study Area

The breeding followed was located in the region of Tiaret (West of Algeria). The herd was monitored according to a technical outline developed on the basis of previous studies in the field and according to international parameters and standards of guides and labels of the ISA F15 breed especially, during the production phase until reform. The study period began in early March 2017 until the end of June 2018, and the farm visits therefore took place during this period.

Study Sample

The band was set up on: 07/12/2016 for a workforce of 45218 females and 5247 males spread over 9 breeding buildings. The monitoring of this band was ensured by 15 production agents, 3 watchmen, 2 electro-mechanics, 1 production manager, 1 center manager, and 2 veterinarians. The production cycle was of 41 weeks. The age at reform was fixed at the 64th week.

We chose only one building for monitoring parameters (number 7).

Table 1 presents the characteristics of the breeding followed for this present study.

Methods

Data collection

Regular visits were made to the farm. The zootechnical and health parameters implemented in this breeding were noted on the technical sheets dealing with these different parameters and the breeding registration sheets. The first visits were devoted to familiarize ourselves with the breeding, take the fixed parameters of the breeding (habitat, equipment, type of accommodation) and collect other information to complete the technical monitoring sheets. The second part of the monitoring began from the age of 18 weeks and until the last chicken reformed in the 70^{th} week in order to take the variable parameters of the breeding (environmental conditions, production, harvest and storage of eggs and mortality).

Table 1. Breeding characteristics

Breeder	(URC Mellakou)
Region	Tiaret
Chicken strain	ISA Hubbard F15
Number at the start of production in building 7	583 Males 5026 Females
Building area (m2)	960
Number of buildings	9

Errors and problems encountered were mentioned during the visits.

Data analysis

Statistical analysis was performed using the STATISTICA software (Version 10, Stat Soft France, 2003). Statistical differences in the mortality rates between males and females were carried out using Student's t-test. The results were considered significant when $P < 0.05$. The data relating to zootechnical performance and health criteria have been compared with the strain standards (breeding guides) and international standards described in the bibliography.

RESULTS AND DISCUSSION

The data collected were presented in the tables in order to organize them to facilitate the interpretation of the results.

General Characteristics of the Building

The breeding building plays a major role in the protection of animals against attacks from the external environment, and must meet the standards and have the necessary equipment for the comfort of the hens and for the good control of the production of hatching eggs (HE). Table 2 shows the results about the building parameters and the installed equipment.

The fitting out of a specific building for the production phase is essential. The building should be parallel or slightly inclined to the prevailing winds to avoid drafts; non-compliance with such a condition exposes the herd to respiratory problems and represents a source of pathogen transmission between buildings.

Table 2. Description of the building and farm equipment

Parameters and equipment	Observation
Production building other than the livestock building	Yes
Exposure to prevailing wind	Parallel
Building type	Obscure
Insulation	Yes
Linear feeders (hens / m)	15
Drinking equipment (fixed-level drinkers)	1 for 90
Lighting material	Lamps
Laying nests (hens / nest)	4
Extractors	10
Radiant	Absent

Unlike the dark building, which facilitates control and compliance with the lighting program, the semi-dark building, where the light intensity depends on daylight, is favorable during sunny days, but external fluctuations require special control for do not disturb the hens in full production, any error in light stimulation affects the laying performance [7]. On the other hand, the unstudied stimulation affects the persistence of laying and promotes the laying of double and small eggs [8]. For this, it is necessary to control the light intensity using a lux-meter. This approach helps to avoid behavioral disorders such as pecking by an excess of light intensity (excitement) or brooding following a decrease in light.

A good insulation system makes the environment more controllable, and keeps the building climate independent from the outside. Animal husbandry encompasses this function and energy expenditure is thus minimized to maintain an ideal temperature.

The sufficient number of drinkers eliminates stress for the animals due to overcrowding. In conclusion, the breeding does not have all the necessary equipment but contains the essentials for a minimum control of the atmosphere in the buildings.

Breeding Management

Ambient quality of buildings

The high density of hens in the building, the low air movements and all the waste that makes the atmosphere of the building intolerable, make it necessary to respect the density and to control the atmosphere at the level of the hens. The quality of the building's ambience is noted in Table 3.

The hygrometry in the breeding was not controlled. Although this problem can be solved by maintaining good ventilation, the installation of a hygrometer is essential for the optimal use of the ventilation equipment.

The temperature which was not controlled calls upon the thermoregulatory function of the animals; this disturbs their food consumption, so that the increase in temperature affects the laying, the weight of the egg [9] as well as the quality of the shell following the decrease in food consumption [7]. It also decreases the activity of hens and roosters; this condition has a negative influence on their fertility. While the drop in temperature leads to overconsumption of food which is an economic loss [10].

It is accepted that the poor insulation of buildings and insufficient ventilation and sometimes the failure of the cooling system lead to the increase in temperature beyond the recommended 20°C, which causes excessive stress to the birds which dies from hyperthermia [11].

Food

Feeding is the management of feed on the farm. This is of the same importance as the composition of the food. In reproducers breeding, the feed is rationed to avoid fattening which deteriorates ovarian function in hens and makes the rooster too heavy, with difficulty in ticking and therefore consequences on fertility. Feeding largely conditions the achievement of good zootechnical performance [12,13]. Table 4 illustrates the food habits in the farm.

For hens, which are grain-eaters, the granulated presentation of the feed is preferable. Indeed, the granulometry of the feed and its mode of presentation (flour, crumbs or granules) influence the level of ingestion [14] and is a determining factor of zootechnical success in poultry [7].

Table 3. Atmosphere quality in the building

Ambience parameters	Observation
Temperature (°C)	21-23
Hygrometry (%)	Not taken
Density (hens / m2)	6
Illumination duration (hours)	16

Table 4. Feeding method in the studied farm

Method	Observation
Food presentation	Crumbs
Distribution program	once a day in the morning
Distribution method	Mechanical
Duration of distribution	Fast
Distinction between food of males and females	No

The advantage is to avoid sorting, and to ensure the acquisition of the entire ration by the animal. Unfortunately, the breeding farm does not have this type of feed which allow food waste.

Mechanization of feed distribution in livestock is more advantageous than manual distribution. When feed distribution is slow, hens that had feed first may still eat the last. In addition, the feed may overflow from the feeder and the roosters would then have access to it. To avoid this, the worker in manual feed farms makes an effort to distribute the feed as quickly as possible (10 to 12 minutes).

The use of chicken feed for roosters provides them with a diet rich in energy, protein and calcium, which causes rapid testicular development and induces fertility that does not last over time [12].

Some roosters eat the eggs; this may be due to calcium deficiency. Therefore, good rationing of roosters improves production and reduces economic losses.

Reproduction

Respect for the sex ratio is essential for the success of fertilization, so it is necessary to have a limited number, maintained at one rooster for 10 hens [8].

The frequency of egg harvesting is important to the reproduction and production of good HE quality [7]. This quality follows two varieties, a first which is the quality of the embryo and its viability, and a second which is the microbiological quality which influences hatchability and the quality of the chicken. The corresponding results are shown in Table 5.

Table 5. Management of reproduction in the farm

Parameter	Observation
Sex ratio (%)	12
Refill in roosters	Exists
Egg harvest	Manual
Egg collection frequency (times / day)	2
Egg sorting	Yes

The sex ratio is respected at the start, and is maintained during the production phase, which poses no problem of reducing the fertility rate by having a high number of hens per rooster, which generates a ticking with poor sperm in spermatozoa, and develops in the rooster a sorting behavior between the hens.

The manual method of harvesting eggs is applied in the farm. To avoid soiling of eggs, their consumption by roosters, as well as the development of the brooding instinct in hens, an increase in the frequency of harvesting by workers is necessary in the farm.

Egg sorting is applied in the farm; this eliminates all downgraded eggs that have a double yolk, a thin, cracked or discolored shell, or other deformations that interfere with incubation and embryonic development.

Storage of Hatching Eggs

The HEs produced are generally stored for a variable time depending on the farm, pending incubation. This storage directly influences the quality of the HEs such that eggs that are poorly positioned or stored for too long (especially in hot or cold, dry or humid climates) deteriorate and embryonic mortality becomes high. The results of the egg storage conditions are shown in Table 6.

The arrangement of a special room for the storage of HE in the farm makes it possible to control the atmosphere. Similarly, the temperature is timidly respected as well as the duration of storage. Sauveur [8] recommended a temperature between 14 and 15°C. While the humidity is uncontrolled, and if it is low, drying causes embryonic mortalities, and otherwise, microbial and fungal growth will deteriorate the quality of HE. The recommendations of Sauveur [8] set an interval of between 75 and 85% humidity for a period not exceeding 5 to 6 days. The storage position is normally observed where the point is down, to allow the egg to breathe, and to avoid ischemia [15].

Prophylactic Measures

Medical prophylaxis

Medical prophylaxis in breeding hens begins on the first day of age of the chicks. Table 7 shows the measures applied from the eighteenth week of age. These measures are represented by the remainder of the vaccination protocol, preventive treatments and nutritional supplements added to the diet or distributed alone.

The use of a live lyophilized vaccine against Newcastle disease at week 27 promotes the reconstitution of antibodies in the hens to give the chicken's passive immunity.

Parasitic diseases, which sometimes exist in breeding, require the establishment of preventive treatments that reduce their incidence; the treatments are limited only to anti-bio-prevention.

The use of nutritional supplements is done normally, thus avoiding deficiency diseases.

Biosecurity

It is known that disinfection and the crawl space of the building between the strips are essential to reduce the microbial load, but once the litter and the hens are installed, the workers walk around the farm. When the food arrives, the microbial load also increases over time. To avoid this, the

Table 6. Egg storage conditions in the farm

Conditions	Observation
Special room	Yes
Temperature	15-18°C
Hygrometry	Not taken
Egg position	Point down
Storage time	Max. 2 weeks

Table 7. Medical prophylaxis measures applied in the farm followed from the eighteenth week of age

Measures	Observation
Vaccination	Vaccine against NC (La Sota)
Preventive treatments	Hepato-protective (at Week 30) Antibiotic prevention (Enrofloxacin at Week 20-23)
Nutritional supplements	Mineral-vitamin supplement and trace elements (at Week 19, 30)

Table 8. Biosecurity measures applied in the farm

Biosecurity measures	Observation
Cleaning of the building and crawl space	Yes
Rodent control	Insufficient
Staff cleanliness	Good
Sanitary barrier	Rotoluve, footbath, lime

application of strict biosecurity measures is mandatory in the farm to keep the microbism at the lowest possible level and to avoid contamination. Table 8 shows the level of applied biosecurity.

The major danger linked to rodents still exists in breeding, despite the establishment of a control program, which exposes the hens to infectious risks, plus the stress generated by the presence and movement of rats in the building.

The working staff do not follow a health monitoring program, which consists of carrying out analyzes of the respiratory system and coprology to avoid contaminating or being contaminated by the hens.

The breeding uses the following products as a sanitary barrier:

- Detergent / disinfectant based on iodine and acids, used in poultry breeding centers and for the disinfection of drinking water of animals.
- Detergent / disinfectant based on Quaternary Ammoniums.
- Quicklime.

Hatching egg hygiene

Table 9 shows the hygiene measures applied to HE to minimize contamination of eggs after laying. The speed of initiation of these operations is important in order to stop the fixation and multiplication and even the penetration of the germs into the egg.

Table 9. Hygiene measures applied to Hatching Egg (HE)

Hygiene measures on HE	Observation
Nests cleanliness	Correct
HE cleaning	Yes
Disinfection of HE	Yes, in storage

Maintaining nest litter, with regular changes, decreases soiling and contamination of HE.

The practice of cleaning HE is done on the farm, the cleaning agents use rags, instead of using metal cloths, which weakens the shell.

Early disinfection of HE is only done in the farm, this allows a good prophylactic measure against diseases transmitted by eggs.

Breeding and Production Performance

Mortality rate

The mortality rate is the regression of the number over time reflecting the state of health of the herd. The results of the mortality rates recovered from the farm are presented in the Figs. 1 and 2.

The curve shows dissimilarity between the mortality of males and females ($P<0.05$). Male mortality is high from onset until the 26th week, with a mortality rate reaching 1.66%. This value shows fluctuations and is more or less maintained until the cull of the herd, with a peak of 1.93% at the 50th week. While the female mortality curve is straight, with low values. The mortality curve of males is higher than that of females in general, and both sexes are struck by mortality at the same time, which may mean the contraction of pathology at the level of the production building, but provided more important information on the immune status of females which is higher than that of males. According to ITAVI [16], males are more sensitive to the effects of heat compared to females.

The production phase mortality rate varies between males and females. The breeding shows a high mortality of males (42.92%) than that of females (8.84%) ($P<0.05$). The death rate has been grossly exceeded by standards.

Food consumption

The amount of feed consumed by the breeding stock varies over time. Depending on the state of fattening and egg production, the amount of feed should be adjusted. Otherwise, the economic losses linked to the increase in feed consumption and the decrease in production performance become significant.

The figures below show two curves, one representing the actual consumption of hens, and the other the normative consumption obtained by calculation (by us) following the recommendations of the Hubbard F15 guide.

The evaluation of feed consumption data in the farm leads to the development of a curve representing consumption. The latter, compared with the normative, reveals a respect in the conduct of rationing of hens.

Spawning performance

In breeding stock, the spawning performance to be recorded is the age of onset, the age and persistence of peak spawning and the spawning rate which is calculated according to the following formula [17]:

(Total number of eggs laid over a period) / (Number of hens over the same period) × 100

The corresponding results are shown in Table 10 with the relative spawning curves (Fig. 4).

The early onset of laying is detrimental to the persistence of laying and the maintenance of the peak. The breeder was able to control this parameter by controlling the lighting program in the dark building. The peak appeared six weeks after the onset of lay, which is quite normal.

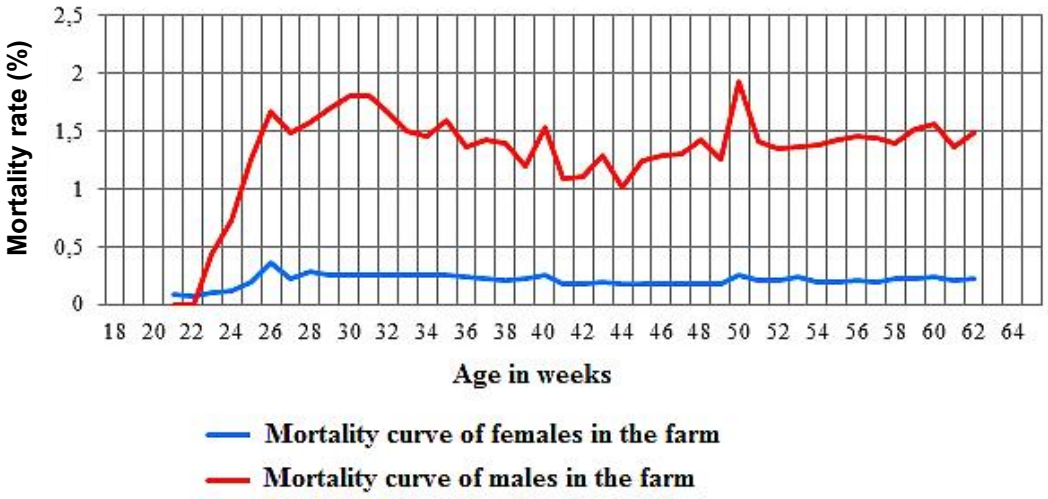

Fig. 1. Mortality curve in the farm

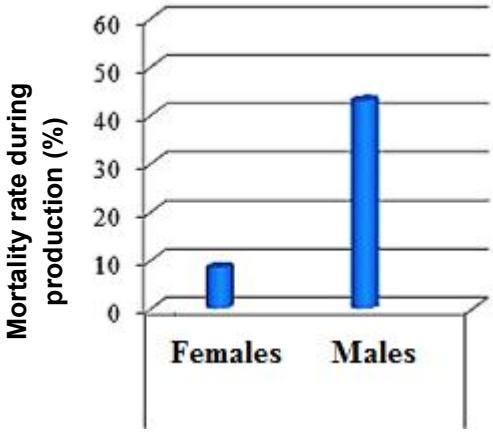

Fig. 2. Mortality rate in the production phase

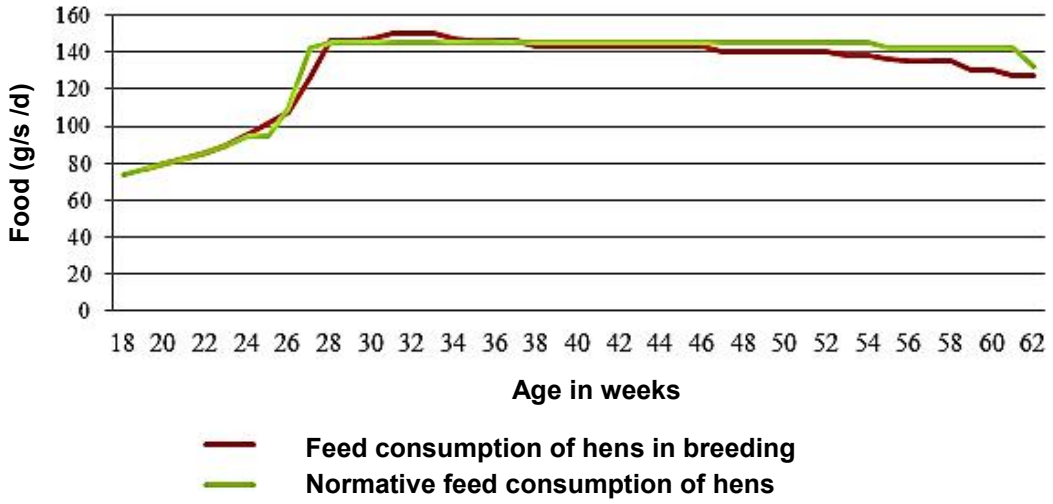

Fig. 3. Feed consumption rate in the farm

Table 10. Age of onset and peak of laying of breeding hens

Notion	Observation
Age of onset (weeks)	24
Peak laying (weeks)	30

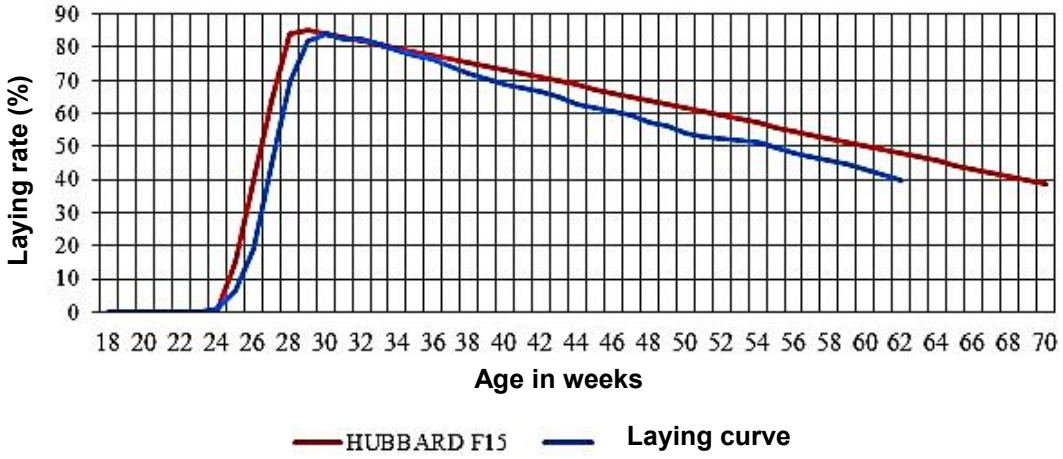

Fig. 4. Spawning curve recorded in the farm

The breeding curve of the farm shows a general appearance similar to that of the Hubbard F15 curve, except that the peak is slightly lower, somewhat persistent, and the

regression tends to separate from the reference, and does not maintain the expected values. The difference between the two curves increases with the age of the herd. This is because the strain misses its peak, which consequently affects the subsequent production of the hens [18]. In addition, the declared mortalities reduce the profitability of breeding.

Age of reform

The decision to reform the breeding herd is linked to the profitability of breeding, so it is purely economic. Thus, a high mortality or a disease which deteriorates the laying at the end of production requires this decision to be made. The reform of the herd began in the 62nd week. Female mortality at this age has not decreased, resulting in considerable losses, and a spawning rate of around 5.1%. The need for reform is an economic obligation.

CONCLUSION AND RECOMMENDATIONS

According to this study devoted to the monitoring of breeding hens, the results showed a variable level of compliance with standards as well as production.

What is retained from the breeding is the acceptable way in which the breeder meets the standards of use of the material. Likewise, no significant problem can be reported concerning the conduct of the illumination. The type of building, completely dark, facilitates the control of the corresponding parameters. The texture of the feed (in crumbs) can be considered as one of the causes of the economic losses, as well as the use of the feed specific to the females in the ration of the males, which further accentuates these losses. However, it is considered that the latter are not very important because the food is distributed in less quantity in males than in females. The standards of hygiene and prophylaxis are generally observed except in the case of parasite control. The mortality of males is higher than that of females and reaches 42.92%.

Although the production of HE in livestock is acceptable, it has never reached the desirable level. The critical points are to be located at the level of several factors, among which we can quote: Either the farmer has an objective of producing HE during the year, or his economic capacities have been limited or he has a low level of education. Often, the food problem has arisen acutely. The recommended solution would be full integration, with the possibility of making your own food yourself.

At the end of this present study and given the problems reported during the monitoring of this breeding, we recommend the following:

- Organize training days for all livestock staff (veterinarian, breeder, agents specializing in poultry farming (ASA), watchman) especially in zootechnical and sanitary information;
- Use measuring equipment such as a hygrometer;
- Respect the law "all full, all empty";
- Separate the food of males from that of females;
- Provide a health monitoring program;
- Take samples for microbiological analyzes to assess immune status and diagnosis of disease.

Regarding the educational framework, we recommend to complete our work by carrying out comparative statistical studies on the breeding studied by covering several successive bands in order to assess the level of mastery of the various qualitative and quantitative parameters.

Study each of the parameters related to the production of HE, their importance and impact on breeding success. We would like to quote:

- The light program, duration and intensity;
- Food restriction (quantity and quality);
- Vitamin E and selenium, effect on reproduction;
- The impact of FA intake (especially linoleic and linolenic acid) on HE weight, yolk quality and embryonic development;
- The density ;
- Temperature, humidity and ventilation;
- Biosecurity;
- The sex ratio, its importance and its interest.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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