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Productive performance and egg physical characteristics of Tufted Creole and Marans hens

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ABSTRACT

Objective: The present study was conducted to evaluate the productive performance and the egg physical characteristics of two backyard-type breeds of birds.

Design/methodology/approach: Tufted Creole (13 hens and a rooster) and Marans (13 hens and a rooster) hens were used in this study. Live body weight, feed intake, egg production, egg weight, egg length and egg width were measured weekly for eight weeks. Collected data were analyzed using a two-way variance analysis; the main factors were breed, week, and their interaction.

Results: Marans hens were heavier and had higher feed intake than Tufted Creole (TCH) ($P<0.05$). The TCH egg was smaller ($P<0.05$) in weight and length with respect to that of Marans hens. TCH produced more eggs than Marans hens ($P<0.05$). The week factor was significant ($P<0.05$) for body weight, feed intake and egg length.

Study limitations/implications: Further studies should be carried out to design a feeding program that would allow both breeds to express their full productive potential and maximize the return on investment in backyard production systems in Mexico.

Findings/conclusions: Marans hens are a heavier breed due to their greater live body weight and feed intake with respect to TCH. TCH are lighter birds but with a higher egg production when compared to Marans.

Keywords: Body weight, egg production, feed intake, poultry, backyard

INTRODUCTION

Backyard poultry farming is an important activity in rural communities of Mexico (Gutiérrez-Triay *et al*., 2017). This activity strengthens the welfare of low-income families, as it provides protein of animal origin and an extra income (Oladunni and Fatuase, 2014). Creole hens (*Gallus gallus domesticus*) are the type of birds that predominate in backyard poultry farming; however, they are being displaced by commercial lines which are genetically selected for high egg production

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but are not well adapted to the outdoor environment and traditional management of typical backyard production systems (Rodríguez- Ortega *et al*., 2019). Some Creole hens have a tuft of feathers on their heads, which is an attractive phenotypic characteristic of these birds for poultry farmers. The shape, color and position of the feathers are important aspects that distinguish different breeds of chickens (Wang *et al*., 2012). Marans hens originated in the city of Marans, France; the most attractive feature of this breed is the production of eggs with dark brown egg shells which appear to be more appealing for consumers. These hens may have black, copper-black, silver, white plumage, and tarsus with or without feathers (Lukanov *et al*., 2015). Despite the desirable rustic characteristics of Tufted Creole and Marans hens, there is very limited information available regarding flock management, performance and egg characteristics. The egg weight, color, length and width are important physical characteristics that describe the breed of hens, age and embryo survival (Narushin and Romanov, 2002; Ikegwu *et al*., 2016). Shell color is an important factor for consumers: a consistent shell color guarantees the purchase of the product. The brown color in the egg is caused by the Protoporphyrin IX pigment (Wilson, 2017), and the deposits of the protoporphyrin-IX are mainly located in the outer epithelial cells within the shell gland (Poole, 1967). The different breeds of hens secrete and deposit pigment at different times giving the egg shells their typical color such as blue, brown or white (Liu *et al*., 2009). Tufted Creole hens as well as Marans are an important genetic resource for the backyard poultry industry in Mexico. Thus, the objective of the this study was to evaluate the productive performance and egg physical characteristics of Tufted Creole and Marans hens in a typical Mexican backyard production system.

MATERIALS AND METHODS

Housing and management. The experiment was carried out at the poultry facilities of the Polytechnic University Francisco I. Madero (UPFIM), located in the state of Hidalgo, Mexico, at approximately 1900 m above sea level. The animals were housed in 6 × 4 m pens, roofed and with dirt/sand floor.

A commercial feed estimated to meet or exceed the nutritional requirements of the birds according to the Poultry NRC (1994) was offered *ad libitum*. Water was offered through plastic bucket-type drinkers. Care to the birds was provided throughout the experiment following the Guide for the Care and Use of Agricultural Animals in Research and Teaching (FASS, 2010).

Breeds. Two breeds of birds were used in the study: Tufted Creole Hens (TCH), 13 hens and a rooster; and Marans (M), 13 hens and a rooster (Figure 1). These birds were obtained from backyard poultry farming in the Valle del Mezquital, Hidalgo, Mexico. At the time of the experiment, all birds were 60 weeks old.

Data collection. The live body weight (g) of the hens was recorded weekly for all birds. Average feed intake per pen (g), egg production, egg weight (g), egg length (mm) and egg width (mm) were measured on a daily basis for eight weeks.

Statistical analysis. Collected data were subjected to two-way ANOVA using a completely randomized design with the Mixed procedure by SAS v 9.0 (SAS, 2011). The main factors were breed, week and their interaction (breed*week). Significant effects were accepted at $P<0.05$. For live body weight, each individual bird was the experimental unit. While average of sampling per day was the experimental unit for feed intake, egg weight, egg width and egg length. The total number of eggs produced was analyzed using the PROC FREC and PROC GLM procedure of SAS v 9.0 (2011, SAS Institute, Cary, NC).

RESULTS

The eggs of backyard hen breeds evaluated in this study had different shell color (Figure 2); Marans hen

Figure 1. TCH, Tufted Creole Hens; M, Marans hens.

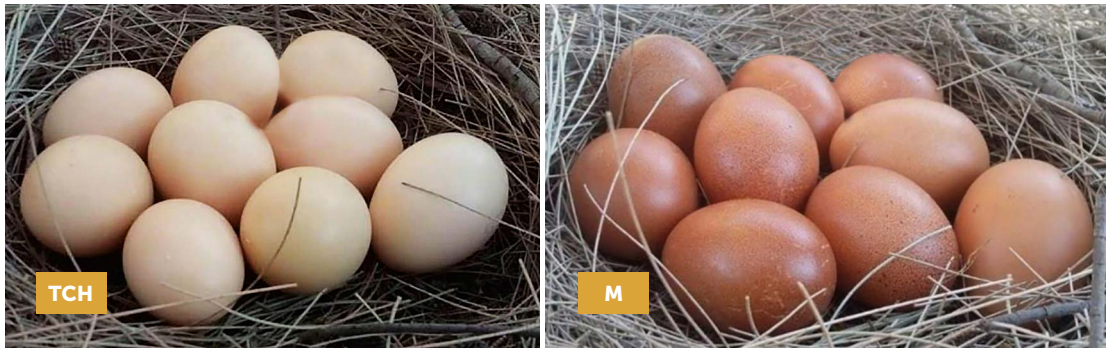

Figure 2. TCH, Tufted Creole Hens; M, Marans hens. Egg color. TCH: beige color egg of Tufted Creole hens, M: egg with shells dark brown color of Marans hens.

eggs were dark brown while Tufted Creole hens laid beige colored eggs.

Overall weekly body weight, feed consumption and egg length of both breeds of hens increased throughout the 8-week trial period. The interaction breed*week for egg length was significant ($P<0.05$) (Table 1). Marans hens were heavier ($P<0.05$) than TCH. Additionally, Marans hens had higher ($P<0.05$) feed intake and egg weight when compared to TCH. For egg production results, TCH laid ($P<0.05$) more eggs than Marans hens. The egg width was not different ($P>0.05$) between breeds and weeks. Egg length was different ($P<0.05$) between breeds; Marans hens had longer eggs compared to TCH (Figure 3).

The color of the shell is highly appreciated by the consumer, which translates into a possible price increase and therefore a higher income for families. Protoporphyrin-IX is the pigment responsible for the brown color of the shell (Samiullah and Roberts, 2013). The intensity of the brown color is determined by the amount of protoporphyrin-IX released in the shell gland (Liu and Cheng, 2010); shell color is a specific characteristic of the genetic variability of laying hens.

The higher body weight of the Marans hens could be due to the fact that these hens were developed to provide meat and eggs; this type of birds is known as dual-purpose. On the other hand, TCH are lighter birds, with slower growth and developed for higher egg production. The Padovanas hens have a feather tuft on the head and a cranial protuberance that increases the size of their tuft (Rizzi, 2018); these birds are light-sized, similar to the TCH hens. De Marchi *et al*. (2005) observed that the Padovana hens had an adult weight of 1328 g, which is similar to the weights registered for the TCH hens in this study. The Marans hens of this study had an average live body weight (2279 g) similar to Rhode Island birds, also considered for dual-purpose. These results are in agreement with Mohammed *et al*. (2013), who reported that Rhode Island Red hens in outdoor production had an average live body weight of 2196 g.

Feed intake results are correlated with body weight. Tufted Creole hens are smaller and had low feed intake. In this study, the TCH had similar feed intake as the Padovana hens used by Tasoniero *et al*. (2018) who observed that Padovana hens had an average feed intake of 72.7 g/d. Feeding management of both breeds of hens was *ad libitum*, which is why both breeds may have increased their live body weight throughout the 8-week trial period. It is important to note that birds were already at their mature live weight (60 weeks old) at the beginning of the experiment.

In the literature, there is very limited information regarding egg production of TCH and Marans hens. The results of this study suggest that the TCH breed is more appropriate for producers whose main focus is total number of eggs produced per hen. The egg weight of Marans hens was similar to the Rhode Island Red and

Table 1. Live weight, feed intake and egg length per week[¥].

Week	Live weight (g)	Feed intake (g)/bird/day	Egg length (mm)
1	2010	126	53
2	2021	135	55
3	2045	137	56
4	2085	138	55
5	2095	137	56
6	2132	141	57
7	2133	141	56
8	2139	146	57
Standard error	56	2	1
Significance	0.041	<0.001	<0.01

[¥]Average body weight, feed intake and egg length of both breeds, Tufted Creole hens and Marans hens.

New Hampshire hens (57.8, 58.3 *vs*. 59 g) as reported by De Witt and Schwalbach (2004). However, the egg weight of 76-week-old ISA Brown hens was higher than Marans and TCH hens (57, 59 *vs*. 62.67 g) as reported by Abou-Elezz *et al*. (2011). Verhoeven *et al*. (2019) reported that egg size is related to body size, and they also observed that the size increases with the age of the birds. In this experiment both breeds were 60 weeks old, however, the TCH were lighter than the Marans, thus, the egg weight was lower. Hanusová *et al*. (2015) reported that the egg width of Rhode Island Red hens was 42 mm, similar to the egg width of Marans and TCH in this study (43, 42 ± 0.13 mm). Ávila (2015) observed that the size of the bird's egg varies fundamentally in relation to the body mass of the adult female and her growth development. The interaction between breed and week may be due to a normal physiological process in birds: as females age, the size and weight of the egg increases (Väisänen *et al*., 1972). The size of the egg in backyard poultry production is a very important characteristic, related to the consumer's preference and the survival of the progeny. Williams (1994) reported that egg size is related to the live weight at birth of the offspring. However, the survival and growth of the chicken is independent of the size of the egg.

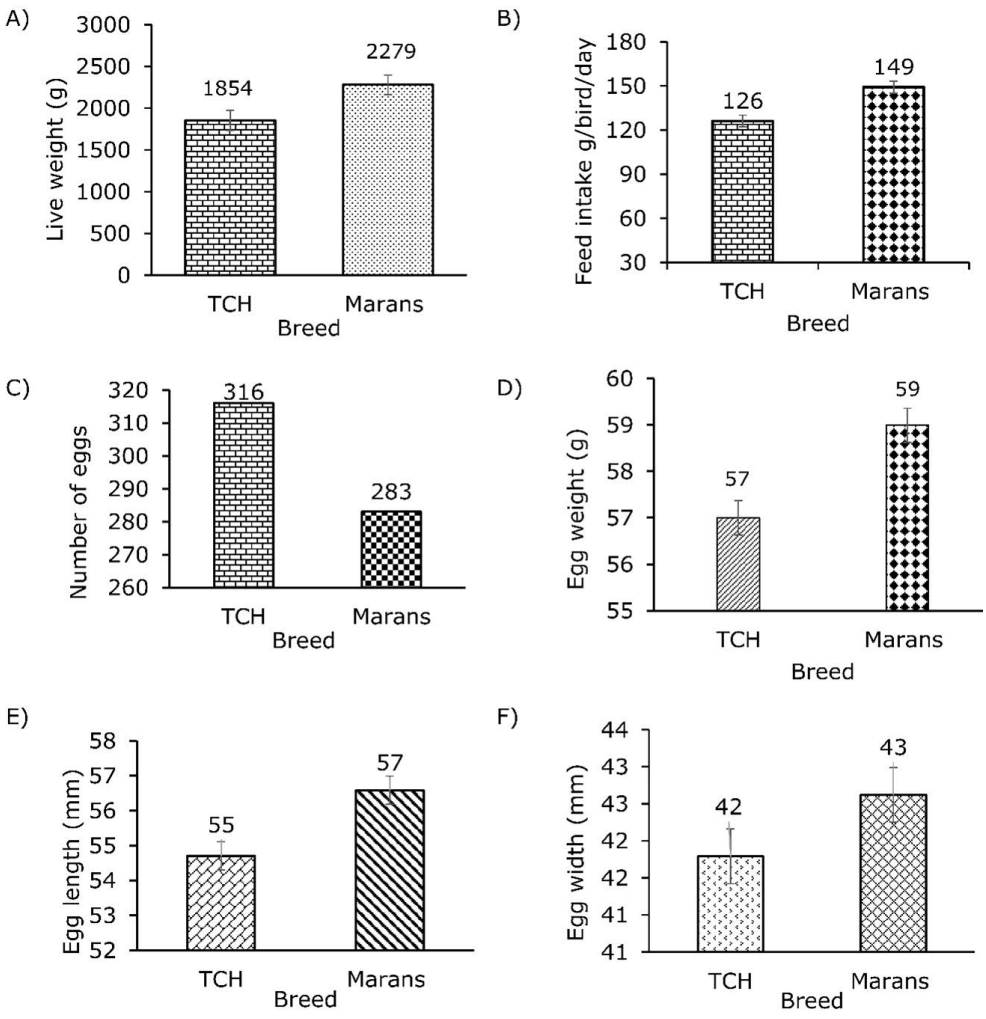

Figure 3. TCH, Tufted Creole Hens; M, Marans hens. A) Live weight of TCH and M hens; B) Feed intake by breed; C) Number of eggs per breed; D) Egg weight of both breeds; E) Egg length; F) Egg length.

CONCLUSIONS

Marans hens are a heavy dual-purpose breed due to their greater live weight and feed intake. Tufted Creole hens are lighter birds with higher egg production. Thus, the latter may be more appropriate for producers that want to focus on number of eggs produced per hen rather than eggs with better external physical characteristics for consumers. Further studies should be carried out to design a feeding program that would allow both breeds to express their full productive potential and maximize the return on investment in backyard production systems in Mexico.

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