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Feeding Practices and Production Performance of Commercial Laying Hen Farms in the Northeast of Algeria

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ABSTRACT

Background: The researcher aims to investigate the process of feeding and assessing the performance of production in different farms with different capacities in Batna province, northeast of Algeria.

Methods: The data have been derived from an organized questionnaire carried out between January 2024 and April 2025 in 144 commercial laying hen farms.

Result: The tendencies of feed procurement were notably related to the farm capacity, with the smaller farms (less than 12,000 hens and 12,000 to 40,000 hens) being more likely to buy the feed in contrast to those larger than 40,000 hens. Supplying pre-lay diets depended highly on the capacity of a farm, with the majority of farms (>40,000 hens) providing pre-lay diets. It was noted that farms with less than 40,000 hens significantly lacked in the application of organic acids and mineral salt supplements compared with large farms. The farms with more than 40000 hens had longer laying periods, greater average and maximum rates of egg production and lower feed consumption and mortality rates than the smaller farms. The results show that most laying hen farms within the area have poor feeding regimes and their production rates do not meet the set standards of the breed.

Key words: Farm, Feeding, Laying hen, Performance, Production.

INTRODUCTION

The laying hen industry in Algeria is significant because of its contribution to the demand for national table eggs. An average of more than 5.8 billion units were produced between 2010 and 2019, an 82% increase in production volume compared to the decade before (2000 to 2009) when the average production was 3.2 billion units. The growth shows that, on average, there was a 4.22% annual increase (ONS, 2020). In 2022, it was estimated that Algerians consumed 144 eggs per capita in a year (Kaci, 2022), which is significantly lower than the projected European Union annual per capita consumption of 217 eggs per capita (Gautron *et al*., 2022).

The performance of poultry farms in Algeria compared to the well-established industry standards shows that poultry farming is relatively undeveloped and the main factors that contribute to such a situation are poor quality of farm equipment, lack of adherence to the recommended technical standards and frequent changes in the production cycles (Kaci, 2015a). The insufficiency in the provision of the inputs in production, the inadequate adherence to hygiene and biosecurity principles, as well as the inability of farm infrastructure to comply with the construction standards affecting the zootechnical performance and, consequently, profitability of the farms in the Algerian context, is negative (Alloui, 2011). Tracking the same logic, technical and economic efficiency of Algerian laying hen farms, which in many cases does not reach the recommended levels, is limited due to zootechnical and health-related issues, high prices of inputs and a lack of balance in poultry markets (Belaid-Gater *et al*., 2023).

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Many studies have been done on laying hen farms across the world with regard to feeding practices and production performance. This kind of research has looked at farm characteristics, production inputs and management practices in India (Shastri *et al*., 2025), Australia (Scott *et al*., 2017) and Canada (Van Staaveren *et al*., 2018). Increasing

productivity in layer poultry farms depends on the effective management of the main inputs, which include labour, flock size and feed input (Jiao *et al*., 2019; Yenibehit *et al*., 2019), along with the implementation of measures and technologies that allow efficient expanding laying cycles (Arulnathan *et al*., 2024). Nevertheless, there is a lack of research on these aspects in the case of Algeria.

Additionally, various obstacles affect the laying hen industry in the Algerian context, such as the expensive production cost of raw materials in feed and health problems (Ayachi *et al*., 2015; Barberis *et al*., 2018). Since the study area is strategically positioned as a supplier of eggs in Algeria, it is important to increase farmers' awareness of the importance of proper feeding to enhance their performance. This can be achieved by giving evidence-based suggestions to enhance the efficiency of production and maintain the profitability of poultry farms.

So far, an analytical study of laying hen rearing has not been conducted comprehensively in this region and scientific information on the management and production practices of Algerian laying hen farms is scarce. Thus, the purpose of the research is to determine the current feeding regimes and summarize and compare the performance of commercial laying hens' farms in Batna province.

MATERIALS AND METHODS

Study area

This study was done in Batna Province. This area is geographically located in the northeastern part of Algeria, with a longitude of 4° to 7° and a latitude of 35°-36°. The climate of the region is semi-arid, with an average temperature of 0.9°C in January and 35.4°C in July. The average annual rainfall is a little over 386.84 mm (Bendib, 2022).

Sampling, survey and data collection

An introductory survey has been done jointly with administrative, technical and professional bodies of the poultry sector. The first step was to collect information about the quantity, geographical location and the number of laying hen farms present in the study area. The study was conducted over the period of January 2024 to April 2025 in nineteen municipalities, including Bitam, Merouana, Ouyoun El Assafir, Aïn Djasser, Ouled Sellam, Aïn Yagout, Rahbat, Lemcen, Ksar Belezma, Oued El Ma, Talkhemt, Ouled Aouf, Hidoussa, Ouled Fadel, Zana El Beida, El Hassi, Lazrou, Aïn Touta and Seriana. The sample size of 225 respondents was identified. Out of this population, a probability sampling method was used to select 144 farmers with the probability sampling formula presented below as developed by Yamane (1967).

$$n = \frac{N}{1 + N\,(e)^2}$$

Where,
n= The sample size,
N= The population size.
e= The margin of error.

For this analysis, N=225 and e = 0.05 (05%).

This study was conducted using a structured questionnaire to acquire the data. The questionnaire was prepared in French and Arabic, as well as a mixture of closed, semi-closed and open questions. It was structured into six thematic areas, namely: (1) socio-economic factors of the farmers, (2) farm factors, (3) environmental control measures, (4) feeding practices, (5) biosecurity practices and (6) production performance, comprising a pool of 37 questions. Data was gathered after physical visits where personal interviews were conducted with farmers and direct visual observations of activities on farms were carried out.There were three categories of farms, based on their sizes: Group I comprising less than 12,000 laying hens which are usually typical of the standard battery cage modules, Group II with 12,000 to 40,000 laying hens and Group III which contains greater than 40,000 laying hens.

Data analysis

SPSS (Statistical Package for the Social Sciences) version 25.0 was used to analyze the data using descriptive statistics. Descriptive data of categorical variables were expressed in the form of frequencies and percentages and continuous variables as mean ± standard deviation (SD). Differences in categorical variables between the groups of farm sizes were analyzed by the Pearson chi-square (χ^2) test. Cramer's V coefficients were used to determine the strength of association between categorical variables and farm size. The analysis of variance (ANOVA) was used to examine the production performance data in order to determine statistically significant differences between the different categories of farm sizes. The statistically significant level was observed at $p \leq 0.05$.

RESULTS AND DISCUSSION

Socio-economic and professional characteristics of farmers

Table 1 shows the socio-economic and professional nature of the surveyed farmers. Most of them were between middle age (79.8%) and aged between 45 and 59 years. There were differences in educational attainment, with 58.33% having attained secondary school, 30.56% in middle school, 6.25% in primary school and only 4.86% having a university degree. Regarding the area of professional experience, more than a third of the respondents (36.81%) had between 11 and 15 years of egg production experience. Similar patterns are noted by Mahmoudi *et al*. (2015) in other regions: in Algeria, in the province of M'Sila, poultry farmers aged 24 to 50 years were 83.3% and 47.61% had between 11 and 22 years of experience in poultry farming. Likewise, in Pakistan, Punjab, the mean age of layer farmers was 43.46 years and the mean professional experience of the same was 12.85 years (Khan *et al*., 2022).

It is interesting to note that the majority of the farmers in the current study (97.92%) had no formal training in poultry production. Instead, self-learned knowledge

(46.53%) or skills that are passed on by parents and other relatives (53.47%) were the sources of farm management practices (46.53%). The result, as shown above, shows that structured training is of paramount importance to enhance flock management and productivity. Ibitoye and Onimisi (2013) showed that there was a positive relationship between training program attendance and productivity of 200 poultry farmers in Kogi State, Nigeria. In a similar sense, Thakur *et al*. (2021) discovered that specialized training for 40 poultry farmers resulted in enhanced technical knowledge and improved poultry production entrepreneurship.

Feeding management practices

Feeding habits of the study area commercial laying hen farms are depicted in Table 2. The pattern of feed sourcing differed considerably across the size of the farm. In farms with fewer than 12,000 birds and farms with 12,000 to 40,000 layers, only food was bought in commercial feed mills (100%). On the other hand, 11.1% of the farms containing over 40,000 layers had a section of their own feed produced on farms through special feed production lines. In general, feed purchased at mills was used in far more farms (99.3%), likely because the on-farm feed production infrastructure would demand high capital investment. In all investigated farms, the only form of feed was mash, which was preferred due to its lower production cost and easier to produce.

Most farmers (92.4%) failed to use pre-lay feeding, with the omission being highest in the two categories of smaller farms (94.6% and 94.9%) against 55.6% in farms with more than 40,000 layers. This does not follow breed management advice that states pre-lay diets at transfer (15-18 weeks), between 17 weeks to 2% lay, or until the first round of eggs laid. Past studies on the effect of various pre-lay diets have shown that feeding a high-energy, high-protein diet (2,700 kcal metabolizable energy and 18% crude protein) supplemented during the transition period boosts laying performance considerably (Sujatha *et al*., 2014).

Very few farms (7.6%) applied midnight feeding. Such practice was significantly less frequent in small farms than in large farms (97.3% and 92.9% *vs*. 66.7%, respectively), which can be explained by the lack of financial resources that could be used to employ night-shift workers on small-scale farms. It is claimed that this strategy enhances the quality of eggshells (Harms *et al*., 1996), calcium retention (Lichovnikova, 2007) and boosts egg weight, serum calcium, phosphorus and alkaline phosphatase (Salehi *et al*., 2025).

Nutritional supplements were employed differently in the surveyed farms, whereby the use of vitamin supplements became the norm in all the farms in this research study, with the use of organic acids and mineral salts being much lower, especially at the units operating at a small scale. Such a low uptake is not consistent with the existing provisions regarding laying hen nutrition, where it is stressed that sufficient macro elements and trace elements consumption must be ensured (Jeroch *et al*., 2011) and the positive effect of organic acids supplementation in the diet is discussed (Abd El-Ghany, 2024).

Production performance practices

Table 3 indicates the performance of the production of the commercial laying hen farms in study region. The laying period also differed significantly among the three groups of farm sizes (p= 0.011), with the longest laying period of Group III farms (>40,000 laying hens) averaging 75.83 weeks. There are some differences which seem to be directly associated with the time of flock replacement, which is made on the basis of both productivity and profitability reasons. Mean laying duration in the whole farms was 71.31 weeks. This is in contrast with the findings of Belaid-Gater *et al*. (2023), who established that laying periods in a table egg production complex in Algeria ranged between 42 and 64 weeks. Moreover, the average calculated in our study does not meet the breed recommendations, which are 73 to 82 weeks (ISA Brown, 2018; ISA White, 2018). The reduced laying periods noted here can probably be explained by a combination of factors that limit farm profitability, such as flock health issues, variable feed prices and unstable market prices for eggs. Existing studies have demonstrated that among operational expenses, the worst culprit in terms of profitability of egg production is high mortality rates, expensive feed and low selling price of eggs (Dogan *et al*., 2018; Sheikh *et al*., 2022).

The rate of production of eggs varied significantly (p<0.001) among the three groups of farm sizes, with the

Table 1: Socio-economic and professional characteristics of investigated farmers.

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
26-44	16	11.1
45-59	115	79.9
Over 60	13	9.0
Educational level		
Primary school	9	6.2
Middle education	44	30.6
Secondary education	84	58.3
University education	7	4.9
Egg production experience (years)		
1-5	1	0.7
6-10	64	44.4
11-15	54	37.5
Over 15	25	17.4
Training in poultry production		
Yes	3	2.1
No	141	97.9
Source of the know-how		
Acquired	66	45.8
Transmitted	78	54.2

Table 2: Feeding practices of commercial laying hen farms in study region.

Factors	Farm size						
	Less than 12.000 n (%)	12.000-40.000 n (%)	More than 40.000 n (%)	Totaln (%)	χ^2	*p*-value	Cramer's value
Feed source							
Produced on the farm	0 (0.0)	0 (0.0)	1 (11.1)	1 (0.7)	15.105	<0.001	0.324
Purchased	37 (100.0)	98 (100.0)	8 (88.9)	143 (99.3)			
Feed structure							
Granulated	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	/	/	/
Crumbled	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)			
Mash	37 (100.0)	98 (100.0)	9 (100.0)	144 (100.0)			
Crushed	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)			
Pre-lay diet							
Yes	2 (5.4)	5 (5.1)	4 (44.4)	11 (7.6)	18.436	Â0.001	0.358
No	35 (94.6)	93 (94.9)	5 (55.6)	133 (92.4)			
Midnight feeding							
Practiced	1 (2.7)	7 (7.1)	3 (33.3)	11 (7.6)	9.734	0.008	0.260
Not practiced	36 (97.3)	91 (92.9)	6 (66.7)	133 (92.4)			
Organic acids							
Used	6 (16.2)	13 (13.3)	9 (100.0)	28 (19.4)	39.921	Â0.001	0.527
Not used	31 (83.8)	85 (86.7)	0 (0.0)	116 (80.6)			
Mineral salts							
Used	15 (40.5)	40 (40.8)	9 (100.0)	64 (44.4)	12.001	0.002	0.289
Not used	22 (59.5)	58 (59.2)	0 (0.0)	80 (55.6)			
Vitamins							
Used	37 (100.0)	98 (100.0)	9 (100.0)	144 (100.0)	/	/	/
Not used	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)			

highest rate (82.89%) recorded in Group III (>40,000 laying hens) as illustrated in Table 3. Such differences can be explained by the inverse correlation between the mortality rate and the production rate of eggs, a tendency confirmed by our results, with the lowest mortality rate and the highest production rate being observed in Group III. The total average rate of egg production, as registered in this study, is lower than the breed guidelines (ISA Brown, 2018; ISA White, 2018) as well as below the minimum commercial viability of 70% (Arulnathan *et al*., 2024). This rate is higher than the 63.68% and 63.63% recorded by Meziane *et al*. (2012) and Kaci (2015b), respectively, but it is lower than the 72% and 75% recorded by Feknous (2012) and Aissaoui *et al*. (2010), respectively. It is also a bit lower than the average 73.43% in 15 years of Algerian table egg production facility (Belaid-Gater *et al*., 2023). Additionally, inefficient flock productivity in regular laying seasons (Calik, 2017), low feed quality, discrepancies between feed ingredient composition (Akinola and Ekine, 2018; Alhotan, 2021) and the negative influence of unregulated environmental factors (Tesakul *et al*., 2025) can be considered as potential factors that explain the relatively low production rates that were observed in the current study. The other possible reason that can lead to this poor performance is the faster wearing out of the laying intensity, leading to poor laying persistence.

Group III had the highest peak production rate, followed by Group II (farm sizes >12,000 to ≤40,000 laying hens) and the lowest peak production rate was that of Group I (farm sizes ≤12,000 laying hens) (p<0.001), as shown in Table 3. The large differences in mean peak production rates between the groups are attributable to differences in the sexual maturity of the flocks in the transition to the first lay to peak production. The average peak production rate in this study was 83.31% which is lower than the breed guideline range of 94-97% (ISA Brown, 2018; ISA White, 2018). This deficit can be associated with an inability to meet and maintain critical metabolic targets or to reach and maintain optimal body weight, the former of which is necessary to reach and maintain earlier and prolonged peak production.

The results of the analysis showed that there were considerable variations in the consumption of feed between the three groups of farm sizes (p=0.006). The group III farms have the lowest mean feed intake of 112.00 g/day/hen, which conforms well with breed recommendations of ISA Brown and ISA White strains (ISA Brown, 2018; ISA White, 2018). The fact that feed intake in Group III farms was relatively low could be due to the modern feeding systems in use, which have eliminated wastage of feeds. On the other hand, previous research stated that particle size and feed form have a significant impact on the intake of feed (Boussaada *et al*., 2024; Yenice *et al*., 2025), besides the nutrient composition of the diet (Bryden *et al*., 2021), laying cycle's phase (Choi *et al*., 2004), feeding tactics (Anene *et al*., 2023), access to water (Pacheco *et al*., 2022) and environmental tenets (Muir *et al*., 2024).

Table 3: Production performance of commercial laying hen farms in study region.

Factors	Farm size								p-value
	Less than 12.000		12.000-40.000		More than 40.000		Overall		
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	
Laying period (weeks)	64.88±8.39^{c}	52-79	72.14±9.09^{b}	52-87	75.83±5.78^{a}	61-79	71.31±7.74	52-87	0.011
Egg production rate (%)	65.00±2.95^{c}	60-69	67.95±4.22^{b}	60-75	82.89±2.85^{a}	79-87	69.48±8.32	60-87	<0.001
Peak production rate (%)	74.83±3.83^{c}	70-83	83.59±9.05^{b}	70-96	93.22±2.17^{a}	90-96	83.31±9.45	70-96	<0.001
Age at 50% rate of lay (weeks)	22.75±1.06	21-24	22.52±1.05	21-24	22.44±0.88	21-24	22.55±1.02	21-24	0.749
Feed consumption (g/day/hen)	115.50±3.34^{a}	110-122	115.05±2.66^{a}	110-120	112.00±1.50^{b}	110-115	114.71±2.83	110-122	0.006
Mortality rate (%)	13.67±1.44^{a}	12-16	11.93±1.72^{b}	8-16	6.11±1.54^{c}	5-9	11.45±3.12	5-16	<0.001

Table 3 indicates that the rates of mortality were considerably different among the three groups of farm sizes (p<0.001). The rates of mortality (13.67% in Group I and 11.93% in Group II) surpassed the breed guideline thresholds of ISA Brown (6-7%) and ISA White (5-6%). (ISA Brown, 2018; ISA White, 2018). Group III, on the contrary, obtained an average mortality rate of 6.11%, which agrees with these standards of breeding. The relatively low mortality rate in Group III could also be explained by the fact that farmers working in it were more experienced and conditions of disease management and overall rearing could be better. The other reason that could be given is that Group III farmers are more focused on the entire health management plans that include enhanced vaccination protocols (Hulme, 2020) and sound biosecurity strategies (Mirwandhono *et al*., 2023). The mean mortality rate observed in our study is still less than those reported by Mahmoudi *et al*. (2015) and Belaid-Gater *et al*. (2023).

CONCLUSION

In part, this research will address the lack of research on feeding habits and pro-duction performance in commercial laying hen farms in Algeria. The results also raise several deficiencies in the feeding measures, including the use of pre-lay diets, selection of feed sources and supplementation with organic acids and mineral salts, which are usually driven by economic reasons. Interestingly, bigger farms that had over 40,000 laying hens have shown a relatively proper handling of such obstacles. The operations with more than 40,000 birds produced the best performance in terms of production when compared to the other farm-size categories, which means that large-scale businesses are more productive in Algerian conditions. However, the general performance of production during the Algerian laying hen farms was still not up to the recommended performance in this research study. The long-term changes will demand that farmers implement efficient feeding regimes and the governmental funds will be used to invest in modern production facilities and increase productivity.

Conflict of interest

The authors declare that there are no conflicts of interest.

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