UCC 636.52/.58:637.41:637.05

QUALITY INDICATORS OF EDIBALE EGGS OF DIFFERENT CHICKEN CROSSES

Tsaruk L.L., *Candidate of Agricultural Science, Associate Professor*
Vinnitsa National Agrarian University

It is known, increasing the productivity of animals including poultry is determined by achievements in the field of selection and breeding by 35-40%. If we combine the use of modern poultry crosses with a high productivity potential with appropriate feeding and keeping conditions, it becomes possible to achieve high results in the production of high-quality agricultural products.

The research material was eggs of the hens of the Cross Loman Brown and High-Line W-98 crosses in the conditions of LLC Tul-Chiken of the Tulchyn district.

As a result, of the studies it was found that the eggs of the Loman Brown cross hens had 1.1 g or 1.7% more weight than the eggs of the High-Line W-98 cross hens (the difference is significant). According to the value of the shape index, the eggs of both crosses correspond to standard indicators (76-78%).

The eggs of the Cross-Loman Brown hens had also less air-chamber height and its diameter, respectively by 0.34 mm (10.9%) and 0.8 mm (3.8%) at (P<0.001), and therefore they were fresh longer.

According to the morphological parameters of the protein and yolk, the eggs of the Cross-Loman Brown hens were slightly better than the High-Line W-98 crosses, but the difference was not significant.

Cross-Loman Brown hens eggs also had a higher percentage of dry matter by 0.7% due to the content of protein (+0.36%) and ash (+ 0.26%). However, eggs with a white shell color had a higher calcium content (0.8%) (High-Line W-98).

In conclusion, it can be argued that the quality of the eggs of the Loman Brown and High-Line W-98 crosses corresponds to the standard indicators. It is recommended to give preference to Cross-Loman Brown hens in the conditions of this poultry farm.

Keywords: *hen eggs, foreign crosses, morphological parameters of eggs, protein, yolk, shell, egg chemical composition*

Fig. 1. Tab. 7. Ref. 6

Statement of the problem. Obtaining a large amount of high quality products encourages the use of highly productive breeds or crosses of poultry. It is known that improving the animals' productivity, including poultry, is determined by achievements in breeding by 35-40%. Combining modern poultry crosses with high productivity potential with proper feeding and keeping conditions creates the opportunity to achieve high results in the production of high quality agricultural products [6].

Specialized poultry enterprises of Ukraine use crosses of both domestic and foreign breeds, but their comparative characterization of economically useful traits was carried out selectively and is not perfect; it prevents egg producers from selecting the most promising cross to use [1, 5].

Increasing the quota for export of chicken food eggs up to 3 thousand tons and 1.5 thousand tons of egg products to the European Union motivates domestic producers to modernize production and to introduce higher standards of product quality [2].

According to studies, the quality of food eggs obtained from different chickens differ in energy value and chemical composition. However, in our country, the assessment of quality indicators of food eggs depending on the cross is not carried out, and at the market eggs category is taken into account, it is determined by morphological features [1, 5]. The main normative documents governing the issue of determining the quality of food chicken eggs in our country are SSU 8104:015 on food eggs, egg products, methods for determining their microbiological parameters [3]. Therefore, the assessment of the quality of products in accordance with the Ukrainian regulations will increase the production of high quality products for the Ukrainian consumer by using more promising crosses. So, no doubt, the conducted research is topical.

Purpose of research. The aim of the research was to compare the quality indicators of Lohmann Brown and Hy-LineW-98 crossbreed eggs in the Tul-Chicken LLC poultry farm of the Tulchyn district.

Materials and methods of research. Research methods are modern conventional methods, i.e. zootechnical (a characteristic of the studied crosses on their productive features); analytical (literature review and generalization of studies), morphological studies; chemical (chemical analysis of constituent eggs), economic (the efficiency of using more promising cross chickens); statistical (biometric processing of digital data).

The study on egg quality indicators was conducted in the conditions of the scientific laboratory of the Livestock Production and Processing Technologies of Animal Products Department of Vinnytsia National Agrarian University, and the chemical analysis of the egg components were conducted at the laboratory of zootechnical analysis of the Institute of Feed and Agriculture of Podillia of the National Academy of Sciences of Ukraine by conventional methods [3, 4].

The research material was the eggs of Lohmann Brown and Hy-LineW-98 crossbreed eggs in the Tul-Chicken LLC poultry farm of the Tulchyn district.

The studies were performed according to the scheme shown in table 1.

Thus, according to the scheme of research (table 1), the morphological and chemical parameters of eggs of hens of two foreign crosses Lohmann Brown and Hy-LineW-98 were studied. 40 eggs at the age of 52 weeks of each cross were selected for research, 30 eggs were used for morphological studies and 10 eggs were used for determining the chemical composition of the constituent eggs.

The egg weight, shape index, white and yolk indices, percent of white and yolk, white / yolk ratio were determined at the individual level.

Table 1

Scheme of research

Group	Cross name	Poultry age, weeks	Number of eggs	The main researched indicators
1	Lohmann Brown	52	30	Morphological indicators
			10	Chemical indicators
2	Hy-LineW-98	52	30	Morphological indicators
			10	Chemical indicators

The egg weight and its internal constituents were determined by weighing eggs, white, yolk, shells on scales to the nearest 0.01 g.

The large and small diameter of the egg, the diameter and height of the air chamber, the height and diameter of the white and yolk were determined by measuring the caliper.

The indices of egg shape, white and yolk were determined by conventional formulas [4].

Such chemical indicators were determined: egg solids, protein, lipids, crude ash in white and yolk, and in the shell — calcium and phosphorus. The mean values were considered statistically significant at *P<0.05; **P<0.01; ***P<0.001. Biometric data processing was performed on a PC using MS Exsel software using built-in statistical functions and a special statistical program.

Research results. The first necessary chain of selection improvement for eggs is to assess their quality. In modern poultry farming, it is quite valuable to have a bird that rapidly grows its egg weight in the first months of egg laying and takes down eggs of the correct shape. Therefore, by assessing the eggs of the test crosses of chickens by morphological indicators at 52 weeks of age (table 2), we found a difference in the weight of eggs of the higher category.

Table 2

Morphological indicators of eggs of laying hens, *M±m*

Indicator	Hy-LineW-98	Lohmann Brown
Weight of egg, g	65.4±1.03	66.5±1.14
The longitudinal diameter of the eggs, mm	56.3±0.68	57.1±0.64
Transverse diameter of eggs, mm	43.4±0.42	43.9±0.44
Shape index,%	77.1±0.77	76.9±0.44
Shell thickness, mm	0.38±0.03	0.41±0.02
Height of the whip, mm	3.12±0.04	2.78±0.03***
Diameter of the whip, mm	21.1±0.19	20.3±0.19***

*Note: ***P<0.001*

Thus, Lohmann Brown's eggs were slightly heavier than Hy-LineW-98 ones (+1.1g or 1.7% difference).

Egg shape is one of the main indicators of quality, which is very important for hatching eggs. According to the value of the shape index, eggs with larger weight (Lohmann Brown cross) were slightly inferior to white eggs, namely 0.2%, but the obtained indicators for both crosses correspond to the norms.

The eggs of the Lohmann Brown cross were better in terms of diameter and height of the air chamber. Thus, the height of the air chamber and their diameter were smaller, respectively, by 0.34 mm (10.9%) and 0.8 mm (3.8%) at (P<0.001), and therefore retained freshness longer. The thickness of the shell of both test crosses was within 0.38-0.41 mm, which corresponds to the normative parameters.

Table 3 shows the morphological parameters of egg white.

Table 3

Egg white quality indicators, *M±m*

Indicator	Hy-LineW-98	Lohmann Brown
Weight of egg white, g	40.3±0.41	41.5±0.39***
Large diameter of egg white, mm	76.12± 1.01	76.9±1.12
Small diameter of egg white, mm	64.9±0.64	65.8±0.49
Average diameter of egg white, mm	70.51±0.59	71.15±0.66
Height of the dense layer of egg white, mm	8.7±0.28	8.8±0.31
Index of egg white, %	12.3±0.29	12.4±0.33

Note: ****P<0.001*

Considering the morphological parameters of egg white (table 3), we observed a higher white weight by 1.2 g or 3.0% (P<0.001) in chickens that had a larger egg weight, namely, Lohmann Brown cross. The small and large diameters of the white of the Lohmann Brown eggs were by 0.78 and 0.9 mm longer than the eggs of the W-98 High Line chicken. According to the height of the dense layer of egg white, the indicator that determines the value of the egg white the difference is also set (+0.1 mm) in favor of eggs of Lohmann Brown crosses.

Lohmann Brown's chicken eggs had a 0.1% advantage according to the egg white quality index.

Yolk is the most valuable part of an egg. It is rich in proteins (16.2%) and fats (32.6%), it contains carbohydrates (galactose and glucose), the minerals are the same as those found in egg white, vitamins D, E, PP and group B.

The morphological parameters of egg yolk quality are presented in table 4.

Table 4

Quality indicators of egg yolk, *M±m*

Indicator	Hy-LineW-98	Lohmann Brown
Weight of egg yolk, g	16.6±0.32	17.1±0.33
Large diameter of egg yolk, mm	40.7±0.56	41.2±0.63
Small diameter of egg yolk, mm	39.5±0.38	39.9±0.43
Average diameter of egg yolk, mm	40.1±0.48	40.6±0.51
Height of egg yolk, mm	17.1±0.21	17.9±0.27***
Index of egg yolk, %	42.64±0.49	44.1±0.52**

Note: ***P<0.01, ***P<0.001.*

Comparison of the quality of the yolk of the studied crosses eggs is evidence of the best performance of Lohmann Brown eggs (table 4).

Thus, the egg yolk weight of the Hy-LineW-98 cross was 16.6 g, or 25.4% of the egg weight. The egg yolk with the brown shell was heavier by 0.5 g or 3.01% than from analogues, and its share was 25.7% of eggs weight.

According to all investigated indicators, Lohmann Brown eggs were slightly better. In particular, the mean diameter of the yolk was 0.5 g, or 1.25%, and the height of the yolk was 0.8 g, or 4.7%.

According to the index of yolk, eggs of hens of the Lohmann Brown cross were 1.46% better than eggs with white shell color ($P<0.01$). As a result, they are longer kept fresh. However, there is no significant difference between the researched eggs. It is 0.48-0.5 or 48-50 in fresh-born eggs, and it decreases during storage.

The weight of the egg components (white, yolk and shell) generally depends on the weight of the egg. Taking into account the average percentages of egg components (white – 56%, yolk – 32 %, and shell – 12%), the studied Lohmann Brown and Hy-LineW-98 eggs had a higher protein content of 11.4 and 10%, respectively (table 5). However, this can be explained by the fact that the conventional ratio varies depending on the species of poultry and egg weight is not the same. As the egg weight increases, the amount of protein in absolute values and in percentage increases, too.

The internal structure of the egg as a biological system is characterized by the ratio of its components such as white and yolk of an egg (table 5 and fig. 1).

Table 5

Ratio of morphological parts of the researched crosses eggs

Indicator	Hy-LineW-98	Lohmann Brown
Ratio:		
white and yolk, %	2.43	2.43
- shell	13.0±0.4	12.0±0.34
- yolk	25.4±0.71	25.7±0.66
- white	61.6±0.91	62.4±0.87***

Note: *P<0.001*

The test eggs of chickens of both crosses exceed the normative indicator of 1.75 by 0.68% in the ratio of white to yolk; it indicates the high reproducible qualities of the eggs of both researched crosses. The High-Line W-98 eggs were worse than Lohmann Brown eggs by 0.8% for white and had a heavier shell by 1 % (fig. 1) despite the same protein ratio of yolk to white and the percentage of yolk. Thus, Lohmann Brown's eggs were the most valuable.

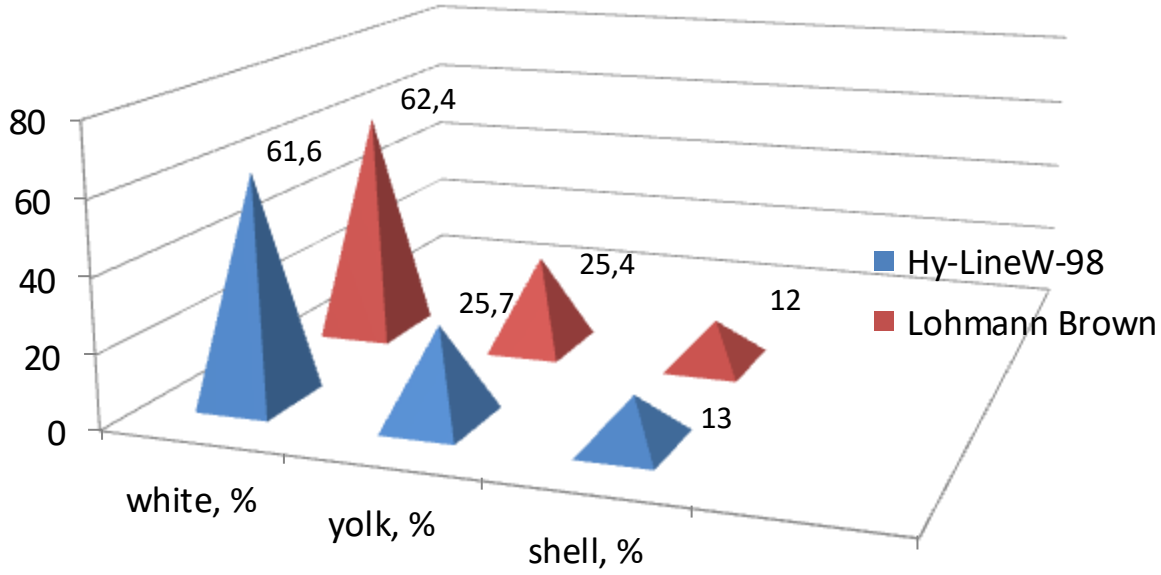

Fig. 1. **The ratio of the eggs components, %**

The level of variation (C_v) of morphological characteristics of the researched birds was additionally analyzed during the study period (table 6).

Table 6

The coefficient of variability (C_v) of morphological characteristics of eggs of the experimental poultry, %

Chicken cross	Weight of eggs	Weight of egg white	Weight of yolk	Weight of shell	Shape index
Lohmann Brown	10.6	11.4	8.1	11.7	3.8
Hy-LineW-98	9.7	14.8	7.8	10.9	2.9

Variability is considered weak if C_v <10%; it is average if C_v is from 11-25%, and it is significant if C_v>25%.

The coefficient of variation of egg weight is in the range of 9.7%-10.6% and is consistent with the trend observed for egg components, which varies for yolk weight at 7.8-8.1% and for white weight at 11.4-14.8% (table 6).

Thus, most egg morphological characteristics have a slight variability of 3.8-11.7% for Lohmann Brown and 2.9-14.8% for Hy-LineW-98.

According to the research results of the chemical composition of eggs of hens of the studied crosses (table 7) no significant difference was established. However, it

should be noted that the eggs of chickens that prevailed by weight (Lohmann Brown) also had a higher percentage of dry matter by 0.7% and, mostly, due to the protein content (+0.36%).

Table 7

Chemical composition of eggs, %

Indicator	Hy-LineW-98		Lohmann Brown	
	White+yolk	Shell	White+yolk	Shell
Dry matter,% including:	24.9	-	25.6	-
protein,%	12.48	-	12.84	-
lipids, %	10.88	-	10.98	-
raw ash, %	1.54	-	1.78	-
phosphorus, g/kg	-	0.076	-	0.075
calcium, g/kg	-	38.6	-	37.8

Assessing the quality of the shell, it can be noted that white eggs have a higher content of calcium, compared to the shell of brown eggs by 0.8%.

Conclusions. 1. It was found that Lohmann Brown 's eggs had a 1.1 g or 1.7% greater weight than the Hy-LineW-98 eggs (the difference is not reliable). According to the shape index, eggs of both crosses meet the normative indexes (76-78%). Also, Lohmann Brown cross hen eggs had smaller air chamber heights and diameters of 0.34 mm (10.9%) and 0.8 mm (3.8%) at $P<0.001$, respectively, and thus they retained freshness longer.

2. The thickness of the shell of both researched crosses was within 0.38-0.41 mm, which corresponds to the normative parameters.

3. The morphological parameters of egg white and egg yolk of Lohmann Brown hens were slightly better than Hy-LineW-98, in particular, the egg white difference was 1.2 g (3.0%) at $P<0.001$ and yolk weight difference was 0.5 g or 1.25%.

4. The test eggs of chickens of both crosses exceed the normative indicator of 1.75 by 0.68% in the ratio of white to yolk; it indicates the high reproducible qualities of the eggs of both researched crosses. The High-Line W-98 eggs were worse than Lohmann Brown eggs by 0.8% for white and had a heavier shell by 1% despite the same protein ratio of yolk to white and the percentage of yolk. Thus, Lohmann Brown's eggs were the most valuable.

5. It was found that most egg morphological characteristics have a slight variability of 3.8-11.7% for Lohmann Brown and 2.9-14.8% for Hy-LineW-98.

6. The eggs of chickens that prevailed by weight (Lohmann Brown) also had a higher percentage of dry matter by 0.7% and, mostly, due to the protein (+ 0.36%) and ash content (+0.26%). However, eggs with a white shell (Hy-LineW-98) had a higher calcium content (0.8%).

Thus, summarizing the results of the research, it is possible to propose to prefer the brown cross hens Lohmann Brown in the conditions of this enterprise.

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АННОТАЦІЯ

ПОКАЗНИКИ ЯКОСТІ ХАРЧОВИХ ЯЄЦЬ КУРЕЙ РІЗНИХ КРОСІВ

Царук Л.Л., *кандидат с.-г. наук, доцент*
Вінницький національний аграрний університет

Нарощення обсягів виробництва й експорту, пошук нових ринків збуту та вирішення наболілих кадрових питань – такі реалії виробників курячого яйця в Україні. Саме це спонукає вітчизняних виробників модернізувати виробництво і впроваджувати більш високі стандарти якості продукції. І одним із шляхів збільшення виробництва високоякісної продукції є використання тих кросів птиці, які виявляться більш перспективними.

В результаті проведених досліджень встановлено, що в умовах ТОВ «Туль-Чікен» Тульчинського району яйця курок кросу Ломанн браун мали більшу на 1,1 г, або 1,7% масу, ніж яйця курок кросу Хай-лайн W-98, (різниця – недостовірна). За значенням індексу форми, яйця обох кросів відповідають нормативним показникам – (76-78%). Також яйця курок кросу Ломанн браун мали менші і висоту повітряної камери і діаметр відповідно на 0,34 мм (10,9%) і 0,8 мм (3,8%) при (P<0,001), а отже, довше зберігали свіжість.

За співвідношенням: білок : жовток, досліджені яйця курей обох кросів переважають нормативний показник 1,75 на 0,68 %, що свідчить про високі відтворні якості яєць обох досліджуваних кросів. Не дивлячись на однакове співвідношення білок : жовток, і відсоток жовтка, яйця кросу Хай-лайн W-98 уступали яйцям Ломанн браун за % білка на 0,8 і на 1% мали важчу шкаралупу.

Яйця курей кросу Ломанн браун мали і більший відсоток сухої речовини на 0,7%, здебільшого за рахунок вмісту протеїну (+0,36%) та золи (+0,26%). Проте, більший в шкаралупі вміст кальцію (на 0,8%) мали яйця з білим кольором шкаралупи (Хай-Лайн W-98).

Узагальнюючи результати проведених досліджень, можна стверджувати, що за якістю яйця кросів Ломанн браун і Хай-лайн W-98 відповідають нормативним показникам і пропонувати в умовах даної птахофабрики надати перевагу курам коричневого кросу Ломанн браун.

Ключові слова: *курячі яйця, зарубіжні кроси, морфологічні показники яєць, білок, жовток, шкаралупа, хімічний склад яйця*

Рис. 1. Табл. 7. Літ. 6.

АННОТАЦИЯ
ПОКАЗАТЕЛИ КАЧЕСТВА ПИЩЕВЫХ ЯИЦ КУР РАЗНЫХ КРОССОВ

Царук Л.Л., *кандидат с.-х. наук, доцент*
Винницкий национальный аграрный университет

Как известно, повышение продуктивности животных в т. ч. и птицы на 35-40% определяется достижениями в области селекции и племенного дела. Если же совместить использование современных кроссов птицы с высоким потенциалом продуктивности с надлежащими условиями кормления и содержания создается возможность достигать высоких результатов в производстве сельскохозяйственной продукции высокого качества.

Материалом исследований служили яйца кур кроссов Ломанн браун и Хай-лайн W-98 в условиях ООО «Туль-Чикен» Тульчинского района.

В результате проведенных исследований установлено, яйца кур кросса Ломанн браун имели большую на 1,1 г, или 1,7% массу, чем яйца кур кросса Хай-лайн W-98, (разница - недостоверна). По значению индекса формы, яйца обоих кроссов соответствуют нормативным показателям – (76-78%).

Также яйца кур кросса Ломанн браун имели меньше и высоту воздушной камеры и ее диаметр соответственно на 0,34 мм (10,9%) и 0,8 мм (3,8%) при (P<0,001), а следовательно, дольше сохраняли свежесть.

По морфологическим показателям белка и желтка яйца кур кросса Ломанн браун были несколько лучше по сравнению с Хай-лайн W-98.

Яйца кур кросса Ломанн браун имели и больший процент сухого вещества на 0,7%, в

основном за счет содержания протеина (+0,36%) и золы (+0,26%). Однако, больше в скорлупе содержание кальция (на 0,8%) имели яйца с белым цветом скорлупы (Хай-Лайн W-98).

Обобщая результаты проведенных исследований, можно утверждать, что по качеству яйца кроссов Ломанн браун и Хай-лайн W-98 соответствуют нормативным показателям и предлагать в условиях данной птицефабрики отдать предпочтение курам коричневого кросса Ломанн браун.

***Ключевые слова**: куриные яйца, зарубежные кроссы, морфологические показатели яиц, белок, желток, скорлупа, химический состав яйца*

Рис. 1. Табл. 7. Лит. 6.

Інформація про авторів

***ЦАРУК Людмила Леонідівна,** кандидат сільськогосподарських наук, доцент, доцент кафедри технології виробництва продуктів тваринництва Вінницького національного аграрного університету (21008, м. Вінниця, вул. Сонячна, 3; e-mail: cll@vsau.vin.ua)*

***ЦАРУК Людмила Леонидовна,** кандидат сельскохозяйственных наук, доцент, доцент кафедры технологии производства продуктов животноводства Винницкого национального аграрного университета (21008,г. Винница, ул. Солнечная, 3; e-mail: cll@vsau.vin.ua)*

***TSARUK Liudmyla,** Candidate of Agricultural Sciences, Associate Professor, Associate Professor of the Department of Technology of Production of Livestock Products, Vinnytsia National Agrarian University (21008, 3, Soniachna Str., Vinnytsia; e-mail: cll@vsau.vin.ua)*