Quality traits of goose eggs: 2. Effects of goose origin and storage time of eggs

Qualitätseigenschaften von Gänseeiern: 2. Effekte der genetischen Herkunft und der Lagerdauer der Eier

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Introduction

Albumen quality is a standard measurement of egg quality that is most often measured as the height of inner thick albumen or a function of this, such as Haugh unit (HAUGH, 1937). Factors that affect albumen height were reviewed by WILLIAMS (1992). Just a few nutritional factors have been implicated, but overall nutrition was of less importance. The major influences on egg quality are genetic strain of hens, age of layers, storage time and storage conditions.

The egg size and its components are influenced by a number of genetic and nongenetic factors (WASHBURN, 1990). Haugh unit, albumen index, yolk index, egg weight, albumen weight, yolk weight, shell weight, shell thickness and shell membrane thickness are affected by genetic or origin (FARUGA et al., 1989; ARROYO, 1993; SILVERSIDES and VIENNEUVE, 1994; PAKULSKA et al., 1995; PUCHAJDA et al., 1995; İŞGÜZAR, 2001; SILVERSIDES and SCOTT, 2001) and storage time (MAI, 1986; ALTAN et al., 1997; SUK and PARK, 2001).

As the age of the layer increases the albumen height decreases, whereas egg weight and total amount of albumen increase as well. Albumen height, Haugh unit, albumen and yolk indices of all eggs are at maximum when the eggs are laid and decrease with increased storage time (HILL and HALL, 1980; SILVERSIDES and VIENNEUVE, 1994; SILVERSIDES and SCOTT, 2001).

Hatchability of fertile eggs was stated as 84.9, 76.7, 80.6 and 80.0% in eggs of two years old INRA, Armutlu, Başkuyu and Tatlicak goose (TILKI, 2001). VARGANE et al. (1999) reported that in eggs of Landes and Hungarian geese fertility was 82.3 and 85.0%, hatchability of fertile eggs was 92.1 and 89.2%, respectively. TOTH (1991) described 74.7, 55.6, 77.6 and 67.7% for fertility and 90.3, 79.5, 75.9 and 81.4 for hatchability of fertile eggs in Kuban, Landes, Babat and (Kuban × Landes × Babat) × Kuban goose eggs. Hatchability decreases rapidly after 6–7 day holding periods although eggs properly stored can be held 10 to 14 days with fair results (ENSMINGER, 1992). Hatchability rates were reported as 83.5, 79.7, 64.5 and 20.7% in eggs of Landes geese stored for 3, 10, 17 and 24 days (BÖGENFÜRST, 1995). KATZ’S unpublished work (cited by BÖGENFÜRST, 1995) calculated 67.0, 70.0 and 85.8% for hatchability and 96.5, 81.5 and 46.7% for fertility in 10, 17 and 24 day stored goose eggs. MERRIT and CLARRIDGE (1959) reported that in eggs of Pilgrim goose stored for 1–7 days and 8–15 days fertility was 62 and 60%, hatchability was 50 and 45% and hatchability of fertile eggs was 50 and 45%, respectively.

Shell thickness was described as 0.52 and 0.53 mm for eggs of 1 and 3 years old Bilgorajska goose (PUCHAJDA et al., 1995), 0.58 mm for eggs of White Italian goose (PAKULSKA et al., 1995) and 0.73, 0.73 and 0.69 mm for eggs of Black, White and Stained goose (IŞGÜZAR, 2001). It was concluded that egg shell thickness higher than 0.60 mm might cause hatchability problems in goose eggs (RAMOS et al., 1991).

Shape index of eggs of 2 years old INRA, Armutlu, Başkuyu and Tatlicak goose were 68.0, 67.2, 66.0 and 65.1% (TILKI, 2001), for eggs of Iages Hybrid goose 65.7% (HALAJ et al., 1991) and for eggs of 3 years old Bilgoraj goose was 65.1% (FARUGA et al., 1999).

Freshly laid and stored eggs from four different origins of geese were studied to investigate the importance of goose origins and storage time on egg external and internal quality.

Table 1. Ingredient and chemical analysis of the concentrate fed during the laying period

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>72.00</td>
</tr>
<tr>
<td>Soybean</td>
<td>17.00</td>
</tr>
<tr>
<td>Barley</td>
<td>1.56</td>
</tr>
<tr>
<td>Fish meal</td>
<td>2.00</td>
</tr>
<tr>
<td>Lime stone</td>
<td>6.00</td>
</tr>
<tr>
<td>Dicalciumphosphate</td>
<td>0.84</td>
</tr>
<tr>
<td>Salt</td>
<td>0.25</td>
</tr>
<tr>
<td>Vit. - Min. Premix¹</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Chemical analysis

| Metabolisable energy² (kcal/kg) | 2900 |
| Dry matter | 92.75 |
| Crude protein (in DM) | 14.94 |
| Ether extract (in DM) | 3.32 |
| Crude fibre (in DM) | 4.32 |

¹ Provided per kg concentrate: Vitamin A, 21,000 IU; Vitamin D₃, 4,200 IU; Vitamin E, 52.5 mg; Vitamin K₃, 4.38 mg; Vitamin B₁, 5.25 mg; Vitamin B₂, 12.25 mg; Vitamin B₆, 7 mg; Vitamin B₉, 0.03 mg; Folic acid, 1.75 mg; D-Biotin 0.08 mg; Vitamin C, 87.5 mg; Niacin, 70 mg; Ca-D-Pantothenat, 14 mg; Choline chloride 218.75 mg; Fe, 140 mg; Zn, 105 mg; Cu, 14 mg; Co, 0.35 mg; I, 1.75 mg; Se, 0.26 mg; Mn, 140 mg.

² Provided by calculation (NRC, 1994).
Material and Methods

Birds and Housing

The research was conducted on eggs obtained from one year old Isparta-Armutlu, Konya-Tatlicak, Konya-Başkuyu and France White geese (INRA), that were kept at the Faculty of Veterinary Medicine, University of Selcuk, Turkey. Geese were housed all together till a month ago before the laying season. Each origin group was settled with 1 male and 5 female goose. Geese were fed a concentrate (Table 1) to meet the National Research Council recommendations for laying geese (NRC, 1994). The concentrate contained 2900 kcal/kg ME and 15% CP and was offered by 250 g/goose/day.

Egg quality traits

Eggs were collected daily. For Armutlu, Tatlicak, Başkuyu and INRA geese 28, 27, 27 and 120 eggs were broken and evaluated, the same procedure was applied to 34, 34, 35, 33, 33 and 33 eggs stored for 0, 5, 10, 15, 20 and 25 days. The number of eggs from native geese was less than 34 eggs from INRA geese as the result of low egg production of native geese. Işguzar (2001), Tilki (2001) and Arslan and Saatç (2003) reported an egg production of 8-15 eggs/goose/year.

Eggs were stored at 13-16 °C and 55-65% relative humidity (Graves, 1985) for 0, 5, 10, 15, 20 and 25 days. At sampling, eggs were weighed and broken onto a flat surface where the height of the albumen was measured half way between yolk and edge of the inner thick albumen by using electronic albumen height gauge. The diameters of the thick albumen were measured using micrometer. The yolk was separated from the albumen and weighed. Shells were dried at room temperature for 10-15 minutes and weighed. The shell thickness and shell membrane thickness were measured from three different parts of shell of each (equator, top and truncated edge) egg using a micrometer and was averaged and was recorded as shell thickness and shell membrane thickness. The weight of the albumen was calculated as the difference between the weight of the egg and the weight of yolk and shell. Then, Haugh unit, albumen index, yolk index and egg weight loss were calculated as follows:

- Haugh unit = 100 · log (Albumen height - 1.7 · Egg weight) + 7.57
- Albumen index = (Albumen height (mm)/(Albumen length (mm) + Albumen width (mm))) · 100
- Yolk index = (Yolk height (mm)/Yolk diameter (mm)) · 100
- Egg weight loss = ((Egg weight - Egg broken weight)/Egg weight) · 100

The maximum widths and lengths of each egg were measured with callipers and their shape indices were calculated using the formula:

- Shape index = maximum width (mm)/maximum length (mm) · 100

Statistical Analysis

All data were analyzed by using the SPSS statistical package (SPSS, 1999). General linear model procedure was used including as main effects storage time and origins of geese and the two way interaction of these factors. The significant means were compared by Duncan’s test.

Where:

Yij = µ + ai + bj + (a + b)ij + eij

Where:

Yij is the observation of measurement (egg weight, egg broken weight, egg weight loss, shell weight, shell ratio, shell thickness, shape index, albumen weight, albumen ratio, yolk weight, yolk ratio, shell membrane thickness, Haugh unit, albumen index, yolk index)

µ is the overall mean,

ai is the effect of origins (i: Armutlu, Tatlicak, Başkuyu and INRA),

bj is the effect of storage time (j: 0, 5, 10, 15, 20, 25 day),

(a + b)ij is the interaction of origins and storage time,

eij is the random error.

Results

Means with their standard errors for egg weight, egg broken weight, egg weight loss, shell weight, shell ratio, shell

<table>
<thead>
<tr>
<th>n</th>
<th>Egg weight (g)</th>
<th>Egg broken weight (g)</th>
<th>Egg weight loss (%)</th>
<th>Shell weight (g)</th>
<th>Shell ratio (%)</th>
<th>Shell thickness (mm)</th>
<th>Shape index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>202</td>
<td>146.2 ± 1.02</td>
<td>143.3 ± 1.00</td>
<td>2.03 ± 0.03</td>
<td>19.9 ± 0.17</td>
<td>13.9 ± 0.10</td>
<td>0.55 ± 0.00</td>
</tr>
<tr>
<td><strong>Origin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Armutlu</td>
<td>28</td>
<td>145.1 ± 2.24</td>
<td>142.4 ± 2.20</td>
<td>1.85 ± 0.75b</td>
<td>19.4 ± 0.38bc</td>
<td>13.7 ± 0.23b</td>
<td>0.54 ± 0.01b</td>
</tr>
<tr>
<td>Tatlicak</td>
<td>27</td>
<td>148.5 ± 2.28</td>
<td>145.5 ± 2.24</td>
<td>2.00 ± 0.77b</td>
<td>21.6 ± 0.38b</td>
<td>14.8 ± 0.23b</td>
<td>0.58 ± 0.01a</td>
</tr>
<tr>
<td>Başkuyu</td>
<td>27</td>
<td>147.2 ± 2.28</td>
<td>144.4 ± 2.25</td>
<td>1.89 ± 0.77b</td>
<td>20.0 ± 0.38b</td>
<td>13.8 ± 0.23b</td>
<td>0.55 ± 0.01b</td>
</tr>
<tr>
<td>INRA</td>
<td>120</td>
<td>144.2 ± 1.07</td>
<td>140.8 ± 1.06</td>
<td>2.37 ± 0.36a</td>
<td>18.7 ± 0.18a</td>
<td>13.3 ± 0.11b</td>
<td>0.55 ± 0.01b</td>
</tr>
<tr>
<td><strong>Storage time</strong></td>
<td></td>
<td></td>
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<tr>
<td>0</td>
<td>34</td>
<td>146.7 ± 2.46</td>
<td>146.7 ± 2.42</td>
<td>21.0 ± 0.36</td>
<td>13.7 ± 0.21</td>
<td>0.55 ± 0.01</td>
<td>68.6 ± 0.49</td>
</tr>
<tr>
<td>5</td>
<td>34</td>
<td>146.3 ± 2.46</td>
<td>145.0 ± 2.42</td>
<td>0.92 ± 0.83a</td>
<td>19.9 ± 0.36</td>
<td>13.8 ± 0.21</td>
<td>0.56 ± 0.01</td>
</tr>
<tr>
<td>10</td>
<td>34</td>
<td>145.9 ± 2.37</td>
<td>143.1 ± 2.33</td>
<td>1.90 ± 0.80a</td>
<td>19.9 ± 0.35</td>
<td>13.9 ± 0.21</td>
<td>0.56 ± 0.01</td>
</tr>
<tr>
<td>15</td>
<td>33</td>
<td>146.2 ± 2.55</td>
<td>142.7 ± 2.50</td>
<td>2.02 ± 0.86a</td>
<td>20.0 ± 0.36</td>
<td>14.0 ± 0.22</td>
<td>0.55 ± 0.01</td>
</tr>
<tr>
<td>20</td>
<td>30</td>
<td>146.1 ± 2.55</td>
<td>141.5 ± 2.50</td>
<td>3.19 ± 0.86b</td>
<td>20.0 ± 0.36</td>
<td>14.1 ± 0.22</td>
<td>0.56 ± 0.01</td>
</tr>
<tr>
<td>25</td>
<td>33</td>
<td>146.1 ± 2.55</td>
<td>140.6 ± 2.50</td>
<td>3.74 ± 0.86a</td>
<td>19.6 ± 0.36</td>
<td>13.9 ± 0.22</td>
<td>0.55 ± 0.01</td>
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<tr>
<td><strong>Origin</strong></td>
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<td></td>
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<tr>
<td>Storage time</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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<td>NS</td>
</tr>
</tbody>
</table>

- Table 2. Effect of origin and storage time on external quality feature of goose egg

Einfuss von Herkunft und Lagerdauer auf Merkmale der äußeren Eiqualität von Gänseierern

α: Differences between values having different letters in the same column are statistically significant (P < 0.05)

NS: Not significant (P > 0.05), *: P < 0.05, **: P < 0.01, *** P < 0.001

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thickness and shape index were presented in Table 2. A significant effect of origin was observed for egg weight loss, shell weight, shell ratio, shell thickness and shape index except for egg weight and egg broken weight. Egg weights of all origins were nearly identical (144.2–148.5 g). Egg weight losses in eggs of INRA geese were greater than for other origins. Shell weight, shell thickness and shape index of eggs of Tatlicak geese was greater than for Armutlu, Başkuyu and INRA geese. Storage of 0 to 25 days did not affect shell weight, shell ratio, shell thickness and shape index. The egg weight loss increased with increasing of storage time.

Table 3. Effect of origin and storage time on internal quality feature of geese egg
Einfluss von Herkunft und Lagerdauer auf Merkmale der inneren Eignlautigkeit von Gänseeiern

<table>
<thead>
<tr>
<th>Origin</th>
<th>Storage time</th>
<th>Egg weight (g)</th>
<th>Egg broken weight (g)</th>
<th>Shell weight (g)</th>
<th>Shell thickness (mm)</th>
<th>Yolk weight (g)</th>
<th>Yolk percentage (%)</th>
<th>Egg index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armutlu</td>
<td>0</td>
<td>74.4 ± 0.72</td>
<td>25.9 ± 0.24</td>
<td>49.0 ± 0.38</td>
<td>34.2 ± 0.23</td>
<td>0.06 ± 0.00</td>
<td>65.9 ± 0.50</td>
<td>7.58 ± 0.07</td>
</tr>
<tr>
<td>Tatlicak</td>
<td>25</td>
<td>72.9 ± 1.58b</td>
<td>51.2 ± 0.54a</td>
<td>50.1 ± 0.83a</td>
<td>35.1 ± 0.50a</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Başkuyu</td>
<td>10</td>
<td>73.7 ± 1.60a</td>
<td>50.6 ± 0.55a</td>
<td>50.3 ± 0.84a</td>
<td>34.6 ± 0.51a</td>
<td>0.07 ± 0.01</td>
<td>65.2 ± 1.13</td>
<td>7.48 ± 0.15d</td>
</tr>
<tr>
<td>INRA</td>
<td>0</td>
<td>74.1 ± 1.61b</td>
<td>51.2 ± 0.55b</td>
<td>50.4 ± 0.84a</td>
<td>35.0 ± 0.51b</td>
<td>0.07 ± 0.01</td>
<td>65.6 ± 1.13</td>
<td>7.72 ± 0.15a</td>
</tr>
</tbody>
</table>

Means with their standard errors for albumen weight, albumen ratio, yolk weight, yolk ratio, shell membrane thickness, Haugh unit, albumen index and yolk index were given in Table 3. Origins of geese significanly affected albumen weight, yolk weight, yolk ratio and albumen index. But, it was not significant for shell membrane thickness, Haugh unit and yolk index. Yolk weights and albumen index of INRA geese eggs were lower than for other origins. Albumen weight, albumen ratio, Haugh unit, albumen and yolk indices decreased with increasing storage time. The values for yolk weight and shell membrane thickness were on the same level for all origins.

The interactions between the storage time and origins were significant for egg weight loss (P < 0.01) and yolk index (P < 0.05). The greatest egg weight loss was observed for eggs from INRA geese stored for 25 days (4.38%). Similarly, the highest yolk index was observed in freshly laid (without storage) eggs from INRA geese (Table 4).

**Discussion**

Egg weight and egg broken weight were similar for all origins (P > 0.05). Means of egg weights and egg broken weights were 146.2 and 143.3 g. This result agrees generally with the findings of FARUGA et al. (1989) and PUCHAJA et al. (1995), but was lower than that reported by ROINSKI (2000) for one year old W11 and W33 strains of White Italian geese.

Although egg weight loss of Armutlu, Başkuyu and Tatlicak geese were similar, a significantly higher egg weight loss was found in eggs of INRA geese. The present results agree with the results obtained by NORTH and BELL (1990) and RIS et al. (1997) that probably larger eggs have less shell area per unit of interior egg weight than smaller eggs. Egg weight loss increased with increasing storage time by 2.82%.

Shell weight, ratio and thickness of eggs of Tatlicak geese were statistically higher than of other origins. Shell weight of INRA geese was statically less than that of
other origins and also INRA egg weight loss was statistically higher than that of the others (P < 0.001). This result is related to egg weight loss and egg shell weight. This might be explained in the way that the light density of egg shell structure of eggs of INRA geese may cause the higher egg weight loss. Results for shell thickness were lower than that reported by İşgüzar (2001), but similar with the findings in literature (Ramos et al., 1991; Pakulskas et al., 1995; Puchajda et al., 1995).

Results found in this study for shell weight were similar to those reported by Halaj et al. (1991) for Ivages Hybrid geese eggs, by Arroyo (1993) for African, Chinese, Toulouse and Emden geese eggs, by Pakulskas et al. (1995) for White Italian geese egg and by Puchajda et al. (1995) for eggs of 1 and 3 years old Bilgorajka geese. Shell weights were not affected by storage time. The results agree with those of many authors, most recently AHN et al. (1999) and SilverSides and Scott (2001), who have found that shell weight does not change with storage time. Average of shell weight was 19.9 g for all origins.

Shape index of Tatlıcak geese eggs (70.3%) was higher than for the other origins, but it was similar to eggs of Armutlu, Ba§kuyu and INRA geese (P < 0.001). Means of shape indices agree with the findings in literature (Ramos et al., 1991; Pakulskas et al., 1995; Puchajda et al., 1995; İşgüzar, 2001; Tilki, 2001). But, the results were lower than that reported by Halaj et al. (1991) and Faruga et al. (1999). These differences between the corresponding study and literature might be explained by age, genotype, diet and different management factors.

Although yolk weight and ratio of eggs of INRA geese were lower than other origins (P < 0.001) albumen weight and ratio were found to be higher than in other breeds (P < 0.05). In terms of the yolk and albumen weight eggs of Armutlu, Tatlıcak and Başkuyu geese were similar. With increasing storage time, albumen weight and albumen ratio (2.03%) decreased (P < 0.05). However, with increasing storage time, yolk ratio increased by 2.03%, but yolk weight was not changed. These findings were similar with those reported by Imai et al. (1986) and SilverSides and Scott (2001).

Haugh unit, albumen index and yolk index were determined by factors before the lay of the egg, storage time and storage conditions. Haugh unit, albumen index and yolk index decreased with storage, as it was expected (Imai et al., 1986; SilverSides and Vienenue, 1994).

Origins did not significantly affect Haugh unit and yolk index (P > 0.05). Haugh unit, yolk and albumen indices for fresh quail eggs (without storage) were found to be lower than that reported by Imai et al. (1986), Ulucak et al. (1995) and Altinel et al. (1996). But, Haugh unit for fresh turkey eggs (without storage) was higher than that reported by Erdi§ir et al. (1999). Haugh unit values (76.9) were similar to those reported by Rosinski (2000) for 1 year-old W11 and W33 strains of White Italian geese.

Fertility, general hatchability and hatchability of fertile eggs may or may not show differences among the origins (TOTH, 1991; Vargane et al., 1999; Tilki, 2001). In the present study, although there were no significant differences in Haugh unit and yolk index albumen index revealed significant differences between the origins (Table 3). It might be accepted that fertility, general hatchability and hatchability of fertility of eggs may easily be affected by Haugh unit, yolk and albumen indices.

Fertility, general hatchability and hatchability of fertile eggs decreased with increasing storage time (MERRIT and Clarridge, 1959; Bogenzürst, 1995). Changes in some interior quality traits (Haugh unit, albumen and yolk indices) during storage may affect indirectly fertility, general hatchability and hatchability of fertile eggs.

Consequently, the observed lighter yolk weight and heavier albumen weight in eggs of INRA geese and the heavier egg shell in eggs of Tatlıcak geese may be accepted as breed and origin characteristics. Longer storage time decreased albumen weight, Haugh unit, albumen index and yolk index. Haugh unit and albumen index in geese eggs were similar to other species. But geese eggs might be characterized by lower yolk index according to other poultry. Changes in albumen and yolk indices and Haugh unit may easily influence hatchability. Therefore, it is important to record these values by standard measurements. Insufficient literatures on the subject make this study as an example for further studies on geese.

Summary

Effects of origin and storage time on some interior and exterior egg properties in 1 year old Armutlu, Tatlıcak, Başkuyu and INRA geese were evaluated. The mean values were 145.1, 148.5, 147.2 and 144.2 g for egg weight, 1.85, 2.00, 1.89 and 2.37% for egg weight loss, 19.4, 21.6, 20.0 and 18.7 g for shell weight, 13.7, 14.8, 13.8 and 13.3% for shell ratio, 0.54, 0.58, 0.55 and 0.55 mm for egg shell thickness, 67.1, 70.3, 66.7 and 68.0% for shape index, 72.9, 73.7, 74.1 and 77.0 g for albumen weight, 51.2, 50.6, 51.2 and 54.6% for albumen ratio, 50.1, 50.3, 50.4 and 45.1 g for yolk weight, 35.1, 34.6, 35.0 and 32.2% for yolk ratio, 0.06, 0.07, 0.07 and 0.06 mm for egg shell membrane thickness for Armutlu, Tatlıcak, Başkuyu and INRA geese, respectively. Mean values for Haugh unit, albumen index and yolk index of freshly broken eggs (without storage) were 76.9, 9.19% and 37.1%, respectively.

Origin significantly affected egg weight loss, shell weight, shell thickness and shape index. Furthermore, effect of origin was significant on yolk weight, albumen weight and albumen index. But, it was not significant for shell membrane thickness, Haugh unit and yolk index. The egg weights of all origins were nearly identical. The egg weight loss increased with increasing storage time. Albumen weight, Haugh unit, albumen and yolk index values decreased with storage time.

Key words

Geese, egg quality, origin, storage time

Zusammenfassung

Qualitätseigenschaften von Gänseeiern: 2. Effekte der genetischen Herkunft und der Lagerdauer der Eier

Es wurden die Effekte der genetischen Herkunft und der Lagerdauer der Eier auf einige Merkmale der äußeren und inneren Eiqualität bei ein Jahr alten Gänsern der Herkünfte Armutlu, Tatlıcak, Başkuyu und INRA untersucht. Für diese Herkünfte wurden die Eigewichte (145, 149, 147 und 144 g), der Gewichtsverlust der Eier (1.85, 2.00, 1.89 und 2.37%), das Schalenengewicht (19.4, 21.6, 20.0 und 18.7 g), der Schalenanteil (13.7, 14.8, 13.8 und 13.3%), die Eischalen dicke (0.54, 0.58, 0.55 und 0.55 Millimeter), der Formindex (67.1, 70.3, 66.7 und 68.0%), das Eiklar-
gewicht (72,9, 73,7, 74,1 und 77,0 g), der Eiklaranteil (51,2, 50,6, 51,2 und 54,6%), das Dottergewicht (50,1, 50,3, 50,4 und 54,1 g), der Dotteranteil (35,1 34,5, 35,3 und 32,2%) und die Dicke der Eischalenmembran (0,06, 0,07, 0,06 und 0,07 Millimeter) bestimmt. Die Haugh Einheiten, der Eiklarindex und der Dotterindex für frische, nicht gelagerte Eier betrugen 76,9, 9,19% und 37,1%.


Stichworte
Gänse, Qualität, Rasse, Lagerzeit

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