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THE INFLUENCE OF HOUSING CONDITIONS ON PERFORMANCE AND WELFARE OF WHITE KOŁUDA GEESE

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Abstract. The aim of the study was to determine the effect of housing conditions on the reproduction and welfare of geese. Welfare evaluation was based on performance indices. The study was carried out in the spring in two farms (A and B), located in the south-eastern Podlasie, Poland. The goose houses in both farms were equipped with similar technical and technological solutions. Evaluation of the housing conditions was based on the indices of area and cubature of the houses and basic parameters of the microclimate (temperature, relative humidity, and lighting). Both farms raised 3-year-old White Kołuda geese. The study showed that housing conditions affect the reproductive performance and the welfare of geese. In farms A and B, most of the analyzed elements of the farming environment remained within the approved welfare standards, with more optimal values observed in farm A. Better conditions in farm A resulted in a higher number of eggs laid (73) and goslings born (40.3) per goose and in lower deaths and culling rates (1.8%). It should be stressed that both farms attained high productivity levels with very little deviation from the farming welfare requirements for geese.

Key words: goose, management conditions, productivity, welfare

INTRODUCTION

Poultry production involves a number of factors that are responsible for the production performance, the health of birds, and the quality of the final product.

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Apart from nutrition, the productivity of a goose farm is shaped by the broadly defined farming environment, including housing conditions [Pingel 1992, Cooper and Washburn 1998, Harmita and Mitchell 1999, McLean et al. 2002, Freire et al. 2003, Stiller et al. 2003, Dawkins et al. 2004, Skomorucha and Muchacka 2007, Książkiewicz 2010, Bombik et al. 2011]. The White Kołuda geese are characterized by a high egg laying performance [Bielińska 2005, Badowski 2007, Mazanowski 2012], therefore it is necessary to provide geese with good welfare conditions. The high performance of laying and brooding geese can be achieved through continuous monitoring and optimization of the management and husbandry [Bombik 1993, 1994].

The aim of the study was to evaluate the effect of management conditions on the reproduction performance and welfare of geese. Housing conditions were evaluated basing on the measurements of the surface and volume of the buildings and their equipment and the basic parameters of the microclimate. The animal welfare was assessed basing on the production performance.

MATERIAL AND METHODS

The experimental material involved 3-year-old White Kołuda brooding geese, lines W11 (females) and W33 (males). The study was carried out in two farms (A and B), located in the south-eastern part of Podlasie, Poland. The geese were in the third laying season; there were 501 geese (including 101 males) in farm A and 405 (including 80 males) in farm B. The goose houses were similar in terms of technical and technological solutions (natural ventilation, litter bedding of the floor, usable attic, natural light supplemented with incandescent lamps). The houses were equipped with basic equipment (nests, feeders and drinkers) in the quantity conforming with the technology standards, as shown in Table 1 [Książkiewicz 2010]. Adjacent to the houses were sandy paddocks. The feeding of geese in both farms was based on a mash of concentrates and farm feeds (red carrots, kale, pasture hay/dried grass, and green forage) and was in accordance with the Nutrition Standards of Poultry [Smulikowska and Rutkowski 2005].

The housing conditions were evaluated by animal hygienic inventory method and by direct measurements of the basic microclimate parameters (temperature, relative humidity, and lighting) following the methodology by Kośla [2011].

The information gathered included the dimentions of the buildings, the number and sizes of windows, and the number and power of light bulbs. These data were used to calculate area-cubature indices, natural light access ratio (the ratio of glazed area of windows to the floor surface area, W:F) and artificial lighting unit power (in $W \cdot m^{-2}$). Moreover, the number of geese per nest and the length of the edge of the feeders and drinkers were determined.

Table 1. Area-cubature indexes of the buildings for laying goose and their technical equipment

Tabela 1. Wskaźniki powierzchniowo-kubaturowe gęśników i ich wyposażenie technologiczne

Specification Wyszczególnienie	Sign of farm Symbol fermy	
	A	B
Building measurements, m Wymiary budynku, m		
length – długość	28.0	30.0
width – szerokość	10.5	10.0
height – wysokość	2.7	2.5
Indexes Wskaźniki		
Area, geese · m^{-2} – Powierzchniowe, szt. · m^{-2}	1.70	1.35
Cubature, m^3 · $goose^{-1}$ – Kubaturowe, m^3 · $szt.^{-1}$	1.58	1.85
Number of geese per nest – Liczba gęsi na gniazdo	5.7	6.5
Length of feeder edge, cm · $goose^{-1}$ Długość brzegu karmidła, cm · $szt.^{-1}$	22	28
Length of drinker edge, cm · $goose^{-1}$ Długość brzegu poidła, cm · $szt.^{-1}$	11	9

The microclimate measurements were carried out in the spring (April and May). Temperature and relative humidity were measured using the COMET D3121 thermo-hygrometer, whereas light intensity was measured with the HD 9221 photo-radiometer. The measurements were carried out three times a day (at about 7:00, 13:00, and 21:00 hours) for 10 days of each month, at the height of bird's back, in three locations inside the house. One measuing site was located in the middle area of the house, whereas the other two were located 5–8 m from each gable wall. The results are presented as the range (minimum and maximum), the arithmetic mean ($\bar{x}$), and the coefficient of variability (V%) [Trętowski and Wójcik 1991]. These indices are given for each studied parameter, taking into account the time of measurement.

The performance of the geese (number of eggs and their hatchability, as well as deaths and culls of birds) was determined from the farm records, the data obtained from the hatchery, and basing on own calculations.

RESULTS AND DISCUSSION

Stocking densities were different in both farms, namely 1.70 and 1.35 birds per square meter in farm A and B, respectively (Table 1), which exceeded the welfare optimum. Badowski [2007] and Mazanowski [2008, 2012] recommend the stocking density for brooding geese at a level of 1 indiv. · m^{-2}. The provisions on animal welfare state that the maximum density for geese should be 6.5 kg per square meter [Ordinance 2010]. Mazanowski [2008, 2012] reports that excessive densities of geese affects their welfare and performance. Cubature index is another parameter important for the evaluation of housing conditions [Rokicki and Kolbuszewski 1999, Kośla 2011]. In the analysed houses, unit cubature per bird ranged from 1.58 m^3, in farm A, to 1.85 m^3, in farm B. Bombik [1993], who studied the effect of thermal protection of buildings on the microclimate of selected brooding-geese farms, showed higher values of this ratio (1.98–2.48 m^3 per bird). The strong variation in area-cubature indices in the studied farms can affect the raising environment, especially the thermal-humidity conditions.

Extreme air temperatures in the spring in farms A and B were at a similar level, namely 8.5–21.0°C and 7.6–19.5°C, respectively (Table 2). Considering the time of measurements (7.00, 13.00, and 21.00 hours), it should be noted that the lowest temperature variations were recorded in the morning (V = 10.9–12.4%), whereas the highest – at noon (V = 18.3–20.8%). The 24-hour mean temperature was higher in farm A (13.2°C). The data in Table 2 shows that positive thermal conditions prevailed in building A, since air temperature showed lower deviations from the optimal range (5–18°C) that is reported in the literature [Mazanowski 2008, Jankowski 2012]. Adult geese are resistant to low temperatures and, as reported by Bielińska [2005], temperature inside the house during the laying period should not fall below 5°C. Air temperatures inside the buildings were shaped by the external conditions. During the measurements, relatively high temperatures (from 4.2 to 24.0°C) with little variation (7.9–19.4%) prevailed outside of the buildings.

Table 2. The values of air temperature (°C) inside and outside buildings

Tabela 2. Wartości temperatury powietrza (°C) wewnątrz i na zewnątrz gęśników

Sign of farm Symbol fermy	Hour of measurement Godzina pomiaru	Inside Wewnątrz			Outside Na zewnątrz		
		range wahania	$\bar{x}$	V%	range wahania	$\bar{x}$	V%
A	07:00	8.5–12.4	9.9	10.9	5.1–10.3	7.7	17.0
	13:00	15.7–21.0	17.5	18.3	19.0–23.4	21.7	8.8
	21:00	10.2–13.4	12.1	16.2	4.2–8.7	6.6	11.5
	mean – średnio		13.2	15.1		12.0	12.4
B	07:00	7.6–11.0	8.2	12.4	4.4–9.5	8.1	19.4
	13:00	13.8–19.5	16.7	20.8	18.8–24.0	22.4	9.5
	21:00	8.9–12.3	10.9	18.5	5.1–9.2	7.3	7.9
	mean – średnio		11.9	17.2		12.6	12.3

In the spring fluctuations in relative humidity in farms A and B were similar and were respectively 62–89% and 59–81% (Table 3). During the day, relative humidity in both farms was lowest in the afternoon (farm A: 62–79%, farm B: 59–74%). A higher (by about 4%) average daily relative humidity, 76%, was recorded in farm A. A similar pattern was found for the measurement hours. One of the factors influencing humidity was the area-cubature index, which was worse in bulding A (Table 1). Like temperature, relative humidity inside the houses was characterized by a low variation coefficient (V = 4.9–17.4%).

Comparing the values of relative humidity in the analyzed buildings to those recommended as animal welfare standard [Herbut 1997, Bielińska 2005, Mazanowski 2008], it should be noted that this parameter exceed the standard optimum in the upper limit of the range. Bombik [1993] states that the primary factor deteriorating thermal-humidity conditions in livestock buildings is their poor thermal insulation and a high cubature ratio.

Table 3. The values of air relative humidity (%) inside and outside buildings

Tabela 3. Wartości wilgotności względnej powietrza (%) wewnątrz i na zewnątrz gęśników

Sign of farm Symbol fermy	Hour of measurement Godzina pomiaru	Inside Wewnątrz			Outside Na zewnątrz		
		range wahania	$\overline{x}$	V%	range wahania	$\overline{x}$	V%
A	07:00	67–89	72	17.4	72–84	78	15.7
	13:00	62–79	76	5.8	62–79	69	8.5
	21:00	69–84	79	4.9	68–89	77	12.8
	mean – średnio		76	9.4		75	12.3
B	07:00	61–81	73	14.5	66–80	75	18.9
	13:00	59–74	69	8.9	69–79	74	10.3
	21:00	65–80	75	6.7	69–84	73	14.5
	mean – średnio		72	10.0		74	14.6

Analyzing the light conditions in the studied geese farm buildings, it should be noted that both buildings had natural light access along with additional artificial illumination (Table 4). There was more natural light in facility B, since the number of windows and their sizes allowed more light in, as evidenced by the ratio of natural lighting (W:F = 1:25). Daylight access in farm A was lower (1:30). Mazanowski [2008] and Kośla [2011] report that the ratio of glazed area of windows to the floor area (W:F) in poultry premises should be around 1:25 with light intensity of 10–15 lx and at 14–16 hour day light. Also, artificial lighting, as calculated by the number of bulbs and their power was different in goose houses A and B: 3.4 and 3.0 $W \cdot m^{-2}$, respectively. Mazanowski [2008] recommends that the power of artificial lighting in the premises for brooding geese be at the level of 2.4–4.0 $W \cdot m^{-2}$. On the other hand, Badowski [2007] proposed stronger incandescent lighting for laying geese: 5.5–6.0 $W \cdot m^{-2}$. Average illuminance (natural and artificial) in the studied goose houses (13.0 and 15.4 lx, respectively in A and B) remaind within the accepted standard values. In contrast, the minimum and maximum values of light intensity did not meet the animal welfare requirements in either house.

Table 4. The characteristics of lighting in buildings for laying geese

Tabela 4. Charakterystyka oświetlenia w gęśnikach

Specification Wyszczególnienie		Sign of farm Symbol fermy A	B
Natural lighting (W : F) Oświetlenie naturalne (O : P)		1 : 30	1 : 25
Artificial lighting, $W \cdot m^{-2}$ Oświetlenie sztuczne, $W \cdot m^{-2}$		3.4	3.0
Lighting intensity, lx Natężenie oświetlenia, lx	min.	6.7	9.5
	max.	24.2	27.6
	$\overline{x}$	13.0	15.4
	V%	32.8	41.8
Daylight lenght Długość dnia świetlnego		natural (14–15 hours) naturalna (14–15 godzin)	

Explanations: W:F – windows glass to floor area ratio.
Objaśnienia: O:P – stosunek oszklonej powierzchni okien do powierzchni podłogi.

Table 5. The characteristics of geese flock and production results in the third season of laying

Tabela 5. Charakterystyka stada i wyniki produkcyjne gęsi w III sezonie nieśności

Specification Wyszczególnienie	Sign of farm Symbol fermy A	B
Number of geese in the third laying year Liczba gęsi w III sezonie nieśności	501	405
Ratio of males to females Stosunek samców do samic	1 : 3.9	1 : 4.1
Mortability and culling from the first to the in the third Upadki i brakowania od wstawienia gąsiąt do III sezonu nieśność		
geese – osob.	49	45
%	8.9	10.0
in the third laying year only: w tym w III roku nieśności:		
geese – osob.	10	12
%	1.8	2.7
Mean number of hatching eggs per 1 goose Średnia liczba jaj wylęgowych od 1 gęsi	73	62
Mean percent of fertile eggs Średni procent jaj zapłodnionych	80.6	82.1
Hatching from fertile eggs, % Wylęg z jaj zapłodnionych, %	68.5	74.4
Mean number of goslings per 1 laying goose Średnia liczba gąsiąt od 1 nioski	40.3	37.9

Good animal hygienic conditions (mainly temperature and humidity) in geese buildings are one of the determinants of positive effects of the production. The performance of geese in the surveyed farms varied (Table 5). In the third laying season the number of geese in both houses (A and B) slightly decreased to 501 and 405 birds, respectively. Deaths and culls, from the moment of gosling stocking to the third season of production, reached 8.9% and 10.0% in houses A and B, respectively. Lower mortality and culling rates in goose house A may indicate, inter alia, better housing and management conditions for of birds.

The proportion of males to females was similar in both studied goose houses, and was 1:3.9–4.1. These values should be considered as appropriate. According to Mazanowski [2008, 2012], the optimal ratio of ganders to laying geese should remain around 1:4–5. It should be noted that the reduction in the number of females per gander has a positive effect on fertilization and hatchability of eggs, but also increases the overall costs of the cycle.

The number of hatching eggs from one laying goose in the third year of production averaged 73 (farm A) and 62 eggs (farm B). According to Badowski [2007], in the second and third laying seasons each about 70 eggs can be obtained from one goose, however with proper nutrition and optimal housing conditions. Elminowska-Wenda and Rosiński [1993] state that geese lay 45–50 eggs under natural day light. Research of other authors [Pakulska et al. 2003], also show lower laying performance in geese, as compared to the results obtained in this study. The number of hatchlings, which is the most important indication of the production performance of the birds, in the analyzed farms was somewhat different, 40.3 and 37.9 goslings from one goose, respectively in farm A and B, which anyway can be considered a very good result.

CONCLUSIONS

The study shows that housing and management conditions affect the production performance of geese. In farms A and B, most of the analyzed elements of the farming environment remained within the accepted standards, with more optimal values shown in building A, which has been reflected in a greater number of eggs and goslings (73 and 40.3, respectively) from one laying goose and lower mortality and culling rates (1.8%). Attaining better reproductive performance and greater survival in better conditions of animal hygiene (farm A) implies that the environment is an important factor of the welfare of geese.

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WPŁYW WARUNKÓW UTRZYMANIA NA PRODUKCYJNOŚĆ I DOBROSTAN GĘSI RASY BIAŁEJ KOŁUDZKIEJ

Streszczenie. Celem pracy było określenie wpływu warunków utrzymania na produkcyjność i dobrostan gęsi reprodukcyjnych. Badania przeprowadzono wiosną w dwóch fermach (A i B), położonych na terenie południowo-wschodniego Podlasia. Budynki posiadały podobne rozwiązania techniczno-technologiczne. Oceny warunków utrzymania dokonano na podstawie wskaźników powierzchniowo-kubaturowych i pomiaru podstawowych parametrów mikroklimatu (temperatury i wilgotności względnej powietrza oraz oświetlenia). W obydwu fermach utrzymywane były 3-letnie gęsi rasy białej kołudzkiej. Przeprowadzone badania wykazały, że warunki utrzymania wpływały na wyniki reprodukcyjne i dobrostan gęsi. W fermach A i B większość analizowanych elementów środowiska hodowlanego kształtowała się w granicach norm zoohigienicznych, przy czym bardziej optymalne wartości wykazano w budynku A. Korzystniejsze warunki utrzymania gęsi w obiekcie A miały wpływ na osiągnięcie większej liczby jaj i gąsiąt od jednej nioski (odpowiednio: 73 szt. i 40,3 osob.) oraz niższe upadki i brakowania (1,8%). Należy podkreślić, że w obydwu fermach uzyskano wysoką produkcyjność przy niewielkich odchyleniach środowiska hodowlanego od wymagań dobrostanu gęsi.

Słowa kluczowe: dobrostan, gęś, produkcyjność, warunki utrzymania

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