PRODUCTIVE PERFORMANCE OF HYBRID ROSS-308 AS A FUNCTION OF POPULATION DENSITY (WELFARE NORMS) AND GROWING SEASON

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Abstract

Poultry practice shows that climatic variations influence production costs in extreme periods of the year through the additional expenses generated by maintaining environmental factors in the physiological comfort zone. Starting from this state of facts, the present study aimed at a comparative evaluation of the performance of broiler chickens raised in accordance with the welfare norms of the E.U. in two different seasons. In each of the considered seasons (winter vs. spring), 61,880 chicks belonging to the Ross-308 hybrid were used, divided into three batches differentiated by the population density: in batches Lc-1 and Lc-2, 19 chicks/m^2, in the Lexp-1 and Lexp-3 batches, 17 chicks/m^2, and in the Lexp-2 and Lexp-4 batches, 16 chicks/m^2. The obtained data showed that stocking at a low density (16 heads/m^2) allowed the achievement of higher slaughter weights by 2.69–3.13% compared to the version with 17 heads/m2 and by 3.98–4.83% compared to the one with 19 heads/m2, of a lower mortality by 0.20–0.25% and, respectively, by 0.39–0.43%, as well as a lower conversion index by 8.76–8.88% and, respectively, by 19.67–26.10%. Compared to chicks reared in the winter season, those from the spring season achieved 10.31–11.11% higher body weights, 0.20–0.25% lower mortality, and lower conversion rates by 6.7–14.11%. These differences were also validated by the resulting scores for the European Efficiency Index and the European Broiler Index, respectively. In conclusion, it can be stated that the application of higher welfare standards for broilers (16 heads/m^2) facilitates the achievement of higher production indicators than other density standards, only that their level is also influenced by the growing season, an aspect that must be taken into account in the annual forecasting of economic efficiency.

Key words: *density, welfare, season, broiler, productive indicators*

INTRODUCTION

At present, poultry meat is obtained using industrial-type technologies, with the use of hybrids characterized by high growth rates, combined feeds developed according to scientific principles, and strict sanitary protection measures for livestock [12].

The intensification of poultry activity has become a profit generator [7, 10], but it has also led to negative reactions in public opinion because the birds are deprived of freedom and do not benefit from living conditions similar to those in the natural environment [6, 14, 16].

Against the background of these ethical issues [1, 8, 15], the European Council adopted Directive No. 43 of 2007, which establishes the rearing density applicable to broilers and the permissible concentrations for noxes (ammonia and carbon dioxide) [18].

This regulation solves two big social problems, respectively, the welfare of the birds and the protection of the environment [9], but it greatly affects the profitability of units specialized in the production of poultry meat [2, 11].

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For this reason, the European Union grants certain subsidies to establishments that comply with the welfare standards for meat birds in order to compensate for the loss of income [19].

In the same context, it should be stated that the performances of birds are influenced by a whole series of factors [3, 5, 13, 17], among which are also the specific zonal climates, an element that is becoming more prominent in the recent period against the background of obvious changes in global climate [4].

Even in our country, there are very large thermal variations between the different seasons of the year, with negative effects on growth indicators and the appearance of additional costs caused by the achievement of an optimal microclimate for broilers [12].

Starting from the mentioned considerations, the present study had in mind the comparative evaluation of the productive performances of the Ross-308 hybrid grown in accordance with EU norms of well-being in two different seasons (winter vs. spring).

MATERIAL AND METHOD

Poultry breeders for meat in our country can access compensatory payments through Measure 14-Package b) Payments in favor of bird welfare only when they apply the reduction of bird density by 10% or 15%, as well as the reduction of noxes by 30% (ammonia=max. 14 ppm; carbon dioxide=max. 2100 ppm) compared to the mandatory minimum requirements imposed by the European Union.

Most units that access such funds apply a density of 36.52 kg/m^2 (corresponds to a stocking density of 16 heads/m^2), but there are also producers with less experience in applying welfare standards that use a slightly higher density of 38.18 kg/m^2 (stocking density of 17 heads/m^2) in order to maintain the economic balance of the farm.

Poultry farms that do not want EU compensatory payments are obliged by national legislation to apply the density of 40 kg/m^2 (corresponds to a density of 19 head/m^2), a rule that allows the settlement of excise duty on diesel.

The investigations were carried out on a total number of 123,760 chickens belonging to the Ross-308 chicken hybrid (61,880 heads in the winter season and 61,880 heads in the spring season), divided in each season into three batches differentiated by the density ensured at population, as follows: in Lc-1 and Lc-2 lots, the houses were populated with 19 chickens/m^2, in Lexp-1 and Lexp-3 lots with 17 chickens/m^2 each, and in Lexp-2 and Lexp-4 lots with 16 chickens/m^2.

The chickens tracked in the two seasons were distributed in three halls equal in usable area (1198 m^2) and equipped with the same type of technological equipment.

The breeding of the chicks was carried out until the age of 35 days, according to the technology specified in the guide for the hybrid used.

The effect of experimental factors on the productivity of broiler chickens was measured using specific indicators that were recorded and analyzed according to the standard method used in poultry research:

- body weight-chicks in the control groups were weighed individually at one day of age and then every 7 days, using an electronic scale;
- the exits from the herd—the daily losses were accumulated by weeks of life of the chicks and/or compared to the initial herd of the week in question;
- the consumption of combined feeds concerned the average daily consumption (g/head/day), the individual consumption (kg/head/period), and the feed conversion index (g/kg weight gain).

- European Efficiency Index:

$$\text{EEI}= \frac{\text{Viability (\%) live wight (kg)}}{\text{Age (days) x Conversion rate (kg n.c./kg extra)}} \text{ x } 100$$

- European Broiler Index:

$$EBI = \frac{\text{Viability (\%) x average daily gain (g/chicken/day)}}{\text{Conversion rate (kg n.c./kg extra) x 10}} \text{ x } 100$$

Where possible, the obtained data were processed statistically, calculating the arithmetic mean (X), the standard error of the mean (±sx), and the coefficient of variation (V%).

RESULTS AND DISCUSSIONS

Dynamics of body weight. At the time of population, the weight of day-old chicks was close between batches, both in the case of those raised in the winter season (40.13–40.21 g) and those in the spring season (40.93–40.96 g), but later differences appeared between batches printed by the two experimental factors.

In the case of chickens from the winter season, the first significant statistical differences were found at the age of 21 days between Lc-1 (19 head/m^2) and Lexp-2 (16 head/m^2), differences that were also preserved at the scale of the day on the 28th. At the end of the growth period, body weights of 1915.08 g were achieved in the chickens of the Lc-1 group, of 1940.66 g in the Lexp-1 group, and of 1994.42 g in the Lexp-2 group, hence significant and, respectively, distinctly significant differences between batches (table 1).

Table 1 Dynamics of body weight in the studied chickens, depending on the growing season

The age of the chickens (days)	Statistical estimators	Winter season (n=50)			Spring season (n=50)		
		Lc-1	Lexp-1	Lexp-2	Lc-2	Lexp-3	Lexp-4
1	$\bar{X} \pm s_{\bar{x}}$	40.21±0.21	40.13±0.20	40.20±0.21	40.95±0.15	40.93±0.23	40.96±0.07
	V%	3.74	3.51	3.65	2.55	3.89	1.16
	Meaning differences	Lc-1 vs Lexp-1: p = 0.944 Lc-1 vs Lexp-2: p = 0.9947 Lexp-1 vs Lexp-2: p = 0.9946			Lc-2 vs Lexp-3: p = 0.9938 Lc-2 vs Lexp-4: p = 0.9961 Lexp-3 vs Lexp-4: p = 0.9956		
7	$\bar{X} \pm s_{\bar{x}}$	170.33±3.0	172.84±2.2	174.39±1.2	189.92±1.2	193.58±1.3	196.19±1.0
	V%	12.69	9.11	4.97	4.52	5.02	3.78
	Meaning differences	Lc-1 vs Lexp-1: p = 0.9814 Lc-1 vs Lexp-2: p = 0.9817 Lexp-1 vs Lexp-2: p = 0.9820			Lc-2 vs Lexp-3: p = 0.9807 Lc-2 vs Lexp-4: p = 0.9816 Lexp-3 vs Lexp-4: p = 0.9810		
14	$\bar{X} \pm s_{\bar{x}}$	456.68±9.3	470.79±6.3	482.54±3.4	509.20±5.7	527.28±4.7	542.76±4.3
	V%	14.44	9.51	5.08	7.99	6.42	5.71
	Meaning differences	Lc-1 vs Lexp-1: p = 0.8651 Lc-1 vs Lexp-2: p = 0.8654 Lexp-1 vs Lexp-2: p = 0.8654			Lc-2 vs Lexp-3: p = 0.8551 * Lc-2 vs Lexp-4: p = 0.0391 Lexp-3 vs Lexp-4: p = 0.8545		
21	$\bar{X} \pm s_{\bar{x}}$	874.56±20,2	890.78±12,6	910.87±6,9	975.13±13,4	997.67±13.4	1024.53±11.9
	V%	16.39	10.02	5.37	9.77	9.56	8.26
	Meaning differences	Lc-1 vs Lexp-1: p = 0.7514 * Lc-1 vs Lexp-2: p = 0.0473 Lexp-1 vs Lexp-2: p = 0.7547			* Lc-2 vs Lexp-3: p = 0.0404 ** Lc-2 vs Lexp-4: p = 0.0038 * Lexp-3 vs Lexp-4: p = 0.0406		
28	$\bar{X} \pm s_{\bar{x}}$	1390.48±34.6	1410.60±24.2	1447.43±13.0	1550.36±26.5	1579.87±25.8	1628.34±23.2
	V%	173.6	11.97	6.21	12.12	11.58	10.09
	Meaning differences	Lc-1 vs Lexp-1: p = 0.6514 * Lc-1 vs Lexp-2: p = 0.0477 Lexp-1 vs Lexp-2: p = 0.7547			* Lc-2 vs Lexp-3: p = 0.0372 ** Lc-2 vs Lexp-4: p = 0.0026 * Lexp-3 vs Lexp-4: p = 0.0390		
35	$\bar{X} \pm s_{\bar{x}}$	1915.08±52.2	1940.66±39.1	1994.42±27.9	2135.31±43.0	2173.54±42.3	2243.72±35.3
	V%	19.28	14.27	9.89	14.25	13.78	11.13
	Meaning differences	* Lc-1 vs Lexp-1: p = 0.0484 ** Lc-1 vs Lexp-2: p = 0.0048 * Lexp-1 vs Lexp-2: p = 0.0486			** Lc-2 vs Lexp-3: p = 0.0018 *** Lc-2 vs Lexp-4: p = 0.0008 ** Lexp-3 vs Lexp-4: p = 0.0019		

* significant differences (0,01 < p < 0,05); ** distinctly significant differences (0,001 < p < 0,01); *** very significant differences (p < 0,001).

In the chickens raised in the spring season, body weights higher than the previous season were found, at all age stages, with the specification that the first statistical differences were recorded starting from the age of 14 days of the chickens (Lc-2 vs. Lexp-4).

The differences between the groups were accentuated at the following control periods, so that on the 35th day, they were distinctly significant (Lc-2 vs. Lexp-3; Lexp-3 vs. Lexp-4) and highly significant (Lc-2 vs. Lexp-4), against the background of body weights of 2135.31 g in the Lc-2 group, 2173.54 g in the Lexp-3 group, and 2243.72 g in the Lexp-4 group (table 1).

Exits from the workforce. This appreciation indicator was influenced by the number of chickens introduced per surface unit, but also by the growing season.

In the series of chickens raised in the winter season, the highest mortality rate, 1.85%, was in batch Lc-1, where the stocking was achieved with 19 heads/m^2 (418 dead chickens from an initial herd of 22,610 heads). Next came the chickens from the Lexp-1 group with a density of 17 heads/m^2, where the mortality was 1.66% (336 dead chickens from an initial herd of 20230 heads), and then the chickens from the Lexp-2 group with a density of 1.66% of 16 heads/m^2, with a mortality of only 1.45% (276 dead chickens from the initial herd of 19040 heads) (table 2).

Table 2 Exits from the herd in the studied chickens, according to the growing season

Age range (days)	Winter season					Spring season				
	Batch	Weekly effective:		Cumulative mortality		Batch	Weekly effective		Cumulative mortality	
		at the beginning (head)	the end (head.)	head	%		at the beginning (head)	the end (head.)	head	%
1-7	Lc-1	22610	22449	161	0.71	Lc-2	22610	22466	144	0.64
	Lexp-1	20230	20119	111	0.55	Lexp-3	20230	20125	105	0.52
	Lexp-2	19040	18979	61	0.32	Lexp-4	19040	18962	78	0.41
8-14	Lc-1	22449	22379	231	1.02	Lc-2	22466	22401	209	0.94
	Lexp-1	20119	20062	168	0.83	Lexp-3	20125	20065	165	0.81
	Lexp-2	18979	18931	109	0.57	Lexp-4	18962	18922	118	0.62
15-21	Lc-1	22379	22316	294	1.30	Lc-2	22401	22348	262	1.17
	Lexp-1	20062	20007	223	1.10	Lexp-3	20065	20015	215	1.06
	Lexp-2	18931	18882	158	0.83	Lexp-4	18922	18878	162	0.84
22-28	Lc-1	22316	22251	359	1.59	Lc-2	22348	22298	312	1.38
	Lexp-1	20007	19953	277	1.37	Lexp-3	20015	19976	254	1.25
	Lexp-2	18882	18823	217	1.14	Lexp-4	18878	18843	197	1.03
29-35	Lc-1	22251	22192	418	1.85	Lc-2	22298	22240	370	1.64
	Lexp-1	19953	19894	336	1.66	Lexp-3	19976	19935	295	1.46
	Lexp-2	18823	18764	276	1.45	Lexp-4	18843	18809	231	1.21

In the spring season, the microclimate factors in the used sheds were maintained at better levels than in the winter season, hence a lower mortality rate.

Thus, in the case of batch Lc-2, there were 370 dead chickens from the initial herd of 22,610 head, resulting in a mortality of 1.64%; in the Lexp-3 group there were 295 dead chickens (initial effective=20230 head) with a mortality rate of 1.46%, while in the Lexp-4 group only 231 chickens died out of the 19040 introduced to the stock, so that the mortality rate was only 1.21% (table 2).

It should be noted that higher mortality rates were recorded in the first week of life of the chicks (0.32-0.71% in the winter season and 0.41-0.64% in the spring season) due to the lower viability of some specimens, probably due to problems during incubation or the quality of the eggs used.

Food consumption. The obtained data indicated consumption differences between the batches, imprinted by the experimental factors.

In the lots where the stocking density of 19 heads/m^2 was applied, the average daily consumption of combined feed was 114.06 g/head/day in the winter season (lot Lc-1) and 118.84 g/head/day in the spring season (lot Lc-2), while in the lots with the density of 16 heads/m^2, the daily consumption was only 99.32 g/head/day in the winter season (lot Lexp-2) and 99.19 g/head/day in the spring one (lot Lexp-4).

Intermediate values for the mentioned indicator were recorded in the chicken batches where the stocking was achieved with 17 head/m^2, of 105.05 g/head/day in the winter season (batch Lexp-1) and of 104.56 g/head/day in the spring (batch Lexp-4) (table 3).

Table 3 Consumption of combined feeds in the chickens studied, according to the growing season

Specification	Winter season					Spring season				
	Batch	Age range (days)				Batch	Age range (days)			
		1-14	15-21	22-35	1-35		1-14	15-21	22-35	1-35
Medium effective (head)	Lc-1	22494,5	22347,5	22254,0	22401,0	Lc-2	22403,0	22374,5	22294,0	22425,0
	Lexp-1	20146,0	20034,5	19950,5	20062,0	Lexp-3	20147,5	20040,0	19975,0	20082,5
	Lexp-2	18985,5	18906,5	18823,0	18902,0	Lexp-4	18981,0	18900,0	18843,5	18924,5
Consumption total (kg n.c./lot)	Lc-1	14920	17250	57256	89426	Lc-2	14226	19285	59763	93274
	Lexp-1	12301	14234	47228	73763	Lexp-3	11337	14544	47612	73493
	Lexp-2	10948	12680	42080	65708	Lexp-4	10447	12891	42359	65697
Consumption individual (g /head)	Lc-1	663,27	771,90	2572,84	3992,05	Lc-2	635,00	861,92	2680,68	4159,38
	Lexp-1	610,59	710,47	2367,26	3676,75	Lexp-3	562,70	725,75	2383,58	3659,55
	Lexp-2	576,65	670,67	2235,56	3476,25	Lexp-4	550,39	682,06	2247,94	3471,53
Consumption daily average (g /head/day)	Lc-1	47,37	110,27	183,77	114,06	Lc-2	45,36	123,13	191,48	118,84
	Lexp-1	43,61	101,50	169,09	105,05	Lexp-3	40,19	103,68	170,26	104,56
	Lexp-2	41,19	95,81	159,68	99,32	Lexp-4	39,31	97,44	160,57	99,19

Feed conversion index. The best results for this productive parameter were in batch Lexp-4 with 1.576 kg n.c./kg growth (spring season) and in batch Lexp-2 with 1.779 kg n.c./kg growth (winter season), respectively, in those batches that used the lowest number of chickens per surface unit (16 heads/m^2).

Good values of the conversion index were also recorded in chickens from the composition of the lots where the stocking was achieved with 17 heads/m^2, with levels of 1.716 kg n.c./kg spor at Lexp-3 (spring season) and 1.935 kg n.c./kg growth at Lexp-1 (winter season).

In the case of the lots where the highest stocking density was applied (19 chicks/m^2), the highest feed conversion indices were also obtained, with values of 1.986 kg n.c./kg gain in the Lc-2 lot (the season of spring) and of 2.129 kg n.c./kg gain in batch Lc-1 (winter season) (table 4).

Table 4 The feed conversion index of the chickens studied, according to the growing season

Specification	Winter season					Spring season				
	Batch	Age range (days)				Batch	Age range (days)			
		1-14	15-21	22-35	1-35		1-14	15-21	22-35	1-35
Spore of increase (g/head/ period)	Lc-1	416.47	417.88	1040.52	1874.87	Lc-2	468.25	465.93	1160.18	2094.36
	Lexp-1	430.66	419.99	1049.88	1900.53	Lexp-3	486.35	470.39	1175.87	2132.61
	Lexp-2	442.34	428.33	1083.55	1954.22	Lexp-4	501.80	481.77	1219.19	2202.76
Consumption of food (g/head/ period)	Lc-1	663.27	771.90	2572.84	3992.05	Lc-2	635.00	861.92	2680.68	4159.38
	Lexp-1	610.59	710.47	2367.26	3676.75	Lexp-3	562.70	725.75	2383.58	3659.55
	Lexp-2	576.65	670.67	2235.56	3476.25	Lexp-4	550.39	682.06	2247.94	3471.53
Conversion index (kg n.c./ extra kg)	Lc-1	1.592	1.847	2.473	2.129	Lc-2	1.356	1.850	2.311	1.986
	Lexp-1	1.418	1.692	2.255	1.935	Lexp-3	1.157	1.543	2.027	1.716
	Lexp-2	1.304	1.566	2.063	1.779	Lexp-4	1.096	1.416	1.844	1.576

European Efficiency Index. The obtained data attest to the positive influence of the use of a smaller number of chickens per surface unit on the performances in meat production, but also their dependence on the growing season.

Thus, in chickens raised in the winter season, the highest IEE value (315.64) was established in the Lexp-2 group (16 heads/m^2) against the background of higher levels of viability (98.55%) and weight bodies at slaughter (1994.42 g), but also the lowest feed conversion index (1.779 kg n.c./kg gain); at the opposite pole was the lot Lc-1 (19 heads/m^2) with a European Efficiency Index of only 252.24 due to the lowest levels of viability and slaughter weight (98.15% and, respectively, 1915.08 g) and of the highest conversion index (2.129 kg n.c./kg gain).

Intermediate values for the IEE (281.77) were in the Lexp-1 batch (17 heads/m^2), where the viability was 98.34%, the slaughter weight was 1940.66 g, and the conversion index was 1.935 kg n.c./kg gain.

In the case of chickens from the spring season, the highest value of the European Efficiency Index (401.85) was also in the Lexp-4 lot (16 heads/m^2), against the background of the highest viability (98.79%) and slaughter weights (2243.72 g) and the lowest feed conversion index (1.576 kg d.c./kg gain).

The chickens from batch Lc-2 (19 heads/m^2) had the lowest European Efficiency Index (302.16) due to the fact that this batch had the lowest viability values (98.36%) and slaughter weight (2135.31 g), but also the highest feed conversion index (1.986 kg n.c./kg gain).

For batch Lexp-3 (17 head/m^2), good values of viability (98.54%) and slaughter weight (2173.54 g) and a satisfactory conversion index (1.716 kg/kg gain) were obtained. so that the value of the European Efficiency Index was 356.61 (table 5).

European Broiler Index. From this point of view, the best results in the winter season were in the lot with the density of 16 heads/m^2 (Lexp-2) where an IEB score of 309.28 was obtained, followed by batch Lexp-2 (17 heads/m^2) where the IEB was 275.96, and batch Lc-1 (19 heads/m^2) where the lowest value for the European Broiler Index was recorded, of only 246.96.

In the chickens raised in the spring season, those from the Lexp-4 group (16 heads/m^2) achieved the highest score for the European Broiler Index (394.53), and the chickens from the Lc-2 group (19 heads/m^2) the lowest European Broiler Index (296.37); intermediate values for IEB (349.89) were in the Lexp-3 lot with a population density of 17 heads/m^2 (table 6).

Table 5 European Efficiency Index

Specification	Winter season			Spring season		
	Lc-1 (19 head./m^2)	Lexp-1 (17 head./m^2)	Lexp-2 (16 head/m^2)	Lc-2 (19 head./m^2)	Lexp-3 (17 head./m^2)	Lexp-4 (16 head/m^2)
Viability (%)	98.15	98.34	98.55	98.36	98.54	98.79
Body weight (g)	1915.08	1940.66	1994.42	2135.31	2173.54	2243.72
Age at slaughter (days)	35	35	35	35	35	35
Conversion index (kg d.c./kg gain)	2.129	1.935	1.779	1.986	1.716	1.576
European Efficiency Index	252.24	281.77	315.64	302.16	356.61	401.85

Table 6 European Broiler Index

Specification	Winter season			Spring season		
	Lc-1 (19 head/m^2)	Lexp-1 (17 head/m^2)	Lexp-2 (16 head/m^2)	Lc-2 (19 head/m^2)	Lexp-3 (17 head/m^2)	Lexp-4 (16 head/m^2)
Viability (%)	98.15	98.34	98.55	98.36	98.54	98.79
Average daily gain (g/head/day)	53.57	54.30	55.83	59.84	60.93	62.94
Conversion index (kg d.c./kg gain)	2.129	1.935	1.779	1.986	1.716	1.576
European Broiler Index	246.96	275.96	309.28	296.37	349.89	394.53

CONCLUSIONS

The research that focused on the productive response of the Ross-308 hybrid under the conditions of applying two experimental variables (population density and growing season) led to a series of conclusions that will be presented in the following.

The dynamics of the body weight of the chickens were normal, with the specification that the best final results were in the lots where it was popular with only 16 heads/m^2, both in the winter season (1994.42 g) and in the spring (2243.72 g); these weights were 2.69–3.13% higher than those of the 17 head/m^2 lots and respectively 3.98–4.83% higher compared to the control lots (19 head/m^2).

Applying a stocking density of 16 chicks/m^2 resulted in a mortality rate of only 1.21–1.46%, which was 0.20–0.25% lower than chicks housed at a density of 17 heads/m^2 and by 0.39–0.43% compared to those where population was achieved with 19 heads/m^2.

Regarding the influence of the season on the survival rate, it was found that the series of chicks from the spring season had a lower mortality rate of 0.20-0.25% compared to those raised in the winter season.

The average daily consumption of combined feed oscillated between 114.06 g/head/day (winter season) and 118.84 g/head/day (spring season) in the two lots where the maximum density was used (19 head/m^2), between 104.56 g/head/day (spring) and 105.05 g/head/day (winter) in plots with average density (17 head/m^2), and between 99.19 g/head/day, respectively (spring) and 99.32 g/head/day (winter) in chickens with the lowest density (16 head/m^2).

The best levels of the feed conversion index were achieved by the chickens housed at a rate of 16 head/m^2 (1.576-1.779 kg b.c./kg gain), lower by 8.76-8.88% than the chickens where a density of 17 head/m^2 was applied and by 19.67-26.10% compared to the lots where 19 chickens/m^2 were introduced.

Chicken batches raised in the spring season achieved lower feed conversion indices by 6.72-11.41% compared to winter season batches.

The differences in productive order printed by the experimental factors were also confirmed by the scores obtained for the European Efficiency Index and the European Broiler Index, respectively, for which higher values were obtained, the lower the number of chickens with which population was achieved.

The conclusion of our study was that ensuring superior welfare conditions for broiler chickens (populated with 16 heads/m^2) allows achieving production indicators superior to other density norms, but also that their level is influenced by the growing season and the variations in external climates influencing the ambient conditions in the halls used for this category of birds.

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