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Genotype – factor influencing performance of chicken production

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Abstract: *Genotype – factor influencing performance of chicken production*. The aim of this study was to establish the effect of the genotype on performance of chickens. The experimental material included 1,320 slow-growing chickens with two genotypes Hubbard JA 957 – available on the Polish market hybrid with a declared slow growth and non-commercial hybrid C×GP, for creation of which a light native breed Greenleg Partridge hens were used. Chickens were maintained up to 63 days of age. During the experiment body weight, feed intake and health of the birds were under control. Based on the observations the growth rate and the feed conversion ratio (FCR) were determined. It was found, that chickens C×GP were characterized by lower body weight, slower rate of growth and higher feed conversion ratio compared with the chickens Hubbard JA 957, but chickens C×GP had a higher health.

INTRODUCTION

Many people choose poultry as main and preferred brand of meat. However consumers frequently declare their willingness to purchase the products obtained from chickens with less intensive farming, which provides a higher animal welfare (Pavlovski et al. 2009). This trend is particularly evident among Western European and the United States societies, where consumers are interested in the welfare standards and have a concern about the way the animals are kept in intensive poultry production (Vanhonacker et al. 2009). Raising chickens in alternative methods consumers associate also with the environment protection (Bogosavljević-Bošković et al. 2012). Latter-Dubois (2000) defined the reasons, why consumers choose alternative poultry housing systems as major contributors to better taste, higher nutritional value, higher welfare of the birds and greater safety of such food.

In Poland, poultry meat from birds kept in unconventional systems constitutes a small part of the market and is available mainly as organic product. According to the regulations of the European Union (EC 1804/99) for organic production, it is recommended to choose the right genetic material for such a system of farming. Currently in our country, the organic production is based on the fast-growing chickens, commercial hybrids used in typical, intensive production.

The only commercially available material of slow-growing chickens is Hubbard JA 957. Using of birds of slow growth, better adapting to changing environmental conditions, showing a higher health status is particularly important due to the introduction of a number of limitations in respect of organic production. In addition, rearing chickens in the alternative system should be reared longer and be willing to prey (Branciari et al. 2009). Moreover the birds in non-conventional system should reach slaughter weight in

a period no longer than required for organic production, which is 81st day.

The aim of this study was to evaluate the results of production of hybrids with different genotypes in terms of their usefulness in non-conventional farming systems.

MATERIAL AND METHODS

The experiment was conducted in 2011 in spring (March–May) at the experimental station of the Warsaw University of Life Sciences (RZD Wilanów-Obory). Experimental procedures were approved by the Ethical Commission (approval no. 27/2009 of the 16 April 2009). The experimental material consisted of 1,320 slow-growing chickens of two genotypes Hubbard JA 957 (660 birds in six replication containing 110 birds in pen) and non-commercial hybrid C×GP (660 birds in six replication containing 110 birds in pen). Day-old chicks have been marked by chicken stamps and maintained up to 63 days of age in compliance with the Regulation of the Minister of Agriculture and Rural Development dated 15 February, 2010 on the requirements and manner of maintaining livestock species, for which protection standards are provisions of the European Union. Stock density in the poultry house was 11 birds per m^2. In the experiment, 4-stage feeding was applied: the starter (0–14 days), grower I (15–35 days), grower II (36–56 days) and finisher (57–63 days). The composition of components and the nutritional value of compound shown in Table 1.

TABLE 1. Nutritive value of basal diet in broiler feeding

Specification	Starter	Grower I	Grower II	Finisher
CONTENT (%)				
Maize	10	11.4	10	10
Wheat	53	55	59.6	60.8
Soybean meal	30.6	27.4	23.2	21.6
Limestone Ca39	1.165	1.175	1.085	0.945
Sodium bicarbonate	0.2	0.14	0.14	0.16
NaCl	0.24	0.28	0.28	0.26
Stimulator	0.01	0.01	0.01	0.01
Dicalcium phophate	1.18	0.78	0.7	0.64
Soybean oil	2.1	2.4	3.6	4.4
Methionine	0.48	0.42	0.36	0.28
Lysine	0.36	0.34	0.36	0.28
Threonine	0.14	0.13	0.14	0.1
Premix	0.525	0.525	0.525	0.525
NUTRITIVE VALUE				
EM (MJ)	12.52	12.76	13.20	13.47
Total protein (%)	21.99	20.78	19.26	18.51
Crude fat (%)	3.67	4	5.14	5.92
Crude ash (%)	5.83	5.35	4.96	4.67

During the experiment, the chickens were individually weighed at weekly intervals. Feed intake and health of chickens were also controlled. Based on the results of observations the growth rate, feed conversion ratio and birds' mortality as a percentage of dead and culled to inserted were determined.

The results were statistically analyzed by one-way analysis of variance using SPSS 21.0 PL for Windows software.

RESULTS AND DISCUSSION

In the experiment the body weight of chickens Hubbard JA 957, and C×GP were monitored at weekly intervals. Based on the obtained data growth rate of birds was determined. Figure 1 shows the body weight changes between compound and rate of growth of chickens.

Significant differences in body weight were already noticed at the insertion, Hubbard JA 957 chickens were heavier than chicken C×GP ($P < 0.001$). The differences observed at the beginning were also evident in the following weeks, chickens Hubbard JA 957 throughout the rearing period had significantly higher body weight compared with the chickens C×GP ($P < 0.001$).

The growth rate of chickens Hubbard JA 957 at the beginning of rearing was high and amounted to almost 120%. C×GP chickens had a lower rate of increase during this period (94%). It should be noted that in chickens C×GP growth rate declined steadily without clearly marked periods and a sudden drop in the final period of rearing (8 and 9 weeks) was higher than in Hubbard. However, in chickens Hubbard JA 957, upon a high initial rate, its sudden decline and a very low level in the last week of life were observed.

Rachwał (2008) reports that in one week old commercial hybrids growth rate is about 140%, i.e. much higher than the results obtained in chickens C×GP and slightly higher than that observed in Hubbard JA 957. Chickens C×GP characterized by low body weight; the 63 day old birds had a weight comparable

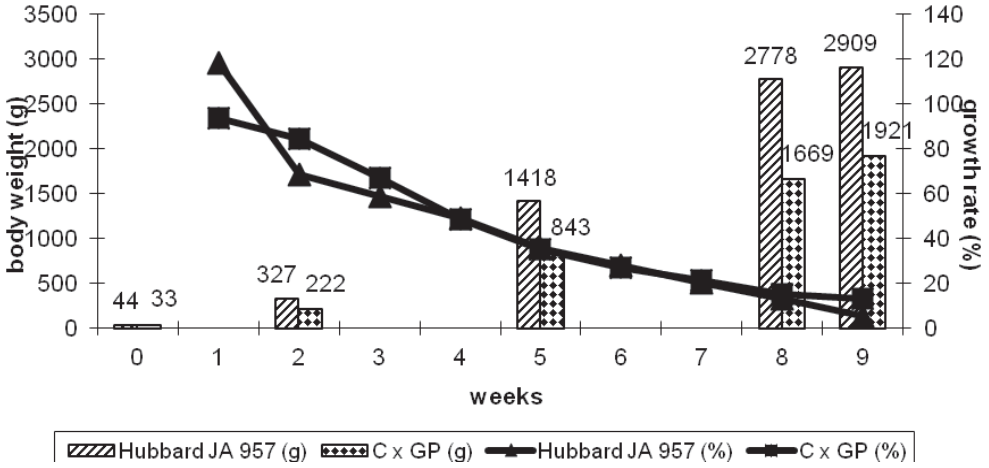

FIGURE 1. Body weight (g) and growth rate (%) in chickens depending of the genotype

to that achieved by commercial broilers at 35 day (Aviagen 2012). It should be noted, that the main purpose for creating hybrid C×GP was not to maximize production results, but to produce the material adapted to less intensive farming conditions.

Hubbard JA 957 chickens had significantly higher body weight, which oscillated between 2,900 g. It is worth to note, that in poultry production the value of 2,000–2,500 g is given as a standard live weight of chickens for slaughter, then a carcass can get the weight mostly desired by consumers – about 1,300–1600 g (Fanatico et al. 2005). So Hubbard chicks reached too high body weight at 63 day of age, therefore slaughter of these birds should have been carried out appropriately earlier. If the aim was to determine the genotype of birds, that could be used in alternative housing systems with access to range, it is worth noting that the chickens with a slower rate of growth better adapt to such conditions. On the basis of Branciari et al. (2009) it can be concluded, that the fast growing commercial hybrids behave very similarly in intensive production and organic farming. Chickens do not have the desire to prey and do not display the typical behavioral poultry burying behavior. The birds are unwilling to use runs and a large part of time were staying in livestock buildings. On the paddock practically do not move, spend most of their time lying down or standing. The slow growing birds show totally different behavior. They more likely have a run, significantly increase their activity, much less time are lying standing and eating, and significantly more move and bury.

Based on the measurements of body weight and growth rate a preliminary hypothesis, that chickens C×GP is the genetic material better adapting to the slow-range farming than Hubbard JA 957. However, it appears necessary to conduct a distinct behavioral research and to determine the basis of their behavior in unconventional rearing system.

Table 2 shows feed consumption (kg/ /kg) and mortality (%) in chickens depending on the genotype.

Basing on these results, it is clear, that Hubbard JA 957 chickens use less feed per 1 kg of body weight gain compared with the chickens C×GP. Such result can be explained by a significantly higher body weight of Hubbard chicks at slaughter. Feed consumption of 2.27 kg/kg (for Hubbard) and 2.84 (for C×GP) obtained in the experiment was significantly higher than that achieved in intensive production. Commercial broilers slaughtered at the age of 42 days use about 1.7 kg of feed to gain 1 kg of body weight (Feddes et al. 2002). However, with increas-

TABLE 2. Feed conversion ratio and mortality in chicken depending on the genotype

Specification	Hubbard JA 957	C×GP
Feed conversion ratio FCR (kg/kg)	2.27	2.84
Energy conversion (MJ/kg)	29.48	36.89
Protein conversion (kg/kg)	0,47	0,56
Mortality (%)	2.72A	0.30B

A, B – difference significant at $P \leq 0.01$.

ing time of rearing the birds an increase of this parameter should be expected; this is due to lowering rate of growth and increasing feed consumption. Castellini et al. (2002) maintaining the chickens up to 81 days of age received even higher feed consumption (3.0 kg/kg).

Mortality of chickens in the experiment was generally low and amounted to 2.72% for Hubbard JA 957 chickens and 0.36% for C×GP. Particularly low mortality for hybrid C×GP can prove the high health of these birds, which is especially important when raising chickens are reared in the conditions ensuring the access to open air.

Fanatico et al. (2008) pay special attention to the genotype in shaping this production factor. Slow-growing chickens have a lower mortality rate compared to the fast-growing chickens. This is mainly due to a lower share of diseases associated with the fast pace of growth, among which tibial dyschondroplasia occurs. Castellini et al. (2002) found, however, that the main cause of falls in fast-growing chickens is a ascites and sudden death syndrome, which in slow-growing birds are much more rarer.

Birds' genotype may be particularly important in shaping mortality in free range or organic rearing conditions. Branciari et al. (2009) observed, that fast growing chickens characterized by relatively low mortality when the rearing is carried out in a closed breeding conditions. Mortality in a flock of broilers considerably increase, when the birds use the free run. However, exactly the opposite situation can be observed in medium and slow-growing poultry, access to open-air significantly reduces mortality among them. These results further confirm the necessity of obtaining slowly growing hybrids in the alternative housing systems.

The results obtained in this experiment as well as the ones of other authors (Castellini et al. 2002, Fanatico et al. 2008, Branciari et al. 2009) indicate the need to adjust the growth rate of birds to the chosen farming system. It should be noted, that due to the production results, which are worse in comparison with commercial broilers (lower body weight, lower growth rate, higher consumption of feed) producers of poultry kept in the alternative housing systems must compensate for the loss resulting in a correspondingly higher price for the poultry product.

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Rozporządzenia Ministra Rolnictwa i Rozwoju Wsi z dn. 15 lutego 2010 w sprawie wymagań i sposobu postępowania przy utrzymaniu gatunków zwierząt gospodarskich, dla których normy ochrony zostały określone w przepisach Unii Europejskiej (Dz.U. 2010 nr 56, poz. 344).

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Streszczenie: *Genotyp – czynnik warunkujący wyniki produkcyjne w stadach kurcząt rzeźnych.* Celem badania było określenie wpływu genotypu na wyniki produkcyjne kurcząt. Badania przeprowadzono na 1320 kurczętach o dwóch genotypach Hubbard JA 957 – dostępnym na rynku polskim mieszaniec o deklarowanym wolniejszym tempie wzrostu oraz C×Zk – mieszaniec, do którego wytworzenia wykorzystano kury rasy lekkiej zielononóżki kuropatwianej. Kurczęta utrzymywano do 63. dnia życia. W czasie odchowu kontrolowano masę ciała, spożycie paszy i zdrowotność ptaków. Na podstawie prowadzonych obserwacji określono tempo wzrostu oraz wskaźnik zużycia paszy. Stwierdzono, że kurczęta C×Zk charakteryzowała mniejsza masa ciała w porównaniu z kurczętami Hubbard JA 957 oraz wolniejsze tempo wzrostu. Mniejsze wykorzystanie paszy na przyrost masy ciała stwierdzono dla kurcząt Hubbard JA 957. Kurczęta C×Zk charakteryzowała natomiast wyższa zdrowotność.

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