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Assessment of the Economic Profitability of Fattening Selected Chicken Genotypes in an Organic Farm

Kazimierz Obremski [1,*], Józef Tyburski [2,*], Paweł Wojtacha [3], Ewa Sosnówka-Czajka [4], Iwona Skomorucha [4], Janusz Pomianowski [5] and Paweł Parowicz [6]

1 Department of Veterinary Prevention and Feed Hygiene, Faculty of Veterinary Medicine, University of Warmia and Mazury in Olsztyn, 10-718 Olsztyn, Poland
2 Department of Agroecosystems and Horticulture, Faculty of Agriculture and Forestry, University of Warmia and Mazury in Olsztyn, 10-719 Olsztyn, Poland
3 Department of Public Health, Faculty of Health Sciences, Collegium Medicum, University of Warmia and Mazury in Olsztyn, 10-082 Olsztyn, Poland; pawel.wojtacha@uwm.edu.pl
4 Department of Poultry Breeding, National Research Institute of Animal Production, 32-083 Balice, Poland; ewa.sosnowka@iz.edu.pl (E.S.-C.); iwona.skomorucha@iz.edu.pl (I.S.)
5 Department of Meat Technology and Chemistry, University of Warmia and Mazury in Olsztyn, 10-719 Olsztyn, Poland; pomian@uwm.edu.pl
6 SBP Feeds Ltd., Piastowska 38A, 14-240 Susz, Poland; pepedom@o2.pl
* Correspondence: kazimierz.obremski@uwm.edu.pl (K.O.); jozef.tyburski@uwm.edu.pl (J.T.); Tel.: +48-895-233-264 (K.O.); +48-895-233-789 (J.T.)

Abstract: The aim of this study was to evaluate whether production costs can be reduced and whether the profitability of organic chicken fattening can be increased by selecting the appropriate genotypes. Rhode Island Red (K-11) and Sussex (S-66) conservative chicken genotypes, as well as modern chicken genotypes such as slow-growing Hubbard JA 957 hybrids and fast-growing Ross 308 hybrids, were selected for the study. One hundred and sixty chickens were used in the experiment (forty birds per group). The birds were fed commercial organic complete feed up to 52 days of age and organic farm-made feed (to reduce costs) between 53 and 81 days of age. Population distribution was determined using the Kolmogorov–Smirnov test. The results were analyzed statistically using one-way analysis of variance (ANOVA) with multiple comparisons and the post hoc Tukey test at a significance level of $p < 0.05$. The 81-day fattening period (the minimum recommended period in organic farming) led to considerable weight deficits in Rhode Island Red and S-66 chickens and excessive slaughter/trade weights in Hubbard JA 957 and Ross 308 chickens. The feed conversion ratio was high in Rhode Island Red (K-11) and Sussex (S-66) chickens at 4.19 and 4.50, respectively, and much lower in Hubbard JA 957 and Ross 308 chickens at 2.79 and 2.53, respectively. The choice of chicken genotypes had a major impact on the profitability of organic farming, and the total costs of feed and other ingredients per kg of body weight were determined at EUR 3.83 for Rhode Island Red (K-11), EUR 3.90 for Sussex (S-66), EUR 6.57 for Hubbard JA 957, and EUR 6.62 for Ross 308 genotypes. The profitability of organic farming can be increased by selecting modern, meat-type, slow-growing chicken genotypes.

Keywords: organic farming; conventional farming; broiler production; economic efficiency

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1. Introduction

Broiler chickens are one of the livestock species that can be farmed organically. Chicken meat has an estimated 82% share of the Polish poultry market [1]. Poultry meat has a high nutritional value, it is a relatively cheap source of protein, and its consumption has been increasing steadily [2,3]. The growing demand for safe animal products and animal welfare concerns have increased the interest in poultry meat from organic farms [4,5].

According to research, many consumers have a preference for poultry from less intensively reared chickens, which are provided with higher levels of welfare [6]. In comparison with conventionally farmed chickens, the meat of organic chickens is more abundant in n-3 unsaturated fatty acids [7]. Organic broiler meat is defined as meat from farming systems that do not use conventional feeds—including feed raw materials from genetically modified plants (mainly soybeans and corn), animal by-products, or synthetic additives—and rely mainly on organic cereals, pulses, oil, seeds, and roughage [8]. The organic farming system (e.g., the Label Rouge system) provides chickens with outdoor access and low stocking-density housing. The organic farming system is regulated at both European and national levels [9]. Due to an increase in demand for organic products [10], the EU has adopted a new regulation (implemented on 1 January 2022) to prevent fraud in organic farming products and improve the competitiveness of European producers against non-EU imports [9].

In conventional production systems, chickens are typically raised in enclosed poultry houses equipped with artificial lighting and controlled temperature, humidity, and ventilation [11,12]. They are usually fed high-energy diets to achieve rapid weight gain [13]. Overcrowding and deprivation of natural behaviors can lead to stress and health problems in poultry [14]. The growth rate is much slower in organic poultry than in conventionally raised birds. Unlike in the conventional system, organically reared birds have unrestricted access to pasture and can roam freely on the farm, although they are not completely free of stress. They receive only organic feed containing grains, pulses, minerals, and natural additives. Such feed does not contain genetically modified organisms (GMO) or synthetic amino acids, which is an important consideration.

The performance of poultry farms is determined by genetic and environmental factors [15]. Poultry are bred selectively to achieve a high growth rate, high feed efficiency, and health benefits [16]. In the group of environmental factors, nutrition is most important because feed costs account for around 65–70% of total costs in broiler chicken production [17]. The feed conversion ratio (FCR), namely the relationship between feed consumption and live weight produced, is the key determinant of a farm's performance, but nutrient utilization is also highly dependent on genotype [18,19]. The minimum age at slaughter is 81 days in organic farming, as opposed to only 35–40 days in conventional production. Therefore, due to their rapid growth rate, fast-growing broilers are not highly suited for organic farming. In contrast to free-range poultry that are highly adapted to low-density diets, modern commercial broiler chickens achieve good health and high productivity only when their nutritional requirements are met [20]. Modern slow-growing chicken genotypes are preferred in organic farms because they grow much faster than dual-purpose breeds (and not much slower than modern fast-growing breeds), but fast-growing breeds can also be reared as long as they are slaughtered at the minimum age of 81 days.

Low-input diets in poultry farming can represent a sustainable approach to poultry production to minimize the use of costly commercial feeds that are rich in soybeans and high-energy grains [21]. These low-input diets favor the use of locally sourced feedstuffs such as cereal grains and legumes [22]. Highly energy-dense and protein-rich diets are not required in free-range systems because poultry are unable to fully utilize the surplus energy [23]. Market research has shown that nearly 100% of consumers would choose organic food if the price were identical to the price of conventional food. In practice, most consumers are willing to pay up to 15–30% more for organic food, but organic poultry meat is much more expensive [16]. Van Loo et al. [24] found that consumers were willing to pay a price premium of 244% for organic chicken breasts, and German consumers were willing to pay a price premium of 108% for organic chickens [25]. Family-run organic farms have their own feed base and can produce energy- and protein-balanced feeds. The appropriate chicken breed, one's own labor, and one's own feed can decrease the inputs associated with the production of one kilogram of chicken meat. The EU's emphasis on the development of organic farming has prompted research into the suitability of different chicken breeds for broiler production under extensive rearing conditions [26]. Therefore, the aim of this study was to evaluate the profitability of fattening selected chicken genotypes on a family-run organic farm. Dual-purpose Rhode Island Red (RIR, K-11) and Sussex (S-66) chicken breeds, as well as modern, slow-growing Hubbard JA 957 broilers and fast-growing Ross 308 broilers, were selected for the study.

2. Materials and Methods

2.1. Birds, Nutrition, Maintenance, and Procedures

An 81-day experiment was conducted between July and September 2022 in a certified organic farm in Godki, Region of Warmia and Mazury in Poland (53°49′12.7200″ N and 20°14′51.0000″ E). The experiment did not require the approval of the Local Ethics Committee for Animal Experiments because it was performed during routine poultry rearing and involved an assessment of fattening efficiency using extensive and complete feeding regimes (Local Ethics Committee for Animal Experiments in Olsztyn, Poland, Decision LKE 27/2022).

The experimental group consisted of Rhode Island Red (RIR, K-11; $n = 40$) and Sussex (S-66; $n = 40$) dual-purpose breeds, as well as slow-growing Hubbard JA 957 ($n = 40$) broilers and fast-growing Ross 308 ($n = 40$) broilers. All chicks were hatched at the hatchery of the Experimental Station of the National Research Institute of Animal Production in Aleksandrowice, Poland. The chicks were vaccinated against Marek's disease, Newcastle disease, and infectious avian bronchitis.

The study was conducted in a single replication due to local conditions and the provisions of Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labeling of organic products [9], which states that organic poultry fattening farms should have an indoor area (net area available to animals in fixed housing) of 10 animals/m^2, with a maximum of 21 kg of live-weight/m^2 and an outdoor area (m^2 of area available in rotation/head) of a minimum of 4 m^2. In the described experiment, the indoor area was around 8 birds/m^2, but the outdoor area available in rotation/head was 5.1 m^2. Chicken runs enabled the birds to groom and take sand baths. The birds were kept indoors on permanent straw litter (10 cm thick). Radiant light bulbs were used to heat poultry houses and artificial quarters. During the rearing period, the temperature in the poultry house, the air exchange, the stocking rate of birds per m^2 of floor space, the length of the feed bank, and the number of birds per drinker were set in accordance with the accepted standards for organic farming. All experimental chickens had ad libitum access to feed and water.

Starter and grower feeds were supplied by a certified organic feed producer (SBP Feeds Ltd., Piastowska 38A, 14-240 Susz, Poland). Feed was prepared on the site from wheat, oats, and triticale produced on the farm, as well as heat-treated peas and a standard organic premix supplied by SBP Feeds Ltd. (Table 1).

The following microclimate parameters were regularly monitored indoors and outdoors: air humidity and temperature (Standard ST-8820 Multi-Function Environment Meter, Wilmington, NC, USA), air movement (HD32.3 Microclimate Meter, Poznań, Poland), and ammonia (NH_3), hydrogen sulfide (H_2S), and carbon dioxide (CO_2) emissions (Dräger X-am® 5000, Lübeck, Germany).

The scoring scale for harmful gas levels was as follows: 5—permissible, i.e., ammonia levels below 20 ppm, hydrogen sulfide levels below 5 ppm, and carbon dioxide levels below 3000 ppm; 2—unacceptable, i.e., ammonia levels above 20 ppm, hydrogen sulfide levels above 5 ppm, and carbon dioxide levels above 3000 ppm.

The moisture content of litter in the poultry house and the condition of skin on the soles of the feet were checked once a week (own criteria). The litter was assessed on the following scale: 5—dry and loose litter (easily moved with the foot), 4—dry but not powdery (difficult to move with the foot), 3—shoe marks remain in the litter; the litter clumps together easily, but the clumps break down easily, and 2—the litter sticks to the shoes and easily clumps into permanent lumps.

The condition of skin on the soles of the feet was examined for the symptoms of pododermatitis on the following scale: 5—no lesions, 4—minor lesions, 3—moderate lesions on one or both limbs, 2—extensive lesions on one or both limbs.

Table 1. Composition and nutritional value of diets used in the experiment [1].

Item	Starter 1–28 d	Grower 29–52 d	Farm-Made Feed 53–81 d
	Diet		
Ingredients (g/kg)			
Wheat	540	585	550
Soybean cake, non-GMO	300	220	-
Peas	80	100	150
Narrow-leaved lupin	-	-	100
Oats	-	20	50
Triticale	-	-	100
Soybeans, non-GMO	40	40	-
Premix [2]	40	35	50
		Nutritional value	
Metabolizable energy (kcal/kg)	2870	2930	2900
Total protein (%)	22.0	20.0	15.7
Crude fat (%)	3.5	3.5	2.0
Crude fiber (%)	4.5	4.5	5.0

[1] Starter: days 1–28, grower: days 29–52, farm-made feed: days 53–81 and up to day 161 of fattening. [2] Premix—vitamins, micronutrients, feed enzymes, calcium phosphate, calcium carbonate, acid sodium carbonate, fodder salt, and mixed herbs.

2.2. Statistical Analysis

Data were processed in Excel 2021 (Microsoft Corporation, Redmond, WA, USA) and Graph Pad Prism 6 (GraphPad Software, Boston, MA, USA) programs. Descriptive statistics, mean values, and the standard error of the mean (SEM) were calculated for all groups. Population distribution was determined using the Kolmogorov–Smirnov test. The results were analyzed statistically using one-way analysis of variance (ANOVA) with multiple comparisons and Tukey's post hoc test at a significance level of $p < 0.05$.

3. Results

3.1. Rearing Conditions and Bird Health

During the experiment, the average daily temperature in July, August, and September 2022 was 17.8 °C, 20.9 °C, and 11.2 °C, respectively, and the relative air humidity was 70.4%, 70.0%, and 77.1%, respectively (Table 2). Mortality cases or missing birds were not recorded during the 81-day experiment. Housing conditions were evaluated by measuring temperature, humidity, air velocity, and harmful gas emissions (ammonia, hydrogen sulfide, and carbon dioxide) (Table 3). The environmental assessment involved an evaluation of the skin on the soles of the feet and the overall health of chickens based on the adopted criteria (Table 4).

Table 2. Weather conditions during the study.

Month	Temperature (°C)	Humidity (%)
July	17.8	70.4
August	20.9	70.0
September	11.2	77.1

Table 3. Indoor microclimate parameters.

Day	Temperature (°C)	Humidity (%)	Air Velocity (m/s)	NH_3 (ppm)	H_2S (ppm)	CO_2 (ppm)
			Organic poultry house			
1	32	55	0.1	not detected	not detected	380
7	31	56	0.2	not detected	not detected	420

Table 3. *Cont.*

Day	Temperature (°C)	Humidity (%)	Air Velocity (m/s)	NH_3 (ppm)	H_2S (ppm)	CO_2 (ppm)
14	28	52	0.2	not detected	not detected	390
28	23	48	0.1	1.2	not detected	460
42	21	45	0.2	1.5	not detected	450
56	22	47	0.2	1.4	not detected	535
70	20	45	0.2	1.6	not detected	550
81	19	48	0.2	1.7	not detected	596
161	20	44	0.2	1.9	not detected	640

Table 4. Housing conditions and chick health.

Items	Rhode Island Red	Sussex	Hubbard JA 957	Ross 308
Bedding	5	5	5	5
Microclimate	5	5	5	5
Skin on the soles of the feet	5	5	5	4
Overall health	5	5	5	5

3.2. Feed Consumption, Bird Growth, and Costs

The performance parameters of chickens are shown in Table 5. The results indicate that growth parameters were influenced by breed and that the effect of genotype was highly significant ($p < 0.05$). The initial body weight (BW) of chickens ranged from 39.74 to 47.72 g, with no significant differences. However, clear differences in the growth rates of the studied chickens were observed starting from 7 days of age. The average BW of RIR (K-11), Sussex (S-66), JA 957, and Ross 308 chickens was 95.22 g, 88.83 g, 33.30 g, and 161.30 g, respectively. In the following 7 days, BW increased by 45%, 47%, 57%, and 54% to 175.60 g, 168.70 g, 310.00 g, and 352.60 g in RIR (K-11), Sussex (S-66), JA 957, and Ross 308 chickens, respectively. On day 28, a further increase of 47%, 50%, 58%, and 62% to 332 g, 342 g, 745 g, and 923 g was noted in RIR (K-11), Sussex (S-66), JA 957, and Ross 308 chickens, respectively. On day 42, BW increased by 45%, 41%, 47%, and 49% to reach 605 g, 587 g, 1421 g, and 1810 g in RIR (K-11), Sussex (S-66), JA 957, and Ross 308 chickens, respectively. On day 56, BW increased by 30%, 31%, 35%, and 35% to reach 860 g, 857 g, 2191 g, and 2777 g in RIR (K-11), Sussex (S-66), JA 957, and Ross 308 chickens, respectively. By day 81, the highest BW (4217 g) was observed in Ross 308 chickens, and the lowest BW (1148 g) was noted in Sussex chickens.

Table 5. Comparison of live body weights in chickens of different genotypes.

Age in Days	Live Body Weight (g), (Mean, SEM)			
	Rhode Island Red	Sussex	Hubbard JA 957	Ross 308
1	45.12 (0.67)	40.10 (1.16)	39.74 (0.83)	47.72 (1.36)
7	95.22 ^{a,b,c} (0.20)	88.83 ^{d,e} (0.47)	133.30 ^{f} (0.42)	161.30 (0.67)
14	175.60 ^{a,b,c} (0.33)	168.70 ^{d,e} (0.84)	310.00 ^{f} (0.59)	352.60 (0.84)
28	332.00 ^{a,b,c} (0.66)	342.00 ^{d,e} (0.56)	745.00 ^{f} (0.47)	923.00 (1.65)
42	605.00 ^{a,b,c} (1.30)	587.00 ^{d,e} (2.03)	1421.00 ^{f} (2.80)	1810.00 (7.38)
56	860.00 ^{a,b,c} (1.73)	857.00 ^{d,e} (1.12)	2191.00 ^{f} (5.12)	2777.00 (2.84)
70	1017.00 ^{a,b} (24.60)	927.60 ^{d,e} (36.43)	2683.00 ^{f} (74.83)	3502.00 (125.80)
81	1217.00 ^{a,b} (28.30)	1,148.00 ^{c,d} (48.27)	3220.00 ^{e} (96.41)	4217.00 (149.50)

The results are expressed as the mean ± SEM (standard error of the mean), $p < 0.05$. Superscript letters in rows denote significant differences on days 7, 14, 28, 42, and 56: ^{a} group E1 vs. group E2; ^{b} group E1 vs. group E3; ^{c} group E1 vs. group E4; ^{d} group E2 vs. group E3; ^{e} group E2 vs. group E4; and ^{f} group E3 vs. group E4. Days 70 and 81: ^{a} group E1 vs. group E3; ^{b} group E1 vs. group E4; ^{c} group E2 vs. group E3; ^{d} group E2 vs. group E4; and ^{e} group E3 vs. group E4.

The values of FCR (kg feed intake per kg BW gain) were 4.19, 4.50, 2.79, and 2.53 in RIR (K-11), Sussex (S-66), JA 957, and Ross 308 chickens, respectively (Table 6).

Table 6. Comparison of feed consumption, chick purchase costs, body weights, and feed conversion ratios during a full production cycle of 81 days in organic farming and 42 days in conventional farming.

Feed	Per Bird	Rhode Island Red	Sussex	Hubbard JA 957	Ross 308
Starter	kg	0.74	0.82	1.19	1.24
	EUR	0.65	0.73	1.05	1.10
Grower	kg	1.93	1.95	2.90	3.79
	EUR	1.66	1.67	2.49	3.25
Farm-made feed/finisher	kg	2.43	2.40	4.92	5.83
	EUR	1.52	1.50	3.07	4.15
Total kg per bird		5.10	5.17	9.01	10.85
Total EUR		3.83	3.90	6.57	6.62
Average body weight (kg)		1.22	1.15	3.23	4.26
FCR		4.19	4.50	2.79	2.53

During the experiment, total feed consumption was highest in Ross 308 chickens (10.85 kg per bird), and feed costs were EUR 6.62 per bird. Total feed consumption was similar in the RIR and Sussex breeds, and it amounted to 5.10 kg and 5.17 kg, respectively, with feed costs of EUR 3.83 per chicken and EUR 3.90 per chicken, respectively.

Total non-feed costs per bird reached EUR 3.29, whereas non-feed costs per kg BW were highest in Sussex chickens (EUR 2.86), followed by RIR chickens (EUR 2.70), and lower in modern broilers at EUR 1.02 in JA 957 and EUR 0.77 in Ross 308. Electricity costs were determined at EUR 0.17 per chicken, and heating costs reached EUR 0.07 per chicken. Labor costs amounted to EUR 1.31 per chicken. Total feed and non-feed costs reached EUR 5.85 per kg BW in RIR chickens, EUR 6.25 per kg BW in Sussex chickens, EUR 3.07 per kg BW in JA 957 chickens, and EUR 2.63 per kg BW in Ross 308 chickens (Table 7).

Table 7. Fattening costs of selected chickens of different genotypes in the organic system with a minimum rearing period of 81 days [1].

Specification	Rhode Island Red	Sussex	Hubbard JA 957	Ross 308
	Feed costs			
Costs per bird	3.83	3.90	6.62	6.62
Costs per kg BW	3.15	3.39	2.05	1.86
	Non-feed costs per bird			
Bedding	0.07	0.07	0.07	0.07
Water	0.01	0.01	0.01	0.01
Purchase of chicks	0.84	0.84	0.84	0.84
Electricity	0.17	0.17	0.17	0.17
Heating	0.07	0.07	0.07	0.07
Labor	1.31	1.31	1.31	1.31
Paddocks/disinfection	0.16	0.16	0.16	0.16
Veterinary services	0.22	0.22	0.22	0.22
Depreciation [2]	0.44	0.44	0.44	0.44
Total non-food costs per bird	3.29	3.29	3.29	3.29
Non-feed costs per kg BW	2.70	2.86	1.02	0.77

Table 7. *Cont.*

Specification	Rhode Island Red	Sussex	Hubbard JA 957	Ross 308
Total feed and non-feed costs per kg BW	5.85	6.25	3.07	2.63

[1] Data were collected for 4800 chickens kept in a 500 m^2 poultry house with runs and 70 inserts. [2] Depreciation period for 20 years of use.

4. Discussion

The performance of broilers with different growth potentials and the profitability of organic farming were evaluated in the study. The experiment was conducted on two genetically pure breeds, Rhode Island Red (K-11) and Sussex (S-66), as well as modern 'slow-growing' Hubbard JA 957 broilers and fast-growing Ross 308 broilers, which are commonly used in conventional fattening. The initial BW of one-day-old chicks was highest in Ross 303 chicks and lowest in JA 957 chicks (Table 5). These differences were consistent with expectations because the BW of newly hatched chicks is determined primarily by breed characteristics, followed by incubation conditions [26], which were identical for all birds in the experiment.

From hatching to day 51 of rearing, the birds were fed a commercially complete diet that was consistent with the organic standard (Table 1). A balanced and low-input diet (made on the farm) was administered between days 52 and 81 of rearing (Table 1). This feeding model was adopted to reduce fattening costs by using one's own feed raw materials for feed production because organic farms generally grow their own grains. The nutrient requirements of chickens and the appropriate composition of diets play an important role because animal performance is directly linked with nutrient density in feed [27]. However, modern breeding genotypes of slow-growing poultry do not require diets that are high in crude protein (CP) and metabolizable energy (ME) for growth and development [28]. Although adequate amounts of CP and ME are recommended for broilers [29], there is no consistent data on the dietary requirements for slow-growing breeds such as RIR [30].

The cost of farm-made feed was calculated based on the market prices of certified organic wheat, peas, oats, and triticale. In line with organic farming regulations [9], the birds were slaughtered at the minimum required age of 81 days.

From the first week of life, weight gains were highest in Ross 308 broiler chicks. An evaluation of incremental results on day 81 of rearing revealed significantly higher weight gains ($p > 0.05$) in Ross 308 broilers compared with other bird groups. Chicken performance is determined by the growth rate of specific breeds as well as the diet. The study revealed that RIR (K-11) and Sussex (S-66) chickens differed in growth rates and final BW from JA 957 and Ross 308 chickens.

The study demonstrated that a minimum rearing period of 81 days in organic farming does not guarantee that broilers will have a commercially satisfactory slaughter weight. Different slaughter times and acceptable weights are observed in conventional production systems in the EU countries. In comparison with the European average, broiler chickens produced in conventional rearing systems in Poland are characterized by one of the highest slaughter weights and one of the longest rearing periods. In Poland, the average weight at slaughter is 2.44 kg [31]. This parameter is higher only in Spain (2.66 kg), Cyprus (2.64 kg), and Italy (2.60 kg) [32]. In contrast, the lightest chickens in Europe are slaughtered in Austria (1.83 kg), Portugal (1.85 kg), the Czech Republic (1.90 kg), and Sweden (1.91 kg) [33–35].

As previously mentioned, feed costs are the largest contributor to total production costs per kg of slaughter weight. Therefore, the achievement of good production results is determined by the efficient use of feed [36]. In the present study, feed consumption during the 81-day fattening period was highest in Ross 308 chickens at 10.85 kg. This is understandable given the fact that the rearing period was longer than that in the conventional system. In a study by Cygan-Szczegielniak and Bogucka [37], the final BW of Ross 308 chickens reared for 82 days in an organic farm was much lower (3.00 kg in ♂and 2.88 kg in ♀), whereas in the work of Fiorilla et al. [38], the average BW of chickens reached 4.2 kg, and it was similar to that noted in the current study. In the first 42 days of rearing, feed consumption reached 3.4 kg, and average BW reached 1.81 kg, which was somewhat lower than in Ross 308 chickens produced in the conventional system (average BW—2.80 kg; feed consumption—4.7 kg). Therefore, the organic farming of Ross 308 chickens appears to be economical.

Under optimal conditions in conventional farming, the average BW of RIR chickens is 3.00 kg in roosters and 2.50 kg in hens after approximately four months of rearing. Males mature earlier, at around 9–10 weeks of age, and females generally reach maturity at 12 weeks. This breed is also highly resistant to Marek's disease [38]. In terms of health, Sussex (S-66) broilers are highly suited for small farms and extensive production of "Label Rouge" type broiler chickens. The average BW is around 2.8 kg for roosters and 2.1 kg for hens. Hubbard JA 957 is a modern, slow-growing genotype that is also highly suited for organic farming. Hubbard JA 957 broilers are characterized by an average BW of around 2.9 kg, which is generally achieved at 63 days of age [39]. In contrast, fast-growing Ross 308 broilers reach a slaughter weight of 2.5–3 kg at around two months of age, and the live weight of adult chickens can reach 5.5–6 kg at 90 days of age [40].

In conventionally produced fast-growing broiler flocks, where the rearing period ends at 6 weeks of age, the FCR does not exceed 2 kg per kg of BW gain [41,42]. According to the Hubbard JA 957 chicken flock management manual, FCR should be 2.27 kg per kg of BW gain during the 63-day rearing period. However, in the present study, FCR was slightly higher at 2.79 kg per kg of BW gain on day 81. In contrast, FCR was much lower in Rhode Island Red (K-11) and Sussex (S-66) chickens at 4.19 kg and 4.50 kg per kg of BW gain, respectively (Table 6). However, as reported by other authors, such values are acceptable because they result from an increase in energy requirements relative to maintenance needs, including mainly locomotion [43]. At the same time, the present study demonstrated that the lower activity of Ross 308 chickens (relative to other genotypes in the experiment) could contribute to their lower FCR (2.53 kg per kg of BW gain).

The labor input in broiler production varies greatly depending on the degree of automation in the production process. The number of birds handled by one worker is much smaller in an organic system than in a conventional system; therefore, labor costs are higher in organic production. Net income from poultry rearing denotes the difference between receipts and costs, and it is the best indicator of a farm's economic performance [44]. In the present study, labor costs in organic farming were determined at EUR 1.31 per bird. As expected, organically raised RIR (K-11) and Sussex (S-66) dual-purpose breeds grew at a slower rate than modern, slow-growing JA 957 hybrids and fast-growing Ross 308 hybrids. Slow-growing broilers reach slaughter weight later than fast-growing conventional broilers, which are generally slaughtered at 42 days of age. Observations of the behavior of chickens kept in the organic system revealed higher locomotor activity and lower resting activity, which undoubtedly had a direct impact on increased feed consumption and reduced productivity.

The live BW of genetically pure breeds is very low at 81 days of age, and the fattening period has to be prolonged to obtain a higher BW. However, prolonged fattening decreases the number of production cycles from four to even two per year, which further increases fattening costs. Cockerels could be used to address this problem. According to Lichovnikova et al. [45], free-range farming provides an opportunity to use roosters rejected by sexing (laying breeds) and obtain meat with similar or supreme quality characteristics relative to fast-growing breeds in terms of high protein content and relatively low-fat content. In addition, due to a slower growth rate, roosters of laying breeds have fewer health problems than fast-growing broilers.

Previous studies examining the growth of conventionally raised Ross 308 chickens have shown that the maximum income is obtained for broilers between 42 and 49 days of age and that profitability decreases with a prolonged rearing period [46]. Other studies [47] confirmed that the rearing period of broiler chickens can be extended to 49 days to maintain high profitability. However, the minimum rearing period in organic farming is 81 days. In the present study, Ross 308 chickens were characterized by the most desirable FCR.

Feed cost per kg of BW gain is one of the key determinants of organic farming costs. In this experiment, feed costs were highest in RIR (K-11) and Sussex (S-66) breeds, and they were nearly twice as high in comparison with Ross 308 chickens and higher than in JA 957 chickens. Similar results were obtained by Cobanoglu et al. [48]. In the context of the growth rate of dual-purpose breeds, the term "slow-growing" may come as a surprise. The Hubbard JA 957 hybrid clearly differs from the fast-growing Ross 308 hybrid in behavior, namely high mobility, eager use of outdoor runs, scratching the ground in search of food, and taking sand baths, whereas the growth rate of the former is not much slower.

The higher cost of organic farming can also be attributed to much lower feed efficiency (−47%) due to a longer statutory rearing period [49], as well as the lower digestibility of farm-made feed. In the present study, feed efficiency (the ratio of animal product to feed intake) calculated for the entire feeding period was 14% (±8%) lower in organic farming than in conventional farming. According to Castellini et al. [50], weight gain and feed efficiency are lower in organic production than in conventional systems [51]. Common problems encountered in organic farms include inadequate feed grinding, the presence of anti-nutritional substances in feed [52,53], and the fact that feed enzymes are not used as feed additives. It should also be noted that organically raised animals are not administered synthetic amino acids, which implies that their diets may not be fully balanced. However, organic production is profitable despite the fact that these factors increase production costs. The average market price of 1 kg of chicken meat is EUR 1.11 for conventionally farmed chickens and EUR 8.57 for organically farmed chickens, which significantly decreases the affordability of organic poultry. The present findings indicate that the efficiency of organic farming can be improved, and price differences can be minimized.

5. Conclusions

In conclusion, maintaining a minimum 81-day organic rearing period led to considerable BW deficiencies in Rhode Island Red and Sussex chickens (BW gain reached around 1 kg in each breed) and excess BW in Hubbard JA 957 and Ross 308 broilers. Due to the low BW of chickens of dual-purpose breeds at 81 days of age, the rearing period should be extended, which would lead to a further increase in production costs and the price of meat. From an economic point of view, Hubbard JA 957 is more profitable than dual-purpose breeds, and the fast-growing Ross 308 hybrid is the most profitable. Despite the use of farm-made feed in the final stage of fattening, production costs were very high in dual-purpose breeds, ranging from EUR 5.85 in RIR (K-11) to EUR 6.25 per kg BW in Sussex (S-66) chickens. Fattening costs were approximately 50% lower in modern breeding genotypes, reaching EUR 3.07 in Hubbard JA 957 and EUR 2.63 per kg BW in Ross 308 chickens. Modern meat-type slow-growing genotypes can be used to achieve a compromise in organic farming by reconciling low BW (relatively small carcasses expected by consumers) at 81 days of age with desirable FCR values and moderate unit costs.

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