Comparison of two broiler genotypes grown under the European Union organic legislation

Vergleich zweier Broilergenotypen für die Biomast nach EU-Verordnung

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Introduction

The food crises in second half of 1990s that occurred at European level have stimulated the concern of the public, which in turn demanded a “cleaner” agriculture (SUNDRUM, 2001). In this respect, the term “organic” has emerged. However, the core of organic farming are production standards, which distinguish it from other types of farming. The European Union (EU) adopted Regulation 1804/1999 for organic livestock production (EU, 1999) which covers all farm animal species. It has to be stressed that the Community law in the EU territory takes precedence over the National law of the Member States.

The EU organic livestock legislation contains a great number of provisions. However, there are several provisions applying especially to poultry production. Among the latter, characteristically, the minimum age of slaughter should be 81 days for chicken, the outdoor area for exercise needs to be at least 4 m² per broiler, while the use of synthetic amino acids and nearly all kinds of feed additives is prohibited in organic feeding. In addition, a horizontal provision for all species states that breeds or strains for organic production have to be adapted to local conditions.

The objective of the present work was to compare two broiler genotypes used locally by determining performance and carcass characteristics of birds grown strictly under the provisions of EU organic livestock legislation.

Materials and Methods

Four hundred and twenty day-old unsexed broilers were used consisting of equal numbers of two commercial genotypes (210 medium growing chickens of breed Redbro and 210 fast growing chickens of breed Cobb). The birds were fattened for a period of 12 weeks according to the rules of Community organic legislation. Chickens were obtained from the “Nitsiakos” (Ioannina, Greece) hatchery and were placed in a specially transformed poultry house. A part of the house was separated from the rest by using a wire netting screen to form twelve pens, each 2.9 x 1.8 m in size (area of 4.8 m²). Every pen had access to an individual outdoor space of 140 m² which was covered with a mixture of lucerne and barley. The floor of pens inside the house was covered with litter of barley straw. Thirty-five chickens were placed in each pen randomly. The two treatments consisted of six replicates each.

Heating was adjusted to 30°C on animal level on the 1st day, and was then diminishing gradually to 20°C until the 21st day. Finally heating was stopped when birds had access to outdoor area at the end of the 5th week. Ventilation was provided by a series of windows along the wall of the poultry house. Lighting of birds was natural during daylight time, whereas, during night, lighting was achieved by means of electric lamps, so that birds have light 24 h the first day, 23 h from 2nd to 21st day and 18 h until the end of the 5th week. After giving birds access to the outdoor area lighting was only natural. During the whole fattening period no vaccination or any pharmaceutical treatment of birds was applied. Feed and water were available for birds ad libitum.

Three diets were formulated depending on the birds’ stage of growth and given as all-mash feed. A starter diet was given from the beginning (1st day) to the end of 3rd week, a grower diet from the 4th to the end of 7th week, and a finisher diet from the 8th to the end of the experiment (12th week). The composition and the content of nutrients of the three diets are given in Table 1. All ingredients used were of organic origin. In addition, since the use of solvent extracted oil-seed by-products is prohibited in organic farming the protein concentrate used in the present study was a heat-treated expeller soybean meal.

Total body weight (BW) of birds in pens was measured weekly. Feed intake was also measured weekly by subtracting leftovers from the initial feed allocated to each pen.

Whereas, final performance measurements (feed and growth) were made at the end of the 12th week of life (84 day), slaughtering of animals was performed on the 87th day for practical reasons maintaining birds on the same diet. Birds were slaughtered after approximately 10 h of feed deprivation. Six birds were chosen from each pen at random (three males and three females) for slaughter. BWs of the selected birds were recorded individually, followed by slaughtering, bleeding, scalding, defeathering and decapitation in an authorized slaughterhouse. In turn, evisceration was performed and warm carcass weight was recorded. Subsequently, carcasses were stored at 2°C for 24 h. Next day, carcasses were weighed individually to record cold carcass weight and commercial cutting and weighing of particular parts was performed. Cutting was done according to Community legislation (EEC, 1991). In particular, wings, legs (thigh and drumstick), breast and abdominal fat were removed and weighed. In addition,
two breast and two leg parts (one male and one female) were selected at random from carcasses of birds from each pen, placed in plastic bags and frozen at –18°C for analyses of chemical components.

Chemical analyses for dry matter (DM) and crude protein (CP) in feed, as well as DM, CP and lipids of carcass samples were performed in triplicate according to standard techniques (AOAC, 1984). Carcass cuts were analysed with fat but without skin.

One-way ANOVA was used to estimate the significance of difference of means for the various characteristics between the two treatments (genotypes). The level of significance was defined a priori to be 5% and the statistical analysis of experimental data was done by using the statistical package SPSS 12.0.

Results

The performance of birds from the beginning of 1st week to the end of 12th week is shown in Table 2. Performance of birds at intermediate stages (end of 5th and 6th weeks) is also presented in Table 2. Performance of both genotypes did not differ distinctly until the end of 5th week, but from the 6th week onwards fast-growing birds showed a significantly better feed conversion ratio ($p < 0.0005$). Overall performance (12 weeks) was significantly higher ($p < 0.0005$) for the Cobb birds, which had lower feed conversion ratio due to their superior growth rate. Mortality did not differ significantly between genotypes, either from 0-6 weeks or 6-12 weeks. Despite no vaccination or other medication was applied in this trial mortality remained low, particularly during the second half of growing period when birds had access to outdoor grazing area.

Mean values for carcass measurements derived from dissection or chemical analysis are given in Table 3. Weight of cold carcass, breast, legs and wings was significantly higher ($p < 0.0005$) for Cobb broilers, whereas, abdominal fat did not differ significantly. In addition, proportions of breast ($p < 0.005$) and legs ($p < 0.05$) (as percentage of live-weight at slaughter) were significantly higher for Cobb broilers, whereas, proportions for wings ($p = 0.073$) and abdominal fat ($p = 0.141$) failed to reach significance. Finally, DM, CP and lipids in breast and legs did not differ significantly between the two genotypes studied.

Discussion

Feed intake, particularly during the period when birds had access to the outdoor grazing area was significantly higher for the fast growing genotypes. However, the question of the actual contribution of the grazed plant material to meeting part of the nutritional needs of the birds is pending. In this respect, further research is suggested utilising the concept of examining the bird’s crop content (Antell and Ciszur, 2006; Horsted et al., 2007). In addition, it should be stressed that all three diets used in the present study, were formulated on the basis of the provision of the initial EU organic livestock legislation (EU, 1999). Here it is defined that for poultry the feed formula used in the fattening stage must contain at least 65% cereals. However, at a later stage, through amendments, this prerequisite was eliminated, making organic feeding of poultry more loose compared to the initial letter of Community law. By this comparison and interpretation of performance results in different trials are rather difficult. Some authors have pointed at the issue of problems related to the provisions and derogations of EU organic livestock legislation (HermanSEN, 2003).

With respect to carcass quality, the response of slow, medium and fast-growing broiler genotypes has been studied in conventional keeping systems (Quentin et al., 2003), but the information on trials with organic broiler production according to EU legislation is limited. Zulkifli et al. (2000) compared performance of two commercial broiler genotypes but used oxytetracycline in their diets, which is not permitted in EU organic legislation. The effect of genotype has also been studied in a conventional system with guinea fowls resulting in heavier carcasses for the faster growing birds than for the slow growing ones (Baeza et al., 2001).

In another study, Suto et al. (1998) applied prolonged fattening of one broiler genotype when they measured various carcass traits and reported sex differences. In a further study, the same group (Horn et al., 1998) compared two major commercial broiler hybrids up to 20 weeks of age in terms of performance characteristics (feed, growth and feed conversion ratio), and reported that differences between genotypes were significant in most of the recorded periods. Furthermore, Harvenstein et al. (2003) measured the carcass composition and yield of 1957 versus 2001 broilers when fed representative 1957 and 2001 broiler diets, and concluded that the Ross broilers produced heavier carcasses, breasts and legs. Holcman et al. (2003) studied the chemical composition of Ross and Prelux-bro chicken meat from free range and extensive indoor rearing for an 8 weeks period. They found that...
genotypes only differed significantly in the content of Dry matter in breast muscle (Prelux-bro chicken contained more dry matter), something that does not agree with the results of the present study where all nutrients measured, either in breasts or legs, did not differ significantly between Cobb and Red-bro broilers.

In addition, GRASHORN and CLOSTERMAN (2002), while studying performance and slaughter characteristics of five slow and one fast growing breeds for extensive production up to 84 days reported that breeds differed significantly in live weights (Ross being heavier in this respect). Furthermore, feed conversion ratio was worse, while carcass and breast meat yields were lower for the slow growing breeds, which is in agreement with the findings of our trial. The same authors reported that the proportion of abdominal fat and the content of fat in thigh muscle were partly higher in slow growing breeds. However, in the present work, the proportion of abdominal fat is relatively lower in Redbro, whereas, the content of lipids in legs appears to be higher in the fast growing genotype (Cobb), the differences for both variables not being significant.

Finally, in a recent study, FANATICO et al. (2005) compared fast, medium and slow-growing genotypes, including Cobb and Redbro employed in the present study, but the design used in their trial was not conform to the standard of organic production in the EU. Therefore, the results from the present study cannot be compared with the results of FANATICO et al. (2005). In fact, they used anticoccidial medication in their diets, initiation dates of their treatments differed, and due to the restricted number of pens, only fast and slow-growing genotypes were provided with outdoor access. The authors reported that fast-growing broilers had higher breast weights than the slow ones and concluded that their study did not show a superior meat quality of slow growing birds in comparison to fast growing birds.

In conclusion, the results of the present study suggest that the performance of the fast growing broiler genotype fattened under the standards of organic production according to the relevant EU legislation could be better than that of medium-growing broilers without necessarily impairing carcass quality traits.

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Summary

Four hundred and twenty day-old broiler chicken were grown organically for 12 weeks. Equal numbers of two genotypes, i.e. a fast (Cobb) and a medium-growing (Redbro), were used. Three diets were fed: starter, grower, finisher. From the 66th week onwards performance differed significantly between the two genotypes, being better for the fast growing broilers. Overall 12 week performance was significantly higher (p < 0.0005) for the Cobb birds which exhibited lower feed conversion ratio (2.93 vs. 3.43) due to the superior growth rate (BW 3969 vs. 2799 g). Weights of cold carcass (2782 vs. 2158), breast (818 vs. 564) and legs (841 vs. 653 g) were significantly higher (p < 0.0005) for Cobb broilers, whereas the abdominal fat (78 vs. 74 g) did not differ significantly between breeds. Similarly, DM, CP and lipid content in breast and legs did not differ significantly between the two genotypes. Results suggest that the performance of a fast growing genotype under organic conditions could be better than the performance of a medium growing one, without necessarily impairing carcass quality traits.
Zusammenfassung

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Für die Untersuchung wurden insgesamt 420 Eintagsküken (zu gleichen Anteilen der Herkünfte Cobb und Redbro) über 12 Wochen unter den Vorgaben der EU-Öko-Verordnung aufgezogen. Zur Fütterung wurde eine Starter-, Grower- und Finisher-Ration verwendet. Ab der 6. Lebenswoche unterschieden sich die beiden Herkünfte signifikant in ihrer Leistung, wobei die schnell wachsende Herkunft generell eine bessere Leistung aufwies. Über die 12-wöchige Mastperiode wurden die Broiler der Herkunft Cobb signifikant schwerer (P < 0,0005; 3969 zu 2799 g Lebendgewicht) als die Redbro-Broiler und erzielten eine günstigere Futterverwertung (2,93 zu 3,43 g/g). In ähnlicher Weise erreichten die Cobb Broiler signifikant (P < 0,0005) höhere Schlachtkörper- (2782 zu 2158 g), Brust- (818 zu 564 g) und Schenkelgewichte (841 zu 653 g), während sich die beiden Herkünfte beim Abdominalfett nicht signifikant unterschieden (78 zu 74 g). Ferner konnten keine signifikanten Unterschiede zwischen den Herkünften für den Trockensubstanz-, Protein- und Fettgehalt von Brust- und Schenkelfleisch beobachtet werden. Die Ergebnisse deuten darauf hin, dass der schnell wachsende Genotyp unter ökologischen Produktionsbedingungen eine bessere Leistung erreicht, während die Schlachtkörpermale nicht beeinträchtigt werden.

Stichworte

Broiler, Genotyp, Ökologische Erzeugung, Leistung, Schlachtkörperqualität

References


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