Free ranging of mixed turkey groups – possible influence of race [Big Six vs. Kelly Bronze] and feeding [organic vs. conventional feed] on weight gain, feather coat, femur stability, and the use of structure elements.

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Aim of the present study was to investigate the possibility to rear commercial turkey breeds BIG SIX, selected for intensive growing, under extensive conditions of organic management standards.

For this purpose, in summer 2005 and winter 2005/06 respectively 36 Big Six and 36 Kelly Bronze were mixed and divided in two groups that were reared under outdoor conditions from 9th to 19th week of life. The groups were fed with conventional or organic feed. Each pasture was enriched with structural elements allowing sitting elevated. Behaviour was observed directly four times per week over 1 h, the use of structure elements [perches, plateaus] was recorded daily [24 h video taping, analyzed every 30 min] over a period of 62 days [n = 2976 recordings/season]. Weight gain and feather coat was controlled every two weeks. The breaking load of both femurs of each animal was investigated post slaughtering.

Dependent of the season [summer vs. winter] BIG SIX showed a mean end weight of 16.9 vs. 19.0 kg (P < 0.001) while KELLY BRONZE exhibits a mean end weight of 15.3 vs. 13.4 kg.(P < 0.001). Social conflicts within the same race did not exceed social conflicts between the two races. The use of the structure elements on the pasture was notably determined by the season [summer > winter] and was influenced significantly by race [P<0.001 (Kelly Bronze > Big Six)], feed [P<0.001 (organic > conventional feed)] and time of day [P<0.001 (night time > daytime)].

The breaking load of the femur bone was influenced significantly by the final body weight during winter season [P < 0.001 (Big Six 812.8 N vs. Kelly Bronze 646.6 N)].

The present results indicate the possibility to establish the intensive growing race Big Six into organic turkey meat production that demands a free ranging and organic feeding system. Using the stocking rate > 4 m²/turkey, as it is postulated for organic farming [VO EWG 1538/91], rearing of both races together is unproblematic. In contrast to Kelly Bronze, Big Six was able to utilize the race specific growth potential as far as possible within their lifespan of 22 weeks under all climatic conditions of free ranging.

Keywords: turkeys; races; free ranging; feeding; behaviour; health
Introduction:

Due to BSE crisis in 2001 the consumption especially of turkey meat has grown. The actual per capita consumption of turkey meat in Germany amounts to 17.8 kg (Böttcher and Schmidt, 2005). However, conditions of intensive rearing (Berk, 1999) resulted in common known health (Hafez, 1996, Reiter and Bessei, 1998) and ethological problems (ref. in Bessei, 1999) caused by intensive weight gain and high stocking rate. Especially by means of beak trimming a reduction of cannibalism should be achieved. Due to this procedure the animals suffer from damage and considerable continuous pain (Fiedler, 2006). The increasing consumer demands for fair minded livestock husbandry (Bennett, 1996), regarding health and animal welfare, require an improvement in different aspects of turkey meat production and intensified the testing of alternative housing systems (Berk and Wartemann, 2006).

One possibility of solving these conflicts is the organic way of animal production under extensive free ranging conditions and minimised stocking rates without any interference like beak trimming (Platz et al., 2003). To meet these requirements, basic standards of organic management in animal production are fixed in the ordinance 2092/91 EWG. It contains essential elements for a pro-animal and environmentally acceptable form of farm animal husbandry. The most important points of these standards are:

- Selection of robust farm animal races with optimal adaptability to the demanded outdoor rearing conditions
- no zoo technical manipulation of the animals like beak trimming, etc.
- outdoor free ranging husbandry-conditions
- food, harvested from the own farm and produced by organic standards, without any additives and animal protein impurities.

With regard to turkeys, only few races, which approximate these demands, are available with about 1% market share. Former studies proved the possibility rearing commercial turkey breeds B.U.T. BIG SIX selected for intensive weight gain, under extensive conditions of organic management standards (Platz et al., 2003).

This study continues that question by comparative analysis of welfare and health indicating parameters - behaviour, weight gain, quality of feathering, and breaking load of femur - between B.U.T. BIG SIX (BS) and the robust strain of KELLY BRONZE broad breasted (KBbb) under the same outdoor rearing conditions To evaluate possible effects of organic vs. conventional rearing conditions, the animals were fed with organic and conventional feed that showed comparable nutritive values.

Materials and methods

Animals and rearing conditions

In both seasons, summer and winter, 36 B.U.T. Big Six (BS) and 36 Kelly Bronze broad breasted (KBbb) were mixed in the first week of life and divided in two groups. The animals were reared under outdoor conditions from 9th to 19th week of life. Afore the groups were raised in stall within conditioned rearing pens. The base area of each free range compartment was 310 m² which resulted in a stocking rate of 8.65 m²/animal. Both compartments were equipped with natural ventilated littered stables with a base of 20m² each. The groups were fed with conventional or organic feed. Each pasture was enriched with structural elements (perches, plateaus) allowing sitting elevated.

Behaviour observations

Behaviour was observed directly four times per week over 1 h (10.00 – 11.00 a.m.) using behaviour and scan sampling technique (Martin and Bateson, 1986). The use of structure elements was recorded daily [24 h video taping, analysed every 30 min] over a period of 62 days [n = 2976 recordings]. Meteorological data were recorded by gauging station of Deutscher Wetterdienst, located 500 m from the test site.
Physiological and health parameters

Weight gain and plumage was controlled every two weeks. The feather coat was evaluated with the following scale: - completely intact (1), failure of some feathers, < 50 cm² featherless (2), 50-100 cm² featherless, some pinfeather broken off (3) to > 100 cm² featherless, much pinfeathers broken off (4). The breaking load of both femurs of each animal was investigated post slaughtering using the material testing machine Zwick/Roell Z005 in combination with the software testXpert.

Results and discussion

Weight gain

Dependent of the season both races showed a different weight development \(P<0.001\). BS exhibits the higher weight gain in the winter season \((18.9 \pm 0.2 \text{ kg})\) compared to the summer period \((16.9 \pm 0.4 \text{ kg})\) while KBbb showed a higher weight gain in the summer season \((15.3 \pm 0.3 \text{ kg})\) compared to the winter period \((13.6 \pm 0.2 \text{ kg})\). This leads to the conclusion that BS seems to be less tolerant to higher temperatures due to their higher growth potential compared to KBbb. On the other hand the slower intensity of growth and the lower capacity of feed intake of KBbb limits the weight gain significantly especially under cold climatic conditions.

While weight gain in winter was influenced mainly by the race \(P<0.01\), the kind of feed showed a significant influence on weight gain in summer between 9th and 15th week of life. The influence of race on weight gain was significant in summer from 17th to 19th week of life \(P<0.05\). Compared to the productive guidelines for intensive fattening of KELLY BRONZE (Hybride Turkeys, 2006, http://www.hybridturkeys.com) KBbb achieved in summer 110.2 % and in winter 98.8 % of the final weight in both feeding groups. BS achieved in the winter fattening period 100 % and in the summer fattening period 92.6 % of the final weight after 19 weeks of life compared with the productive guidelines BUT BIG SIX (Moorgut Kartzfeln, Germany). Overall, both races seem to be able to utilize the race specific growth potential as far as possible under all climatic conditions within their lifespan of 19 weeks.

![Figure 1 Weight development of free ranged turkeys in summer and winter and the possible influence of race [BG vs. KBbb] and feeding [organic vs. conventional feed] (n=16)](image)

Behaviour

Feather pecking/plucking and impressing differed significantly between the two races (Table 1). But this resulted only in a small scale in combat operations. Looking to the mean ratio of impressing to fighting of 10: 1, it can be concluded, that impressing is very effective in avoiding advanced social conflicts. The indispensable assumption for this is the possibility for the underdog to retreat. However this is not possible in the case of high stocking density under intensive indoor fattening conditions.

Ranking fights within the same race did not exceed social conflicts between the two races. Due to the low level of combat operations it can be concluded that conjointly rearing of both races is
unproblematic when using the stocking rate of one turkey/4 m², as it is required by the VO (EWG) 1538/91.

**Table 1** Summarizing data of behaviour dependent on race [**BS vs. KBbb**] (n = 40 days of observation/season, 1 hours/day)

<table>
<thead>
<tr>
<th>behaviour parameter (sum of observed actions)</th>
<th>KB vs. KB</th>
<th>KB vs. BS</th>
<th>BS vs. KB</th>
<th>BS vs. BS</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>feather pecking/plucking</td>
<td>454ᵃ</td>
<td>529ᵇ</td>
<td>472ᵃᵇᶜ</td>
<td>580ᵇᶜ</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>impressing</td>
<td>626ᵃ</td>
<td>338ᵇ</td>
<td>195ᵇ</td>
<td>492ᵇᶜ</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>retracting/fight</td>
<td>41</td>
<td>32</td>
<td>64</td>
<td>28</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Evaluating the feather coat no influence of race (**KBbb 2.5 vs. BG 2.6**) could be observed in the summer season. In contrast the quality of feather coat was influenced significantly by race [P < 0.001 (**KBbb 2.9 vs. BG 3.2**) in the winter season. The cause of the better status of feathering of **KBbb** could be seen in the observed denser feather coat especially during winter and in the significant less actions of feather pecking/plucking compared to **BS** (Table 1).

The use of the structure elements on the pasture was notably determined by the season. In summer the nocturnal use of structure elements on the pasture was relatively frequent and it was influenced significantly by race [P < 0.001 (**KBbb > BS**)], feed [P < 0.001 (**organic > conventional feed**) and time of day [P < 0.001 (**night time > daytime**)]. During winter season the animals stood overnight in the stable by the majority. The use of the structure elements was rare and influenced by feed only [P < 0.001 (**organic > conventional feed**)] (Fig. 2). Regarding animal welfare it becomes apparent that it is necessary to offer the animals possibilities to sit elevated both at the pasture and in the stable.

![Figure 2 Frequency of use of plateaus by free ranged turkeys dependent on race [**BS vs. KBbb**], feeding [**organic vs. conventional feed**] and time of day](image)

**Breaking load of femur**

In summer season breaking load of femur only tended to be influenced the by race [P = 0.073 (**BS 854.5 ± 15.53 N vs. KBbb 815.4 ± 15.13 N**)]. Due to the lower weight gain in winter season (Fig 1b) **KBbb** showed – in spite of the same age – significantly less breaking load of the femur bone compared to **BS** [P < 0.001 (**646.6 N ± 10.14 vs. 816.5 ± 14.62 N**)]. This leads to the conclusion that breaking load of the femur is influenced more by the mechanical stimulus of increasing body weight than by the age of the animal. These results showed that the more intensive growth potential of **BS** does not influence the bone stability negatively. A difference of breaking load between left and right femur was not detectable within and between the two races and during both seasons.
Conclusion

Summarizing the results of this study it can be concluded that BS – besides KBbb - can be established into the organic turkey meat production without disadvantages regarding animal welfare and health. From the economical viewpoint it must be emphasised that the genetic fixed growth potential guarantees satisfactory weight gain under all climatic conditions of outdoor rearing. Under conditions of organic outdoor rearing standards with the low stocking rate of > 4m²/animal the conjointly rearing of BS and KBbb is possible, and advanced social conflicts can be avoided by impressing. To enable resting behaviour characteristics of the species, it is necessary to offer structures allowing sitting elevated. Due to the seasonal use of the pasture, these structures must be installed both on the pasture and in the stable.

Reference