

# GROWTH AND SENSORY CHARACTERISTICS OF ALTERNATIVE GENOTYPE BROILERS REARED IN ORGANIC ORCHARDS

Klaus Horsted<sup>1)</sup>, Judith Henning<sup>2)</sup> and John E. Hermansen<sup>1)</sup>

1) Danish Institute of Agricultural Sciences, Department of Agroecology, P.O. Box 50, DK-8830 Tjele

2) The Royal Veterinary and Agricultural University, Department of Food Science, Sensory Science Group, Rolighedsvej 30, DK-1958 Fredericsberg C

*Key words: Organic broiler production, orchard, alternative genotypes, age of slaughter, weight, eating quality*

## Abstract

The effects of age, sex and genotype on growth and sensory characteristics in organically produced broilers, when kept considerably longer before slaughtering, were examined. A total of 450 birds consisting of three genotypes, Light Sussex, New Hampshire, and the commercial strain I 657 were inserted at Fejoe Research Orchard. Half the birds were slaughtered at 91 days of age and half at 120 days of age. I 657 was significantly heavier compared to the slower growing breeds and Light Sussex was significantly heavier than New Hampshire. Males were significantly heavier than females across genotype, but weight ratios differed with genotype. No overall effect of genotype was found on the flavour or smell of the breast meat, but the commercial strain went towards a tougher and less tender consistency at 120 days of age, whereas the opposite was the case for the slower growing pure breeds. The positive flavour of salt was significantly improved at 120 days of age across genotype and age, with females having saltier flavour than the males. The positive flavour of sweet corn was improved in the meat from the males, but the positive smell of sweet corn was significantly improved in both males and females. No negative consequences of age were found.

## Introduction

Broilers produced in orchards may have a positive effect as pest controllers (Pedersen et al., 2004) though they seem most efficient when they reach the normal age of slaughter. This may not be a good option for conventionally used broiler strains that are selected for a high capacity of growth and earlier maturing and consequently are exposed to different kinds of health problems. Also, there is a risk of the meat quality deteriorating (Nielsen et al., 2003). For that reason we examined the effects of age, sex and genotype on growth and sensory characteristics in organically produced broilers kept considerably longer before slaughtering.

## Methodology

450 broiler chickens evenly distributed in three genotypes, Light Sussex, New Hampshire, and the commercial strain I 657, were inserted at Fejoe Research Orchard at 5 weeks of age. The feed during the experimental period at Fejoe Research Orchard consisted of a commercial concentrate containing 160 g protein, 7 g lysine, 3.1 g methionine and 3.0 g cystine per kg feed. The protein and amino acid concentration was a little lower than the normally used starting and growing feed for organic broiler chickens, since the chickens were meant to forage in the orchard and thus get protein feedstuffs in the form of insects, larvae and clover grass in the plantation.

At the age of 91 days and 120 days, respectively, half the broilers were slaughtered. Live weight was recorded and carcasses from each group (sex\*age\*genotype) were evaluated for sensory characteristics. A clinical welfare assessment was carried out and samples from the cloaca of 60 randomly chosen birds were taken and analysed for salmonella.

Sensory profiling of the breast meat was made by a trained sensory panel consisting of two men and eight women at the Sensory Laboratory at the Royal Veterinary and Agricultural University in Copenhagen. The judges in the sensory panel were trained on three successive days. After the training of the sensory panel all the samples were assessed three times, i.e. one assessment daily for three days. All samples were evaluated at a 15 cm unstructured scale. For further evaluation an average of the assessments of the 10 judges was used.

## Results and discussion

The clinical welfare assessment suggests excellent welfare of the broilers when kept in an orchard. Moreover, no types of salmonella were found.

At 91 days of age as well as at 120 days, I 657 was significantly heavier than the slower growing breeds, and Light Sussex was significantly heavier than New Hampshire (table 1). Moreover, we found that considerable growth still occurred in all genotypes in the period from 91 days to 120 days of age. However, as indicated by the significant interactions sex\*age and genotype\*sex\*age, male chickens grew faster in this period, particularly the male chickens of Light Sussex and New Hampshire. The male chickens of these slow-growing genotypes were 40-48% heavier than the females at an age of 120 days compared to 23% at 91 days of age, whereas the weight ratio of male and female chickens of I 657 was 1.32 and 1.35 at the days of slaughter, respectively. The average weight gain per day from 91 days to 120 days of age varied from 12.8 g to 31.3 g, with the Light Sussex males having the largest weight gain and the Light Sussex and New Hampshire females having the lowest weight gain.

**Table 1.** Live and slaughter weight of different genotypes and sex at different ages, least square means (standard errors), g/bird

	New Hampshire		I 657		Light Sussex	
	Live weight	Slaughter weight	Live weight	Slaughter weight	Live weight	Slaughter weight
<i>Males:</i>						
91 days	1639 (31)	1073 (24)	2590 (28)	1867 (22)	1764 (30)	1168 (23)
120 days	2406 (30)	1623 (23)	3257 (28)	2430 (22)	2671 (34)	1851 (27)
<i>Females:</i>						
91 days	1331 (34)	870 (27)	1957 (28)	1399 (22)	1432 (39)	939 (30)
120 days	1714 (44)	1168 (35)	2417 (37)	1776 (29)	1804 (46)	1225 (36)

Significant effects: Genotype  $P<0.0001$ ; age  $P<0.0001$ ; sex  $P<0.0001$ ; sex\*age  $P<0.0001$ ; genotype\*sex  $P<0.0001$ ; genotype\*sex\*age  $P<0.05$

The crumpling, juicy, sticking and stringy characteristics were not significantly affected by any of the factors investigated. The major source of variance for softness was breed, whereas the major sources of variance for hardness, tenderness and toughness were interactions between breed and age. The least square means of these characteristics are given in table 2 for each breed and age.

**Table 2.** Influence on texture and physical characteristics

	Softness (positive)	Hardness (negative)	Tenderness (positive)	Toughness (negative)
<b>Breed: (P)</b>	$P<0.05$	NS	$P<0.05$	$P\approx 0.05$
New Hampshire	9.3	4.3	10.4	4.0
I 657 (Scan Labelle)	8.5	5.0	10.0	4.0
Light Sussex	7.9	5.2	9.2	5.1
<b>Breed and age: (P)</b>	NS	$P<0.05$	$P<0.05$	$P<0.01$
<i>New Hampshire:</i>				
91 days	8.6	5.1	9.9	4.5
120 days	9.7	3.5	11.0	3.5
<i>I 657 (Scan Labelle):</i>				
91 days	8.8	4.5	10.5	3.0
120 days	8.1	5.5	9.4	4.9
<i>Light Sussex:</i>				
91 days	7.8	5.5	8.7	5.7
120 days	8.1	5.0	9.6	4.5

We found a tendency for I 657 to be tenderer than the slower-growing genotypes when slaughtered at 91 days of age. However, when the broilers were kept 29 days longer before slaughtering we found a significant change in the development of tenderness and toughness. Thus, the slower-growing genotypes went towards a tenderer consistency of the breast meat whereas the opposite was the case for the faster growing I 657.

Since we found large growth rates in this last period only among the cockerels from the slower growing genotypes, and the interaction between genotype and sex concerning meat tenderness turned out to be non-significant, the development in meat tenderness cannot be correlated to a fast growth rate alone. Probably, the genotypes Light Sussex and New Hampshire are simply better suited for slaughtering at a higher age compared to I 657.

No overall effect of genotype was found on the flavour and smell of the breast meat. As shown in table 3, the positive flavour of salt was significantly improved at 120 days of age across genotype and age, with females having a saltier flavour than the males. The positive flavour of sweet corn was improved in the meat from the males, whereas the positive smell of sweet corn was significantly improved in both males and females. No negative consequences of age were found.

**Table 3.** Influence of sex, age and breed on selected characteristics of flavour and smell

	Smell of sweet corn (positive)	Flavour of sweet corn (positive)	Flavour of salt (positive)	Flavour of iron/liver (negative)
<b>Sex: (P)</b>	NS	NS	P<0.01	NS
Males	5.8	5.6	2.7	2.9
Females	6.1	5.5	3.2	2.9
<b>Age: (P)</b>	P<0.01	P<0.01	P<0.05	NS
91 days	5.5	5.2	2.8	3.0
120 days	6.4	6.0	3.2	2.7
<b>Breed and age: (P)</b>	NS	NS	NS	P<0.05
<i>New Hampshire:</i>				
91 days	5.5	5.3	2.7	2.4
120 days	6.4	6.2	3.2	2.7
<i>I 657 (Scan Labelle):</i>				
91 days	6.1	5.2	3.1	3.0
120 days	6.4	5.5	3.1	3.1
<i>Light Sussex:</i>				
91 days	5.0	4.9	2.6	3.5
120 days	6.6	6.3	3.2	2.4
<b>Breed and sex: (P)</b>	NS	NS	NS	P<0.05
<i>New Hampshire:</i>				
Males	5.7	5.8	2.6	2.1
Females	6.1	5.7	3.2	3.0
<i>I 657 (Scan Labelle):</i>				
Males	6.3	5.4	2.9	3.1
Females	6.2	5.3	3.3	3.0
<i>Light Sussex:</i>				
Males	5.4	5.5	2.6	3.4
Females	6.1	5.7	3.2	2.6
<b>Sex and age: (P)</b>	NS	P<0.01	NS	NS
<i>91 days:</i>				
Males	5.2	4.8	2.5	3.0
Females	5.8	5.5	3.1	2.9
<i>120 days:</i>				
Males	6.4	6.4	2.9	2.7
Females	6.5	5.6	3.4	2.8

## **Conclusion**

We conclude that it is possible to keep broilers longer in the orchard before slaughtering without compromising the eating quality of the meat. We also conclude that alternative, slow-growing genotypes could be a particular option for future broiler production in orchards.

## **References:**

- Nielsen, B.L., Thomsen, M.G., Sørensen, P., Young J.F. (2003) Feed and strain effects on the use of outdoor areas by broilers. *British Poultry Science*, 44: 161-169.
- Pedersen, H.L., Olsen, A., Horsted, K., Korsgaard, M. & Pedersen, B. (2004) Combined production of broilers and fruits. *ECO-FRU-VIT. 11th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing*, Weinsberg, pp. 131-136.