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Applied Animal Behaviour Science 73 (2001) 59–68

APPLIED ANIMAL BEHAVIOUR SCIENCE

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Reducing feather pecking when raising laying hen chicks in aviary systems

B. Huber-Eicher*, F. Sebö

Federal Veterinary Office, Centre for Proper Housing: Poultry and Rabbits, Burgerweg 22, CH-3052 Zollikofen, Switzerland

Accepted 5 January 2001

Abstract

Aviary systems for laying hens offer several advantages over battery cages. However, pecking the feathers of conspecifics remains a serious problem that negatively affects the welfare of the birds as well as the economy of a farm. From experimental studies with small groups, it has been shown that feather pecking and foraging behaviour are related and that both behaviour are influenced by early access to litter substrate. We, therefore, hypothesised, that feather pecking in aviaries can be reduced with an adequate management in the first 2 weeks of life.

Each of seven pens on six commercial poultry farms, was divided into two identical compartments (matched pair design). In one of the compartments (experimental compartment) chicks were reared for the first 2 weeks of life with access to litter (wood shavings, in one case with additional straw), while the chicks in the other compartment (control) were kept on a plastic grid. Thereafter, all chicks had unrestricted access to litter and there were no differences between the two compartments neither in housing conditions nor in management procedures.

Chicks in the experimental compartments spent significantly more time foraging (week 5), showed significantly less feather pecking (weeks 5 and 14) and significantly fewer birds had damaged tail feathers (weeks 5 and 14).

The study demonstrates that in aviaries, under commercial conditions, early access to litter substrate has a significant effect on the development of feather pecking. In order to reduce feather pecking and to increase foraging behaviour, it is recommended that laying hen chicks raised in aviary systems do get access to litter from day 1 on.

Keywords: Feather pecking; Rearing; Chicken-anomalous behaviour; Aviaries

* Corresponding author. Tel.: +41-31-9153516; fax: +41-31-9153514.
E-mail address: beat.huber@bvet.admin.ch (B. Huber-Eicher).

0168-1591/01/$ – see front matter
PII: S0168-1591(01)00121-6

1. Introduction

In Europe, more and more consumer demand eggs that are not battery produced. As a consequence, alternative husbandry systems are of interest to commercial poultry farmers as well as to scientists and governments. The two main systems under development are modified battery cages or improved deep litter systems that can be run with a higher density of birds. A higher density is achieved by applying additional elevated levels and led to the construction of aviary systems (for more information on alternative systems see, e.g. Appleby et al., 1992; Blokhuis and Metz, 1995). In Switzerland, where batteries were banned in 1981, aviaries are performing well. Today 65.2% of all laying hens in the country are kept in aviaries (Häne et al., 2000). However, aviaries have their peculiarities, and to run these systems different skills are required by the producer, and different management procedures have to be applied. It became obvious that appropriate rearing conditions are crucial for the birds so that they can make use of the elevated structures from the first day of introduction. Today it is common to raise the chicks in the same type of aviary system as they are kept in later on when in lay. For the first 2 weeks of life, chicks are confined to the lowest tier of the aviary to keep them close to the feeding and drinking facilities. Only after this time do they get access to the litter on the floor.

One major problem which remains in aviaries is feather pecking and cannibalism. It is not only observed in laying hens, but also during the rearing of the chicks, with 37.5% of farmers reporting this kind of problem (Huber-Eicher, 1999). There is good evidence that feather pecking is related to foraging behaviour (Blokhuis and Arkes, 1984; Blokhuis, 1986; Huber-Eicher and Wechsler, 1997). Experimental studies with small groups (30–40 birds) have shown that foraging behaviour as well as feather pecking are influenced by access to litter substrate during the first 2–4 weeks of life (Huber-Eicher and Wechsler, 1997; Johnsen et al., 1998). We hypothesised that with an adequate management during the first 2 weeks of life, it should be possible to reduce the development of feather pecking in commercial aviary systems. Thereby, the acceptance of aviary systems could be improved with respect to animal welfare. The aim of the study was to test whether the reducing effect of early access to litter on feather pecking found in small groups and under laboratory conditions could also be observed in commercial flocks and under commercial management procedures.

2. Methods

2.1. Birds and housing

Seven different pens on six commercial poultry farms were involved in the study. The farms had previously participated in an epidemiological survey on rearing conditions of laying hens in Switzerland. Flock size varied from 750 to 2850 birds (median 1275 birds) and the density varied between pens from 12.5 to 19.9 birds/m^2 available area (median 13.4). Surfaces were deemed to be available if there was a clear height of at least 45 cm above them, if they were at least 30 cm wide, and if the slope did not exceed 12%. There were three flocks with white LSL, two flocks with brown Bovans, one flock with brown ISA

and one flock consisted of white and brown Hypex at a ratio of 1:1.04. The chicks were not beak-trimmed.

The three most common types of aviaries in Switzerland (2 × Rhis-Boleg, 2 × Natura, 2 × Voletage; Fig. 1) were represented in the study. One pen contained a newly imported type (Harmony). The pens showed two general layouts. They were either long with the aviary system installed in one row, or more square with two rows (Fig. 2). Each pen was divided into two identical compartments (either lengthways or widthways) by means of wooden laths and wire mesh. Part of the partition was made of solid plywood or synthetic material to prevent visual contact between birds in the two compartments. A matched pair design was used and each pen served as its own control. In one of the compartments (experimental compartment) the grid of the lowest tier was covered by cardboard and littered with wood shavings for the first 14 days of life. If necessary, wood shavings were added to make sure chicks had unlimited access to litter. In the second compartment (control compartment) the grid of the lowest tier was covered by a plastic 'chicken mesh' (grid 3 mm, mesh 1 cm^2). This kept the chicks from falling through the grid while at the same time letting through particles chicks could possibly have pecked at. Rearing in the two compartments was started simultaneously. When the chicks arrived from the hatchery, they were randomly assigned to the compartments and confined to the lowest tier for the first 14 days of life. Thereafter, the litter on the tier, the cardboard and the 'chicken mesh' were removed and the chicks had unrestricted access to the whole compartment. From day 14 onwards, there were no differences between the two compartments, either in housing conditions or in management procedures. The farmers were advised to proceed with the rearing in their usual way (light regime, feeding, vaccination) and not to change anything because of the experiment.

2.2. Behavioural observations

In weeks 5 and 14 the rate of feather pecking and the condition of tail feathers were determined in each pen by direct observation during one observational session. A session consisted of four blocks of 50 min. Observations started 100 min before the middle of the photoperiod. This meant two blocks were arranged before and two blocks after the middle of the photoperiod. The first block was randomly assigned to one of the compartments (control or experimental), thereafter the compartments were observed alternately. In this way, the compartments were observed during two blocks and for a total of 100 min. each. At the start of a block, the observer sat down on a chair in the litter area. During 10 min he estimated the percentage of birds with damaged tail feathers, while the birds had time to get used to the presence of the observer. Damaged feathers are an indirect indicator of the amount of feather pecking in a flock (Bilčík and Keeling, 1999). A tail was judged to be damaged when feathers were missing, broken off or when clear signs of pecking were found at the vane of the feathers. Starting from the nearest bird, all tails in view were judged until 10% of the total number of birds in the pen was reached. The procedure was then repeated once.

Actual feather pecking and foraging behaviour was observed during the 40 min following the assessment of the tails. Observations were concentrated on a maximal area of 2 m^2 containing approximately 20 birds and where the number of birds did not vary

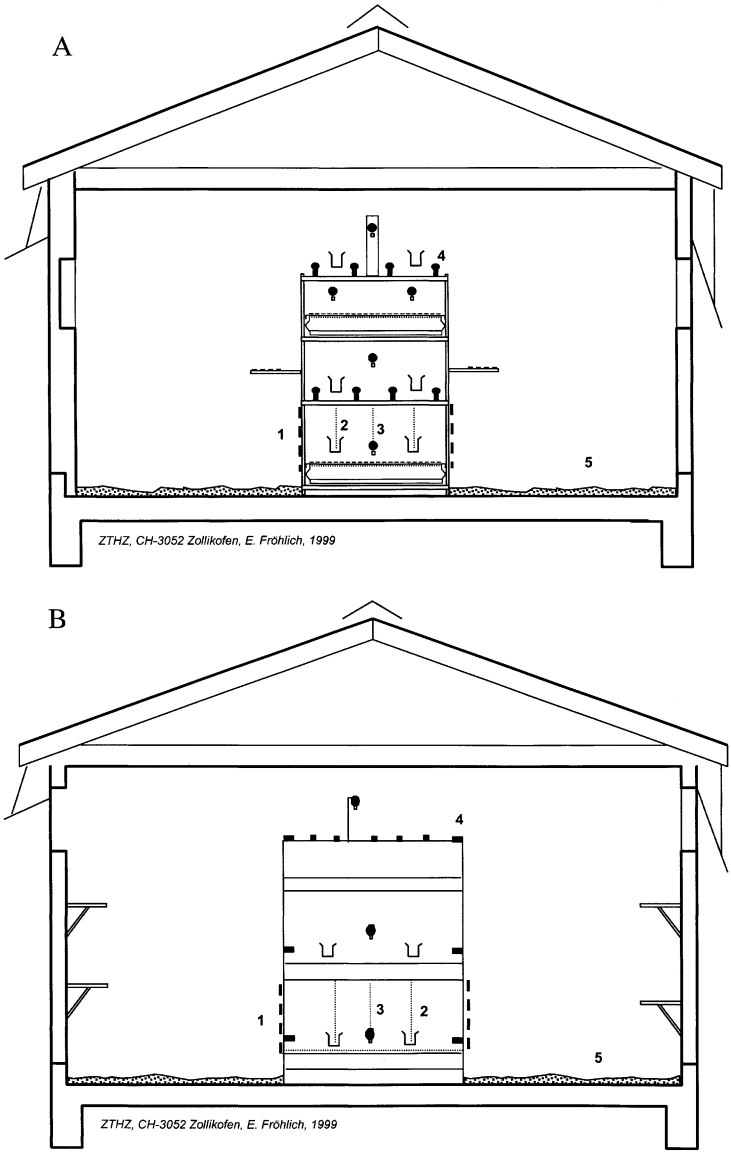

Fig. 1. Cross-sections of the three most wide spread types of aviary in Switzerland: Rhis-Boleg (A); Natura (B); Voletage (C); and of the new system Harmony (D). Numbers indicate: (1) grid to keep the chicks on the lowest tier during the first 2 weeks of life; (2) feed chains with adjustable height; (3) nipples drinkers with adjustable height; (4) perches; (5) litter area.

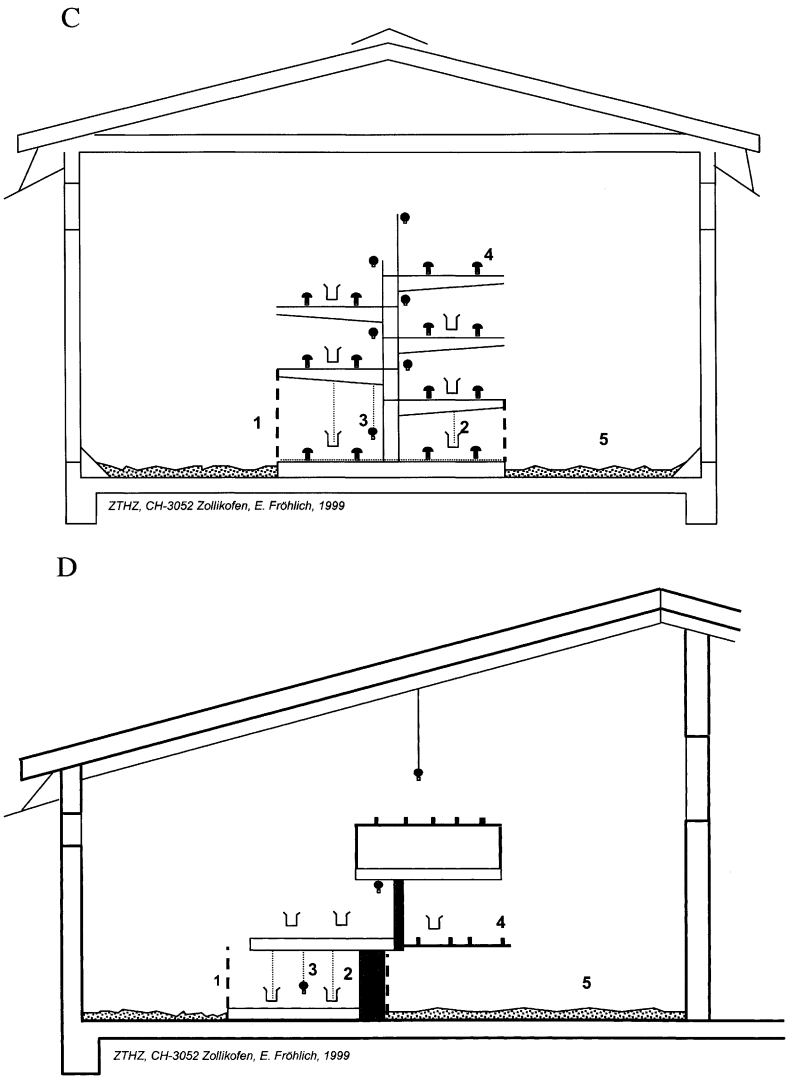

Fig. 1. (*Continued*).

greatly (±5 birds). The values of 2 m^2 and 20 birds are derived from earlier experimental work and pilot observations on commercial farms, where it was found that in this way, it is possible to reliably note all incidents of feather pecking. The observed area lay in the littered area adjoining the lowest tier, including the edge of the tier and the space between the edge and the feed chain, usually 30 cm in depth. The exact location of the area was determined, taking into account the peculiarities of the pen and making sure that the areas in the two compartments corresponded. 'All occurrences' (Altmann, 1974) of feather

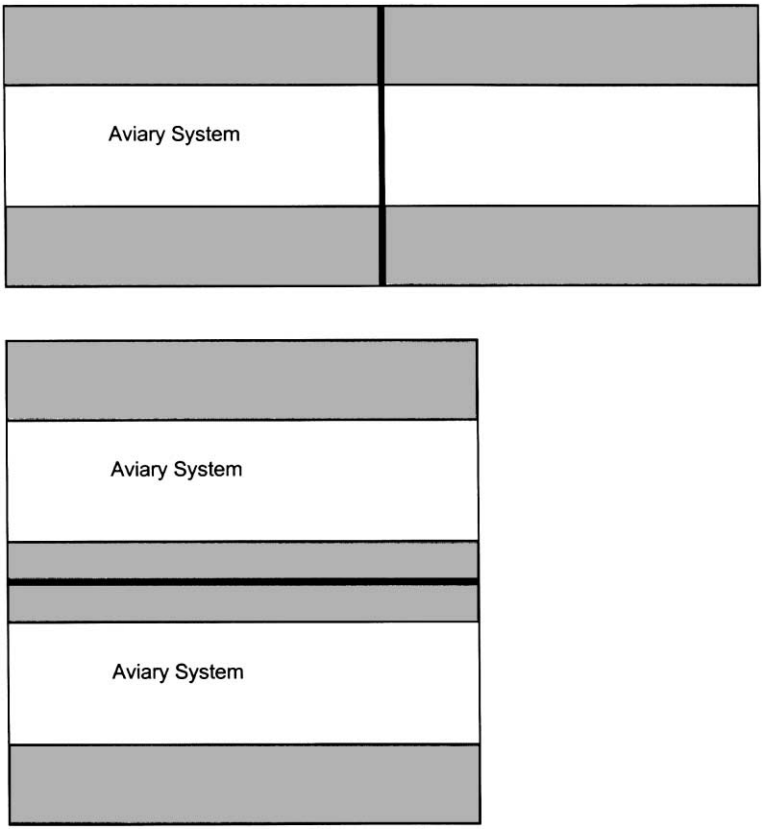

Fig. 2. Two general arrangements of aviary systems in a pen (ground plan). The bold black line indicates the division of the two compartments.

pecking interactions between individuals in the observation area was recorded. Repeated pecks to the same individual were judged as one interaction. An interaction was deemed to have ended, when there were no more pecks during a 4 s period. Only pecks to feathered parts of the body were classified as feather pecking. An interaction that consisted of 'gentle' feather pecking (gentle pecks at feathers, with feathers neither being pulled out nor with the receiver showing a reaction to the peck) or one of 'severe' feather pecking (forceful pecks, sometimes feathers are pulled out and receiver of the peck may move away) were differentiated between. The frequency of 'severe' feather pecking interactions is given as percentage of all feather pecking interactions observed in a compartment during a observational session. The recording of all occurrences of feather pecking interactions was shortly interrupted every 5 min so as to count the number of birds in the observed area. This number was necessary to calculate the frequency of feather pecking interactions which is given as interactions/30 individuals/30 min. The first 10 min in which feather pecking was recorded, was followed by 5 min in which the number of foraging individuals

was recorded. An individual was deemed to forage, when its head was lower than its rump and it was not sitting. All foraging birds in view were counted. If it was not possible to view the whole compartment, then it was divided into as many equal compartments as necessary and the number of birds counted was multiplied accordingly. The number of foraging birds is given as percentage of all birds in a compartment. Observation of foraging behaviour was followed by 10 min observation of all occurrences of feather pecking interactions, then again 5 min foraging behaviour and finally another 10 min of feather pecking. Each block of 50 min, thus, consisted of 30 min observation of all occurrences of feather pecking interactions, six counts of the numbers of birds observed in the defined area, two counts of damaged tails and two counts of the number of foraging birds.

The farmer reported any causalities separately for each compartment up to week 14. We then summed up the number of dead birds over 5 and 14 weeks and calculated the mortality as a percentage of the number of day-old chicks introduced into a compartment. Only after the observations in the first pen, which were completed before starting the observations in the other pens, we decided to include counting of the damaged tails during the first 10 min of a block, when previously no data was recorded. For this reason, we only have data from six pens on this parameter. Foraging was only recorded in week 5. In week 14, the overall view of the birds was too poor, and it was not possible to count the birds inside the aviary system due to their increased body size. No data on foraging was recorded in one pen in week 5 due to poor visibility (dust and very low light intensity).

2.3. Statistical analyses

The compartments were taken as the statistical unit and the two compartments of a pen as a matched pair. The permutation test for paired replicates (Siegel and Castellan, 1988) was used to test for differences between experimental and control compartments. Tests are one-tailed with an alpha level of 5%. One-tailed tests were chosen, because clearly directional hypothesis were tested.

3. Results

Birds in the experimental compartments showed significantly less feather pecking than control birds (Table 1). Access to litter during the first 14 days of life significantly reduced the frequency of feather pecking interactions in week 5 as well as in week 14. The percentage of feather pecking interactions judged to be severe was significantly lower in experimental compartments in week 5 (median: experimental 14.5%, control 42.2%; permutation test for paired replicates, $P = 0.008$), but no such difference was found in week 14 (median: experimental 36.3%, control 38.5%, $P = 0.203$). The percentage of birds with damaged tail feathers was significantly lower in experimental compared to control compartments, both in week 5 and week 14 (Table 1). There were also differences in foraging behaviour. In week 5, a significantly higher percentage of birds were observed foraging in experimental compartments than in controls. As for mortality, no significant differences were found between the two treatments, neither after 5 nor after 14 weeks (Table 1).

Table 1
Results of the observations in weeks 5 and 14, made in the control and experimental compartment of each of the seven pens included in the study[a]

Measure		Pens							P^*
		1	2	3	4	5	6	7	
Birds per compartment		2850	1275	750	1428	1000	2346	1056	
Density (birds/m^2)		19.9	13.1	19.8	12.7	12.5	18	13.4	
Feather pecking (gentle + severe) (interactions/30 birds/30 min)									
Week 5	Control	146.0	59.3	36.7	22.6	59.8	31.4	49.4	
	Experimental	67.1	52.7	13.5	13.8	34.5	15.2	20.0	
	Difference	**−78.9**	**−6.6**	**−23.2**	**−8.8**	**−25.3**	**−16.2**	**−29.4**	**0.008**
Week 14	Control	96.1	134.0	73.9	41.3	28.0	39.2	83.9	
	Experimental	68.8	83.4	71.6	46.9	27.0	23.6	30.3	
	Difference	**−27.3**	**−50.6**	**−2.3**	**5.6**	**−1.0**	**−15.6**	**−53.6**	**0.039**
Birds with damaged tail feathers (%)									
Week 5	Control	17.5	36.8	0.3	0.0	0.2	12.6		
	Experimental	11.6	9.9	0.0	0.0	0.0	4.8		
	Difference	**−5.9**	**−26.9**	**−0.3**	**0.0**	**−0.2**	**−7.8**		**0.031**
Week 14	Control	13.3	29.5	5.2	2.5	7.0	7.2		
	Experimental	12.3	13.3	4.5	2.3	5.9	6.5		
	Difference	**−1.0**	**−16.2**	**−0.7**	**−0.2**	**−1.1**	**−0.7**		**0.016**
Birds foraging (%)									
Week 5	Control	2.8	10.9	9.3	3.2	6.9		16.0	
	Experimental	2.9	13.5	10.6	4.0	8.2		17.7	
	Difference	**0.1**	**2.6**	**1.3**	**0.8**	**1.3**		**1.7**	**0.016**
Mortality (%)									
Week 5	Control	4.6	3.8	2.9	0.6	1.1	2.3	1.7	
	Experimental	2.3	3.8	0.5	1.5	0.2	2.0	1.5	
	Difference	**−2.3**	**0.0**	**−2.4**	**0.9**	**−0.9**	**−0.3**	**−0.2**	**0.102**
Week 14	Control	4.8	4.2	3.3	1.3	1.4	3.2	3.0	
	Experimental	2.5	4.1	3.7	4.5	10.8	2.7	2.0	
	Difference	**−2.3**	**−0.1**	**0.4**	**3.2**	**9.4**	**−0.5**	**−1.0**	**0.360**

[a] Additionally, the number of birds in a compartment and the density is given.
[*] Permutation test for paired replicates.

4. Discussion

The results show that an early introduction to litter affects the development of foraging behaviour and feather pecking not only under experimental conditions and in small groups, but also in large flocks raised on commercial farms and under commercial management procedures. It must be emphasised that the effects on feather pecking were long lasting (up to week 14). Unrestricted access to the litter area for 12 weeks was apparently not enough to compensate for the lack of litter during the first 2 weeks of life. Similar long-lasting

effects were seen by Johnsen et al. (1998) under laboratory conditions. Chicks were raised from day 1 either on wire, or with access to sand or to sand and straw. After 4 weeks, all chicks were allowed access to sand and straw. When in lay, wire raised chicks developed higher rates of feather pecking, laid fewer eggs and had a higher mortality (mainly caused by cannibalism).

Feather scoring is often used as a convenient measure to asses feather pecking in large flocks of laying hens (Hughes and Duncan, 1972; Nørgaard-Nielsen et al., 1993; Kathle and Kolstad, 1996; Gunnarsson et al., 1999). In week 5 (but not in week 14) we found that the quality of feather pecking changed with increased feather pecking frequency. In control compartments more feather pecking interactions were observed from which proportionally more were judged as 'severe'. Such an increase in the proportion of severe feather pecks with an increasing frequency of feather pecking was also observed earlier (Wechsler et al., 1998). There is evidence that feather damage is largely caused by severe feather pecks (Bilčík and Keeling, 1999). Therefore, feather scoring actually measures the amount of severe feather pecks, but because of the proportionality, it is also a measure of the total frequency of feather pecking.

The mortality in control and experimental compartments was not significantly different. In week 5, the mortality in experimental compartments tended ($P = 0.102$) to be lower. Considering the small sample size, one may suspect a positive and economically relevant effect of the treatment, although it did not reach statistical significance in our study. In week 14, in three of the seven pens mortality was higher in the treatment compartments. This was mainly due to a similar incident. After the opening of the lower tier, birds had normally started to perch in the evening and reliably spent the night on the perches of the aviary. In week 6–9, they still perched in the evening, but after all birds were perched and just before the final turn off of the lights, they started to jump down in the litter, crowded along the walls or in corners and birds got crushed to death. No such incident was reported in the control compartments. We were not able to find any references to this behaviour in the literature. A survey of the advisory services of the most important rearing companies in Switzerland revealed that the phenomena is observed now and then and that it usually starts in week 6–9. Once this begins, the birds continue with the new behaviour for the rest of the rearing period, as they also did in our experiment. The only known measure against it is to turn down the light suddenly (without a dimming phase) when the birds are still on the perches. At the moment, we do not have more information on such incidents, but, because perching while sleeping is essential for a good functioning of aviary systems and because the incidents are fatal, more research is needed to reveal the causes of this change in behaviour.

In conclusion, we recommend that laying hen chicks, raised in aviary systems, are given access to litter from day one on, in order to reduce feather pecking and to increase foraging behaviour. The tier, where the birds are kept during the first 2 weeks of life, should be covered with strong cardboard, the cardboard should be bent upwards at the edges, so as to minimise the loss of litter from the tier. Wood shavings proved to be suitable litter material. Less litter (depth not exceeding 1 cm), but supplementing every second day is advisable as this reduces problems with litter in the feeder chain and increases the attractiveness of the litter as foraging substrate.

Acknowledgements

We are grateful to the Swiss Federal Veterinary Office and the Swiss Federal Office for Agriculture for their financial support.

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