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Aviary housing for layers

Technically, a sensible housing alternative

Within the framework of a model programme financed by the BMELF in Bonn and entitled "Species-oriented and environmentally-acceptable poultry production" comprehensive investigations were carried out in Vechta from 1997 to the end of 1999 with a newly-built house for 10,000 layers into different questions on its environment-acceptability and welfare-suitability.

Main focal points of the investigations were the utilisation of the outer scratching area and of the laying nests, the quality of the house climate and ammonia emission as well as the nutrient stress on the outdoor hen run.

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The timber-framed fully-insulated house for a total of 10,000 layers was newly built in 1997. The building is 70 m long and, when the outer scratching area is included, 21.24 m wide.

The building interior comprises two identically-large departments parallel to the longitudinal axis and a storage and packing room at one gable end. Both fully-enclosed departments (each 61.20 m • 6.95 m), in each case for 5,000 birds, are each equipped as single room housing with longitudinal arrangement of laying nests, two A-frames and four feed belts.

The ground area accessible to the animals is 383.6 m^2 per department with a stocking rate of 13 hens/m^2.

The roll-free nest boxes are built on one level and in a single row as colony nests. (1.21 m • 0.45 m) and fitted with mats with slightly moveable bristles. On the entry side of each nest are three flexible opaque plastic hanging strips. The nests are fitted with an automatic outdrive help linked to a timing meter which stops entry to the nests between 6 pm and 3.30 am.

In each department there are two rows of nests with a total length of 114 m • 0.45 m depth. This equals an effective nest area of 51.3 m^2 or 97 hens/m^2 effective nest area, a value which lies within the requirements of the Lower Saxony Ministry of Agriculture (80 to 100 hens/m^2).

Along the back of each nest row is a transport belt which conveys the eggs to the sorting and packing area.

Both so-called outer scratching areas run the entire length of the building alongside each department with the measurements 61.20 m • 3.15 m = 192.8 m^2 area.

On the long outer side of the scratching area there are ten openings (each 1 m • 0.4 m) to the free range area. In each department the hens are allowed exit from the building to the scratching area through seven openings (1.1 m • 0.4 m) and then into the outside run from 10 am to 5 pm.

In the outer scratching area, which is separated from the free run by wire netting only on three sides, a moveable plastic curtain is fitted from the eves. In each scratching area are eight round drinkers distributed evenly along the mid-axis.

The outer scratching room is littered and can be driven into with a tractor from one gable end.

The outruns comprise large quadrangular areas of meadow bordering the left and right of each longitudinal aspect of the building. During the investigation, each department of 5,000 layers had access to 1.8 ha of meadowland. The total available area in the rotational meadow system was 10 ha.

Outer scratching area

The so-called outer scratching area for each department of 5,000 hens measured 61.20 m • 3.15 m and is accessed from the building interior via seven openings (1.10 m • 0.40 m) evenly distributed along the longside of the building. The scratching area was littered every 10 to 14 days with chopped straw (7 to 10 cm total height). After four to six weeks the area was completely mucked-out and freshly littered. The percentage proportion of layers (average daily value) which used the roofed outer scratching area on eight different observation days within a year lay between 13 and 17.2% (*table 1*). With this, the utilisation of the roofed scratching area is notably smaller than with smaller groups of layers [1].

Practical steps to enable a higher utilisation could be the transfer of further objects into the outer scratching area (drinkers are already present), the matching of light conditions between the outer scratching area and the building interior and above all the substantial increase in the available area in the outer scratching area. For instance the extremely high occupation in the outer scratching area is noticeable at the beginning of the outrun period. After a short stay in the outer scratching area, a proportion of the hens withdraw back into the building.

It was very clearly shown through the activities of the hens in the outer scratching areas that easily the most-often practised activity was pecking of substrate (*fig. 1*).

Nest occupation

The colony nests with a usable area of 0.42 m^2 were occupied at different intensities during the run of the day. There appeared an oc-

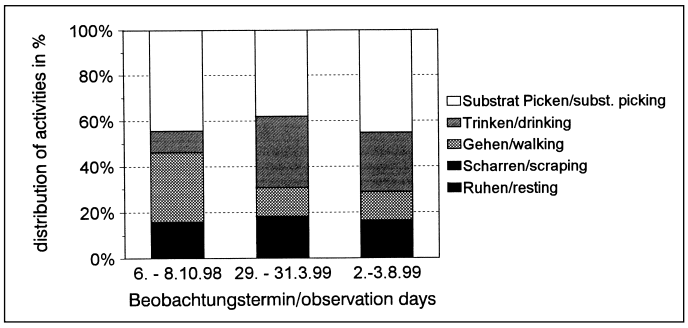

Fig. 1: The five most common behavioural actions within the protected outer scratching area as a % of all observed behavioural actions (observations over three or two days in each case)

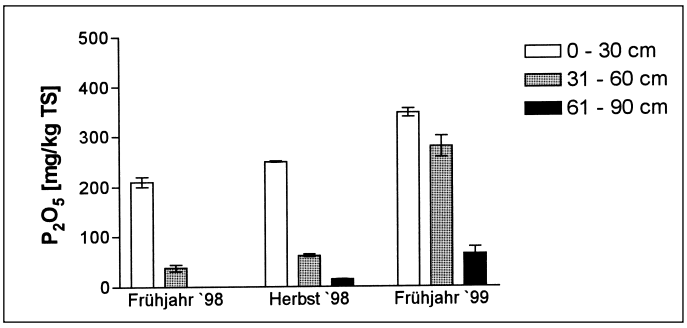

Fig. 2: P_2O_5 content in ground of the hen run area at a distance of 60 m to the poultry building

cupation pattern in the investigated nests where the highest value could be found between 7 am and 10.30 am. In the period between 5 am and 5 pm the number of hens in the nest varied between four and nine.

A point to remember is that in the unit investigated there were no great problems with laying in the wrong areas. The main reason for this positive balance lay possibly in the layout of the nest on the ground and in the rearing of the layer chicks in a system that prepared them for the investigated housing set-up.

House climate and emissions

Vacuum ventilation was used within the enclosed house interior with the exhaust air being pulled out of the building via several fans in the roof ridge. Ventilation was via a combined and intensive over/under floor system.

The droppings produced in the building interior during the entire laying period were stored under manure gratings. Comprehensive building climate and emission investigations have shown that the complicated underfloor suction systems do not lead to the expected improvement in air quality.

On the one hand, only a small portion of the exhaust air was actually directly sucked out from underneath the grating floor. On the other, the air currents within the building were substantially influenced through air egress through the hen exits to the outer scratching area. Thus, very uneven air conditions had to be reckoned with when wind speeds were high.

During the winter six months, the ammonia concentration in the animal area varied from 10 and 35 ppm (ground), depending on time and location.

The average daily ammonia emissions per bird in the measurement period from July 22 to August 17 1998 for department 1 lay at 1.46 g and for department 2, 1.27 g. The summer values were very high in comparison with battery hen values even with regard to the facts that the measurements were carried out at the end of the laying period and that the droppings from the whole laying period were stored in the building. Finally, a large proportion of the droppings was deposited in the outer scratching area and in the outrun from which further ammonia emissions were given-off, but could not be quantified.

Nutrient stress on the outrun

Independently from the outrun area and the stocking rate, the area near the building was in principle used to a great extent for dunging. The nutrients excreted in the droppings remain lying on the surface and can then be washed away or stored in deeper layers of the soil.

The investigations have shown (*fig. 2*) that increased N_{min-} and also phosphate contents were identified, even in distant points of the outrun.

A suitable parameter for the estimation of the potential ecological risk in free range systems for layers, because of its lesser mobility and higher chemical and physical stability, appeared to be the P_2O_5 content.

An even utilisation of the total free area through rotational meadow system and the intermittent introduction of arable cropping is extremely difficult and also depends on a complete artificial protection from birds of prey. The natural protection afforded by trees and bushes is then opposed to the regular use of the land for arable cropping.

The excessive nutrient stress of the soil in the area near to the building is only able to be limited through the regular exchange of a relatively permeable soil substrate down to 50 cm depth.

Investment costs and economic viability

The investment costs for building and technology including sorting and labelling plant, but without mains connections, ran to around 80 DM per layer place.

Because of this, a sustainable enterprise profit is only possible after a gross margin of around 6 pf/egg is reached and is only able to be achieved through an average market return of around 16 pfennig or more and with a laying performance at least comparable to that in battery systems.

	Observation times							
	6.10.98	7.10.98	8.10.98	29.3.98 **	30.3.99 **	31.3.99 **	2.8.99 **	3.8.99 **
Average values in %	15,1	14,7	15,8	15,4	17,2	17,2	13,0	14,4
Maximum number hens * in %	18,8	18,4	18	19	27	27,4	16,4	16,9
Smallest number of hens * in %	13,5	9	13,5	11,4	13,5	12,7	9,3	10,2

*In the reporting of the maximum and minimum, the extreme highest and lowest values are ignored in that these exceptions are not fully representative of the spot check.
**As well as outdoor scratching area, meadow land was also available.

Table 1: Hens at the outdoor yard in % and maximum and minimum values at the respective observation days between 10 , 10.30 resp. 11 am and 5 pm. Observation of 245, 235 and 225 animals focus animals at intervals of 30 min.

Literature

[1] *Abdolmohammadi, A.*: Värsphönshallning ned begränsad utevistelese. Fördjupningsarbete. Univ. Of. Agric. Sc., Skara, Sweden, 1998