ANALYSIS OF SEASONAL CHANGES OF AMMONIA NITROGEN, DUST EMISSION AND MICROBIOLOGICAL AIR POLLUTION IN DUCK HOUSES

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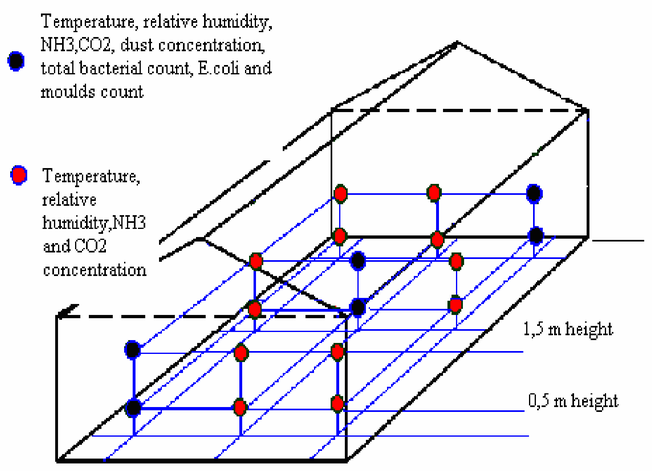
Materials and methods: The experiment was implemented in the years of 2005-2006 in the duck house where 2000-3000 birds are kept. There are six holes (0. 7 x 0. 6 m) for the exit to the barnyard in the duck house. The premises are with natural and active ventilation. During experiment five ventilators warranted the flow of air of 15060 ± 4590 m^3 $hour^{-1}$. Feeding and water is hand operated. The ducks were fed by feeding made in the farm. The birds were kept on deep litter in groups of 450-700.

All year round once a month (12 months) periodic registrations were done. The number of birds, the quantity of used feed, litter, accumulation of manure in 24 hours, the parameters of microclimate (Figure 1), the productivity of ducks was registered during the research.

Figure 1. The point of taking air samples and determination of microclimatic indices



Results: After the evaluation of the emission of ammonia nitrogen in the stable (Table 1), we can state that averagely 0.244±0.055 kg of nitrogen for one bird is lost when the technologies of litter floor for ducks are applied. It would make 17.82±2.47 % of nitrogen excluded with excrements. High and statistically reliable correlation dependence between the intensity of ammonia emission in the poultry house and air temperature in the premises (r=0.89, P < 0.005) was determined. There is also a clear statistically reliable correlation dependence on the intensity of ammonia emission in the poultry house and the emission of ammonia nitrogen for one AU (r=0.62, P < 0.05).

The factors of microclimate in the duck house (Table 2) depended on climate conditions, season and ventilation of premises. Concentration of dust in air was directly proportionate to the flow rate of air. The total number of bacteria was directly correlated with the amount of other microorganisms in air and the amount of AU in the duck house. The average concentration of carbon dioxide in the poultry houses during the investigation varied from 412 to 4671 ppm, the concentration of ammonia varied from 3 to 24 ppm. The relative air humidity and temperature in the premises depended on the conditions outdoors (respectively r=0.96, P<0.01 and r=0.69, P<0. 05).

The use of nitrogen with feed of investigated birds, its conversion into the production and accumulation in fresh excrement, calculated by the method of weight balance is presented in Table 3.

Table 1. Emission of ammonia nitrogen in the duck house.

Year/Month	Indoor NH_3 emission intensity g h^{-1}	Indoor NH_3 emission intensity g h^{-1} m^{-2}	N - NH_3 emission kg per year per bird	N - NH_3 emission kg per year per bird AU*
2005/IV	74.8	0.18	0.168	52.3
2005/V	94.8	0.22	0.184	47.4
2005/VI	243.0	0.57	0.472	81.2
2005/VII	78.9	0.19	0.566	78.7
2005/VIII	65.5	0.15	0.157	55.7
2005/IX	116.8	0.27	0.280	40.6
2005/X	20.1	0.08	0.044	43.8
2005/XI	35.2	0.15	0.118	49.2
2005/XII	10.1	0.04	0.097	24.3
2006/I	7.0	0.03	0.067	12.0
2006/II	19.8	0.08	0.189	31.6
2006/III	61.4	0.25	0.588	84.0
Average	68.9±18.8	0.18±0.04	0.244±0.055	50.1±6.5

AU- Animal Unit, equals 500 kg of live weight number of birds

Figure 1. Annual dynamics of nitrogen emission factors in the duck house, in percentage.

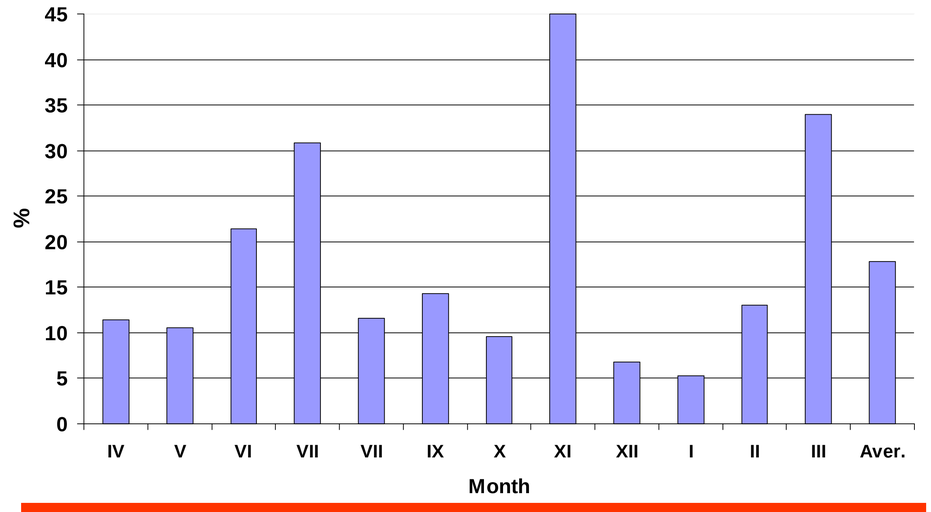


Table2. Microclimatic indices in the poultry house.

Year / Month	AU count in the poultry house	Air flow rate per 1 AU, m^3h^{-1}	Dust concentration in the air, mg m^{-3}	*E. coli* count, thous. CFU m^{-3}	Total bacterial count in the air, thous. CFU m^{-3}	Moulds count, thous. CFU m^{-3}	CO_2, concentration, ppm	NH_3 concentration, ppm
2005/ IV	10.3	831	56	42	57.612	84	1167	12.3
2005/V	14.4	860	41	303	75.010	105	1200	10.8
2005/VI	21.5	878	35	12735	76.569	70	917	18.1
2005/VII	7.2	890	58	173	30.100	76	900	17.3
2005/VIII	8.4	887	19	1052	56.111	30	1180	12.3
2005/ IX	20.7	2270	5	100	89.927	188	533	3.5
2005/ X	3.3	835	23	1247	27.849	85	1428	10.3
2005/ XI	5.1	1920	38	521	95.863	21	502	5.0
2005/ XII	3.0	1586	40	93	86.349	62	426	3.0
2006/ I	4.2	137	12	270	229.280	15	3547	17.2
2006/ II	4.5	263	23	127	157.107	15	1994	23.6
2006/ III	5.3	1468	365	38	87.027	33	648	11.2
Average	8.99± 1.88	1069± 182	59± 28	1392± 1037	89.066± 16.050	65± 14	1158 ±24	12.1± 1.8

Table3. Conversion of mitrogen and accumulation in fresh manure, kg per day

Conversion of nitrogen	Bird	M±m
Nitrogen with feed in a day	Ducks	0.0085±0.0003
	Ducklings	0.0051±0.0006
Nitrogen into the production of eggs in a day	Ducks	0.0010±0.0001
Nitrogen into the production of meat in a day	Ducks	0.0004±0.0002
	Ducklings	0.0019±0.0003
Nitrogen into manure in a day	Ducks	0.0072±0.0005
	Ducklings	0.0033±0.0005

Conclusions

- The total number of bacteria in air of duck houses with littered floor was 89066 ±16050 CFU m^{-3} and did not depend on the season. Statistically reliable direct correlations were determined between the AU in the premises, E. coli and the amount of spores of mould fungi in air of the duck house (respectively r= 0.58, P<0.05 and r= 0.68, P<0.01).
- The concentration of spores of mould fungi in air was less when the relative humidity of premises was higher (r= -0. 75, P< 0. 05).
- High and statistically reliable correlation dependence between intensity of ammonia emission in the poultry house and air temperature in the premises (r= 0. 89, P<0.005).
- Matured ducks assimilated 16. 47 % of nitrogen from balanced combined feed for the production of eggs and weight adding; ducklings breaded for meat assimilated 22. 35 % of nitrogen.
- 17.82 ±2. 47 % of nitrogen extracted from the excrements is lost in calendar year because of ammonia emission when the technologies of birds' keeping on littered floor are applied. The average ammonia emission in the duck house was 5.7 g $hour^{-1}$ AU^{-1}.