THE EFFECT OF MANURE REMOVAL FREQUENCIES AND CAGE DENSITIES ON AMMONIA PRODUCTION AND HOUSE FLY LARVAE POPULATION ON THE MANURE

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ABSTRACT

Three hundred and twenty-four Hysex-brown layers, 11 month of age, were used to study the ammonia production and manure house fly larvae population. Manure was removed every 10, 20 and 30 days, from cage densities of 1 and 2 layers per cage. The result showed that ammonia production and house fly larvae population, faecal temperature and water content of manure significantly (P<.05) increased by treatments, but the effects were not significant on feed consumption, hen day production, egg weight and total manure production respectively.

Key words: Manure removal, Layer densities, Ammonia, House fly, Population

INTRODUCTION

The development of modern, intensive layer production require efficient usage of land area, so battery cages became the choice for raising higher stocking densities of layers, because the size of the cage is an economic factor. The concentration of birds at higher stocking density, will create considerable problems of manure disposal and spread of diseases between farms (Strauch, 1987), because of physical, chemical and biological pollution.

Manure accumulates in pits beneath the cages and serves as an excellent medium for filth fly breeding (Quisenberry and Foster, 1984). El Boushy and Poel (1994) stated that cage layer manure is highly suitable for the development of fly eggs to pupae. Bowman and Lynn (1995) found that house fly (*Musca domestica*) lays eggs on animal manure or almost any kind of decaying organic mater. A female *M. domestica* may deposit about 2,000 eggs in an average lifetime of six to eight weeks. Furthermore, Nolan (1981) stated that each pound of poultry manure can produce from 100 to over 1000 house flies, and manure with a moisture content of less than 25% or above 80% will not support house fly populations. El Boushy and Poel (1994) stated that cage layer manure in its fresh form contains 75-80% moisture that is closely associated with the organic matter.

The largest part of the gases arising from animal husbandry derives from the animals excreta, (Hartung and Phillips, 1994). Ammonia is one of the chemical pollutant from the poultry industry, resulted from microbial activities in which uric acid and undigested proteins are degraded. The rate of breakdown and the production of ammonia will be influenced by moisture and temperature (Huton, 1987), and also carbon dioxide is produced in this process (Middelkoop, 1995).

One of the problems in the housing system used in intensive poultry industry is the manure accumulation and manure disposal that can produce excessive flies and odor if not handled properly, caused environmental pollution and public protest. This study was undertaken to evaluate cage densities and manure removal frequencies on ammonia and houseflies population in the manure.

MATERIALS AND METHODS

Three hundred and twenty-four Hysex-brown layers, 11 month of age were

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used in this experiment. The birds were allocated into treatments of manure removal every 10, 20 and 30 days, and cage densities of 1 and 2 layers per cage with three replicates per treatment group. The experiment diets used were of commercial feed, containing 2800 kcal/kg metabolizable energy and 17, 3.7 and 0.6% of crude protein, calcium and phosphorus respectively. Feed and water were provided *ad libitum.*

Parameters collected from the manure were ammonia production, house fly larvae population, temperature, water content and total manure production and layer performances include hen day production, feed consumption, feed conversion ratio and egg weight.

Ammonia was measured by placing an ammonia detector (Drager Pac III version 1.1) on the manure of each treatment, covered by a closed transparent box (37 x 32 x 22cm). Larva's population of house fly was determined using the technique described by Southwood (1978) and water content of manure using AOAC (1984).

The data were analysed statistically using the factorial design (Steel and Torrie, 1980) and Duncan's multiple range test was used to determine the significant differences within each parameter.

RESULTS AND DISCUSSION

This experiment has shown that low densities layer in the cage and frequent manure removal helps to decrease ammonia production by the faeces and house fly larvae population in the manure. The effect of cage densities (CD) and manure removal frequencies (MRF) and their interaction effect of CD and MRF are presented in Table 1 and 2.

Cage density had significantly increase (P<.05) ammonia production, house fly larvae population, faecal temperature, and water content in the manure but not significant on manure produced, feed consumption, feed conversion ratio, hen day production, and egg weight. Increasing CD produced faster accumulation of more manure immediately and as such increase ammonia production, house flies larvae population, faecal temperature and water content. These conditions became a very good medium for fly breeding. This study is consistent with the findings of Axtell (1968) that the manure accumulated over winter was 60 cm deep and the fly larvae, *M. domesticae,* were abundant. CD had no effect on manure produced, feed conversion ratio, hen day production and

Table 1. The effect of cage densities and manure removal frequencies on parameters taken during the experiment

Parameter	Cage densities (layer)		Manure removal frequencies (per days)		
	1	2	10	20	30
Ammonia (ppm)	15.20 ^{a}	24.13 ^{b}	16.50 ^{p}	24.10 ^{q}	31.80 ^{r}
Larvae population (200g-mn)	142 ^{a}	194 ^{b}	94 ^{p}	180 ^{q}	286 ^{r}
Manure temperature (C)	28.20 ^{a}	2 9.70 ^{b}	28.60	28.90	29.30
Manure water content (%)	68.90 ^{a}	7 1.80 ^{b}	69.90	70.80	71.50
Manure produced (g/hen/day)	72.30	72.98	72.71	72.75	72.81
Feed consumption (g/hen/day)	111.70	111.00	111.00	110.20	112.60
Feed convesrion	2.21	2.17	2.23	2.16	2.18
Hen day production (%)	82.42	82.73	80.15	83.83	84.25
Egg weight (g)	60.96	61.63	61.44	61.33	61.11

Note. (200g-mn) : per 200 gram manure

$^{a,b\ \&\ p,q,r}$ Mean within row with different superscripts are significantly different (P<.05)

Table 2. The interaction effect of cage densities and manure removal frequencies on parameters during experiment

Parameter	Cage Densities x Manure Removal (cd/mr)					
	1cd/10 mr	1cd/20 mr	1cd/30 mr	2cd/10 mr	2cd/20 mr	2cd/30 mr
Ammonia (ppm)	10.0^{a}	16.0^{ab}	19.6^{abc}	23.0^{bc}	32.3^{c}	44.0^{d}
Larvae population (200g-mn)	81^{a}	146^{ab}	246^{b}	107^{a}	215^{b}	326^{c}
Manure temperature (C)	27.8	28.3	28.6	29.5	29.6	30.0
Manure water content (%)	68.1	68.9	69.9	71.7	71.8	72.0
Manure produced (g/hen/day)	2.66	72.31	72.13	72.76	72.19	72.99
Feed consumption(g/hen/day)	111.9	110.7	112.4	110.2	109.8	112.9
Feed conversion	2.23	2.21	2.21	2.23	2.12	2.16
Hen day production (%)	81.38	81.86	84.03	80.15	82.83	84.14
Egg weight (g)	61.66	60.78	60.43	61.23	61.88	61.11

Note. (200g-mn) : per 200 gram manure

^{a,b,c,d} Mean within row with different superscripts are significantly different (P<.05)

egg weight, due to that feed intake was not significantly reduced and the space requirement for layers is still normal as in these experiments the cage area was 25.5 cm x 45 cm (1147.5 cm^2) for two layers, as recommended by North and Bell (1990) that floor space requirement per laying pullet should be 542 cm^2.

Manure removal frequencies had increase significantly (P<.05) the levels of ammonia produced and house fly larvae population on the manure, but no significant effect on temperature, faecal water content and manure produced, feed consumption, feed conversion ratio, hen day production and egg weight. If manure accumulates beneath the cages and the removal is not done frequently, this will increase the ammonia production and house fly larvae population significantly, as also reported by Nolan (1981) that if the litter in poultry houses is removed twice or more frequently, this will prevent fly breeding and odor problems. Feed consumption, feed conversion ratio, hen day production and egg weight had not been effected by MRF directly.

Interaction of cage densities and manure removal frequencies had a significant effect (P<.05) on ammonia production and house fly larvae population in the manure (Table. 2), because removing manure more frequently and followed by low cage density tend to decrease ammonia and house fly larvae population, because of this practice resulted in less degradation of uric acid and adult fly laying eggs in the manure.

There was no significant interaction effect of cage densities and manure removal frequencies on faecal temperature, water content and manure produced, also feed consumption, feed conversion ratio, hen day production and egg weight (Table. 2).

REFERENCES

AOAC. 1984. Official Methods of Analysis, 14th ed. *Association of Official Analysis of Chemistry*. Arlington.VA.

Axtell, R.C. 1968. Integrated house fly control: Population of fly larvae and praceous mites Macrocholes muscadomesticae, in poultry manure after larvacide treatment. *J. Econ Entomol*., 61(1):245-249

Bowman D.D. and C.R Lynn 1995. *Georgis' Parasitology for Veterinarians'* 6th ed. WB. Saunders Company. A Division of Harcourt Brace & Company. Philadelphia. London. Toronto. Montreal. Sydney. Tokyo.

El Boushy, A.R, and van der Poel. 1994. *Poultry Feed From Waste Processing Use*. Chapman & Hall.

Hartung, J. and V.R. Phillips., 1994. Control of gases emissions from livestock building and manure stores. *J Agric. Engng Res.*, 57:173-189.

Huton, P. 1987. How ammonia can affect pullet and laying hens. *Poultry International.* June. 1987. Pp.:18-19.

Middelkoop, K. 1995. Environmental aspect of intensive poultry production. *World Poultry Sci J.*, 11(10):41-45.

Nolan, P. M. 1981. Living with your neighbours. *Poultry Digest*. March. 1981. Pp.:160-162.

North, M.O, and D.D. Bell. 1990. *Commercial Chickens Production Manual*. 4th ed. An AVI Book. Published by Van Nostrand Reinhold New York.

Quisenbury, S. S. and D. E. Foster. 1984. Cost-benefit evaluation of housefly (*Diptera muscidae*) control in caged layer poultry houses *Poultry Sci.*, 63:2131-2139.

Southwood, T.R.E. 1978. Ecological Methods with Particular Reference to the Study of Insect Populations. London Chapman and Hall. A. Halsted Press Book. John Wiely & Sons,. New York. Pp.:309.

Steel, R.C.D. and J. H. Torrie. 1980. *Principles and Procedures of Statistics : A Biometrical Aproach*. McGraw-Hill Book CO, Inc, New York. NY.

Strauch, D. 1987. Hygene of animal waste management. In: *Animal production and Animal Health*. D.Strauch (Ed). Elsevier Science Publisher BV. Amsterdam.