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EFFECTS OF HOUSING SYSTEM ON LAYER PERFORMANCE IN A COOLED HOUSE[1]

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An experiment was conducted to evaluate four types of housing systems including, floor pens, flat-deck, 2-tier, and 3-tier of cages which were located in one cooled house equiped with fans and cooling pads at KFU Research Station. Three hundred and sixty pullets at KFU Research Station. Three hundred and sixty pullets were allocated at random at 21 weeks of age to the different systems of housing. Five replicates were used for each treatment. Birds during the experimental period were fed ad libitum and were exposed to 14 h of light daily. Records were kept daily for 52 weeks of production.

Results indicated that hens in different types of cages had the same performance but they differed from those kept in floor pens. Birds on the floor were superior for most of the traits studied. They laid more and larger eggs, had heavier egg mass and better livability. They also consumed more feed but the efficiency of feed utilization was not affected ($P > 0.05$) by the housing system.

Key words: Cages, floor, housing, layers

The recent trend of housing system in the large poultry farms in Saudi Arabia is towards using the 3-tier type of cages. There is limited information about the feasibility of this system in comparison to others. Investigators in other countries evaluated the different systems of housing and their effects on layer performance (Bhagwat and Craig 1975). Christmas et al (1974) compared hen-housed production in floor pens vs cages. They found that pullets housed in floor pens laid more eggs but caged ones had better efficiency of feed utilization. A different result was reported by Bareham (1972), who stated that caged birds produced more eggs than those in deep litter.

Oluyemi et al (1977) housed layers in cages and different types of litter housing and reported that egg weight and production were in favour of cages, whereas mortality rate and feed efficiency were similar in both systems.

This study was carried out to evaluate the performance of layers in floor pens and different types of cages in a cooled house for one year of production.

Materials and Methods

Day-old Shaver Starcross-288 female chicks obtained from a local hatchery on August 25, 1980 were housed and reared in floor pens on savings in an open house at the KFU Research Station. Water and grower diet containing 180 g protein and 2802 Kcal ME per kg were supplied ad libitum.

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At 21 weeks of age, 360 pullets were debeaked and allocated at random to four housing systems which were located in a cooled house equiped with fans and a cooling pad system. The layout and the details of the house along with locations of the fans and the pads are shown in Figures 1 and 2. The housing systems were floor pens, flat-deck, 2-tier and 3-tier cages.The design of the experiment and number of pullets used are presented in Table 1. Five replicates were used for each treatment and each 3 adjacent cages were considered one unit. Water supplied by a nipple system and a layer ration containing 170 g protein and 2706 Kcal ME per kg, were provided ad libitum.

The birds in each experiment unit were fed as a group and were exposed to a minimum of 14 h of light daily throughout the experimental period (52 weeks). The daily temperature at bird level in the hot months ranged from 20-32°with an average relative humidity of 65%.

Least squares analysis of variance (Harvey 1960, 1972) was used to test the effects of housing systems and time-period effect on layer performance using the unit means of the following traits: egg production per hen-day and per hen-housed, egg weight, egg mass, feed consumption (feed intake/ bird/d) and conversion (g of feed/g of egg). Data collected during the 52 weeks of production were divided into four periods each of 12 weeks except the last one which included 16. Two analysis were run: one to test the effect of housing systems and the other to test the effects of time periods. The overall model was as follows:

$$Y_{ikl} = u + S_k + P_i + SP_{ki} + e_{ikl}$$

where Y_{ikl} = any observation of trait Y

u = overall mean

S_k = 1, 2 ... 4 housing systems

P_i = 1, 2 ... 4 time-period

SP_{ki} = housing system x time period interaction

e_{ikl} = random variation

Table 1:

Details of the experiment and number of pullets used for each treatment

Housing system	Floor area (m^2/bird)[1]	Density (Birds/pen or cage)	Cages or pens per replic	Birds/replic	Cage or pen size (m2)
Floor pens	.200	30	1	30	2.00 x 3.00
Cages					
Flat deck	.042	4	3	12	.42 x .40
2-tier	.036	5	3	15	.45 x .40
3 tier	.036	5	3	15	.45 x .40
Total number of birds/replicate					

[1]Total number of pullets used: 72 x 5 replicates = 360

Figure 1:
Layout of the cooled house showing the location of the fans and the cooling pads

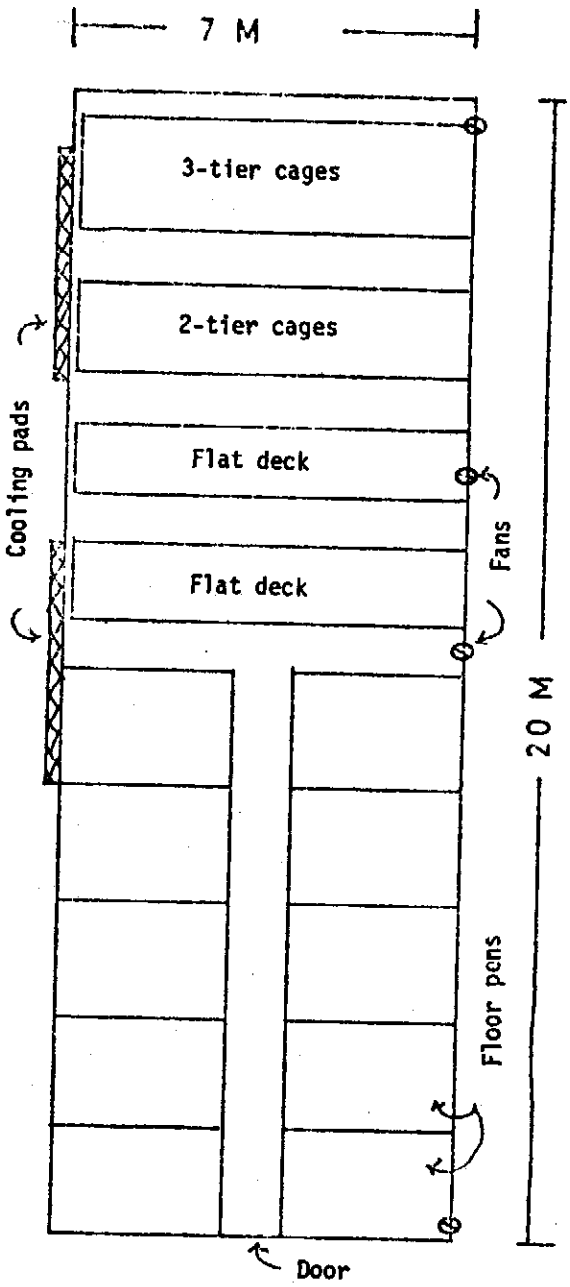
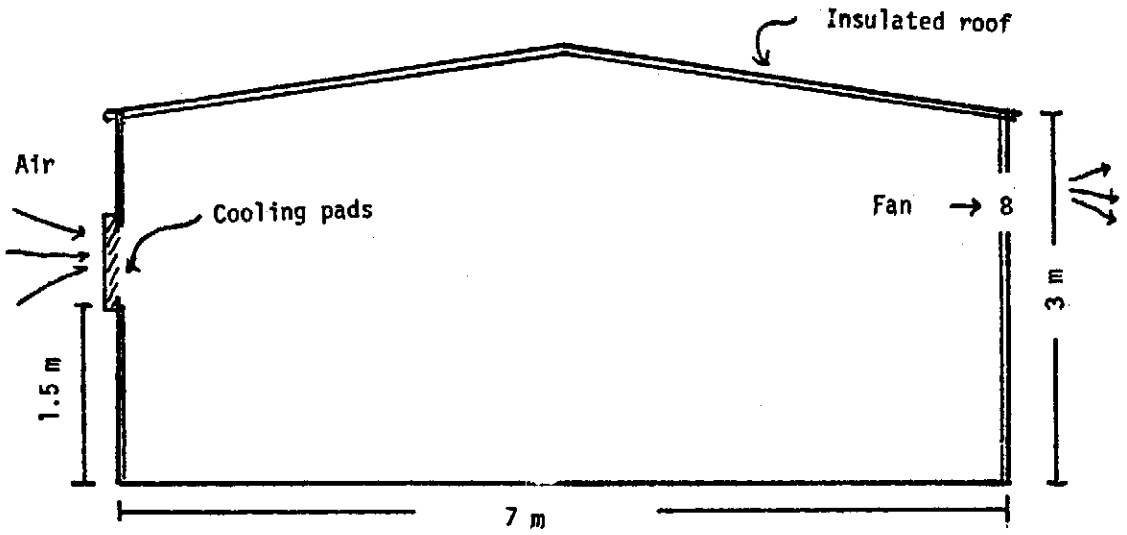


Figure 2:
Cross-section view of the cooled house used in the study



Duncan's multiple range test (Duncan 1955) was used to test for differences among means involving more than one degree of freedom.

Results

Effects of housing systems: Table 2 shows the least squares means for hen performance as affected by the housing systems. Feed consumption was significantly ($P < 0.05$) affected by housing, being 136 for birds on the floor and 115 g/d for those in cages. Feed onnversion was not influenced ($P > 0.05$) by the type of housing. The increase in feed intake coincided with an increase in both egg production and body weight. Housing significantly ($P < 0.01$) influenced hen-housed production. Floor hens laid at the rate of 71%, compared to 55% as an average for the three types of cages.

Housing did not influence egg weight, but rate of egg mass production was higher ($P < 0.05$) for floor hens which also had the lowest mortality (Table 2).

Time-period effects: All traits except feed consumption were significantly ($P < 0.05$) influenced by period of production (Table 3). Body weight increased markedly reaching 1.870 kg at the end of the fourth period. This increase in body weight was accompanied by a gradual increase in daily feed intake and reduction in efficiency of feed utilization in the last period.

Table 2:
Least-squares means of performance traits as affected by the housing system

Performance trait	Housing			
	Litter floor	Cages		
		flat deck	2-tier	3-tier
Body weight, kg	1.925[a]	1.794[a]	1.858[a]	1.908[a]
Hen-day production, %	73.9[a]	67.8[a]	67.4[a]	68.9[a]
Hen-housed production, %	70.8[b]	54.3[a]	54.6[a]	55.5[a]
Eggs hen-housed	259[b]	213[a]	199[a]	202[a]
Egg weight, g	61.1[a]	60.8[a]	60.4[a]	60.3[a]
Egg mass, g/bird/d	43.3[b]	33.2[a]	33.0[a]	33.5[a]
Feed intake, g/d	136[b]	118[a]	113[a]	118[a]
Conversion, feed/ egg wt	2.51[a]	2.90[a]	2.79[a]	2.84[a]
Mortality, %	6.0[a]	31.7[b]	30.7[b]	29.7[b]

[a,b]Means within each row different superscripts are significantly different ($P < 0.05$)

The hen-day production was highest (77%) during the second period and least (63%) during the last period, showing that as the pullets got older they produced fewer eggs. This depression was accompanied by an increase in egg weight. The maximum egg weight was recorded during the last period. A similar trend was noticed in mortality which increased with time.

Table 3:
Least-squares means of performance traits as affected by the time period

Característica de comportamiento	Period (weeks)			
	0-12	13-24	25-36	37-52
	Least-squares means[1]			
Body weight, kg	1.66[a]	1.80[b]	1.84[b]	1.87[b]
Hen-day production, %	71.7[ab]	77.0[b]	71.4[ab]	63.2[a]
Hen housed production, % la, %	69.6[b]	67.5[b]	56.8[a]	49.0[a]
Eggs hen-housed	58.5[b]	56.8[ab]	47.8[a]	54.9[ab]
Egg weight, g	51.6[a]	59.7[b]	63.3[c]	66.1[d]
Feed intake, g/d	118[a]	120[a]	121[a]	124[a]
Conversion, feed/ egg wt	3.22[a]	2.64[a]	2.68[a]	3.13[b]
Mortality, %	7.3[b]	11.9[c]	1.7[a]	4.2[ab]

[a,b,c]Means within each row different superscripts are significantly different ($P < 0.05$)

There was a significant ($P < 0.05$) period-by-housing interactive effect on mortality. Pullets housed in 2-tier cages had the highest mortality during the second period.

Discussion

The most important finding was the superiority of the floor housing system as compared with the use of cages. This is in agreement with the reports of Christmas et al (1974) from Florida and Bhagwat and Craig (1975) but contrary to the results of Moore et al (1977) and Oluyemi and Roberts (1975)

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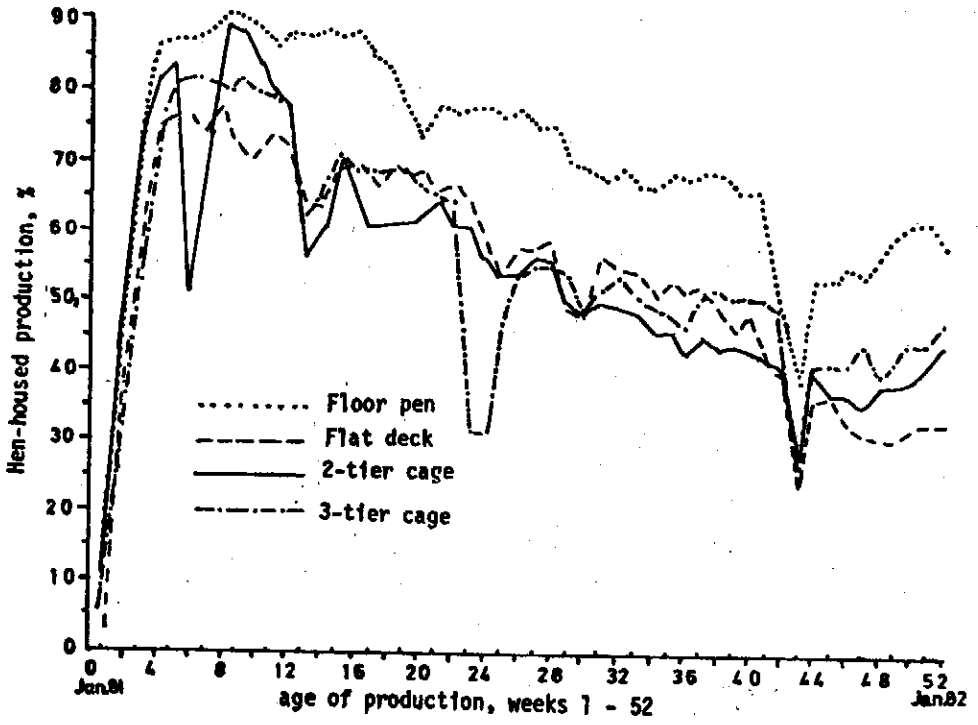
The variation in performance with time (Figure 1), and the significant housing X period effects were probably due to changes in environmental conditions over time. Similar findings were reported by Al-Rawi et al (1976) and Vohra et al (1979).

Figure 3:

Hen-housed egg production for different housing systems during the laying period



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