The University of Georgia
Cooperative Extension Service
College of Agricultural and Environmental Science/Athens, Georgia 30602-4356

Poultry Housing Tips

Problems Associated with Insufficient Light Trap Area

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Most light controlled pullet houses in the United States do not have enough inlet and fan light trap area. As a result, it is not uncommon to find pullet house exhaust fans operating at less than 60% of their rated capacity. The reason that little has been done to address this problem is that pullets are on restricted feed and are placed at very low densities mortality problems are extremely rare, and the loss in ventilation fan efficiency is not easily recognized as a real problem. Complicating matters is the fact that until recently there was little or no reliable information on the proper amount of light trap to install. In addition, light traps are fairly expensive and the amount of light trap area installed was often minimized in an effort to cut costs.

It is important to keep in mind that just because birds are not dying does not mean that the insufficient light trap area is not costing a producer money. A recent trip to a newly constructed pullet farm provides a good example of just what the cost associated with insufficient light trap area can be.

Light Trap	Light Reduction Factor	Exhaust Fan Light Trap Requirements (cfm per square foot)	Inlet Light Trap Requirements (cfm per square foot)
Dandy (Black-Air T.M.)	2,300	850	575
Acme (Metal)	8,000	800	550
Munters (MI-T-Dark T.M.)	2,100,000	750	500
Dayton	180,000	700	500
Acme (Plastic)	21,000,000	700	475
W.W.F. Light Deflector	11,000	600	425
Gigola (Night Air - 97 T.M.)	5,000	550	375
Dandy (Black Majic T.M.)	3,100,000	500	350
General Shelters (Light Eliminator T.M.)	4,700,000	400	275

Table 1. Light Trap Requirements.

The farm had four new 40' X 400' pullet houses with dropped ceilings and white on black sidewall curtains. The houses were tunnel-ventilated with six 48" slant wall fans. The 48" fans were installed in one end wall and a solid wall was constructed five feet from the intake side of the fans to hold eight 48" X 48" W.W. F Light Deflector light traps. On

the opposite end of the house (inlet end) there were four 48" X 48" W.W. F Light Deflector light traps in one side wall adjacent to the end wall and another five in the opposite side wall. On each side wall there was a "dog house" that extended out from the house approximately five feet to shade the inlet light traps from direct sunlight. The sides of the "dog house" were solid from roof of the "dog house" to within two feet of the ground. The house had 12 small five foot by one foot adjustable side wall inlets with light traps for use during cold weather.

	Required	Actual
Exhaust Fans	96,000 cfm @ 0.15"	5 X 15,800 = 94,800 cfm @0.15" (from fan lab test data)
Fan Light Trap	From Table 1 (600 cfm/ft^2) Area = 94,800 cfm / 600 cfm per ft^2 *158 ft^2*	Eight 48" X 48" light traps Area = 8 X 16 ft^2 *128 ft^2* (-19%)
Inlet Light Trap	From Table 1 (425 cfm per ft^2) Area = 94800 cfm / 425 cfm per ft^2 *223 ft^2*	Nine 48" X 48" light traps Area = 9 X 16 ft^2 *144 ft^2 (-35%)*
Inlet Light Trap Shade Structure	Opening should be larger than light trap area (500 cfm per ft^2) Area = 94800 cfm / 500 cfm per ft2 *189 ft^2*	(north side) 30' X 2.25' = 68 ft^2 (south side) 35' X 2.25' = 79 ft^2 *147 ft^2 (-22%)*
Tunnel Curtain over Inlet Light Trap	Should not obstruct any of the inlet light traps	Curtain pockets covered ends of light trap Area lost = 24 ft^2

Table 2. Required and Actual Light Trap Area for a 40' X 400' Pullet House

	Light trap requirement per 48' fan	Number of fans which could operate efficiently with available light trap
Fan Light Trap	Area per fan = 15,800 cfm / 600 cfm per ft^2 *26.3 ft^2 per fan*	# fans = 128 ft^2 / 26.3 *approximately five fans*
Inlet Light Trap	Area per fan = 15,800 cfm / 425 cfm per ft^2 *37.2 ft^2*	# fans = 144 ft^2 / 37.2 *approximately four fans*
Inlet Light Trap Shade Structure	Area per fan = 15800 cfm / 500 cfm per ft^2 *31.6 ft^2*	# fans = 147 ft^2 / 31.6 *approximately five fans*

Table 3. Number of 48" fans which could operate efficiently

Table 2 provides a comparison of the amount of exhaust fan capacity, inlet and fan light trap area and shade structure opening the house in question had, compared to what it should have been equipped with in order to maximize exhaust fan performance as well as bird cooling. From Table 2 it can be seen that the houses' exhaust fan capacity was

essentially the same as the desired. Where the houses fell significantly below the specified requirements was in the amount of exhaust fan and inlet light traps (22% and 35% below required, respectively). Making matters worse, the tunnel curtain pockets covered a portion of the inlet light traps, further reducing the available light trap area. In addition, the shade structure ran too close to the ground causing another restriction. These deficits in inlet light trap area may not seem like much, but in fact can have a dramatic effect on exhaust fan performance.

One way to evaluate the seriousness of the problem is to determine how many fans can be effectively run with the available fan and inlet light trap area. For instance, in Table 3 it can be seen that one square foot of fan light trap is needed for every 600 cfm of exhaust fan capacity. Thus a 15,800 cfm fan would require 26.3 square feet of fan light trap area. With a total of 128 square feet of available light trap, and each fan required 26.3 square feet of light trap, only five fans could be operated efficiently. These calculations can be repeated to determine inlet light trap as well as shade structure opening needs.

From Table 3 it can be seen that the weakest link was the minimal amount of inlet light trap. Though the house had enough shade structure and fan light trap area to operate five fans, it only had enough inlet light trap to operate four fans. When it comes to air flow in a pullet house, air moving ability is determined by the greatest restriction, in this case the inlet light trap. Even if the fan light trap area was doubled, the fact would remain that the inlet light trap was the limiting opening so only four fans could operate effectively. Another way to look at this concept is to compare it to a garden hose. If you squeezed the middle of the garden hose thereby restricting the amount of water flow, increasing the nozzle opening would not increase the flow of water.

The fact that the inlet was limiting the number of exhaust fans which could be operated efficiently can be seen in the summary of the air velocity measurements taken in the broiler house (Table 4). When the first four fans were turned on, air velocity increased approximately 55 ft/min per fan. But, when the fifth fan was turned on there was only a 20 ft/min increase in air speed. When the sixth fan was turned on the increase in air velocity was only 10 ft/min. The slight increases in air velocity when the fifth and sixth fans were turned on verifies that there was only enough inlet light trap for four fans. In total, the amount of air moved only increased from 62,000 cfm to 66,000 cfm by turning on the fifth, and sixth fans.

Fans	Air Velocity (ft/min)	Air Velocity change (ft/min)	Single Fan Output (cfm)	Total Fan Output (cfm)	Single Fan Power Usage (watts)
1	50	50	19,500	19,500	1,060
2	105	57	18,500	37,000	1,080
3	169	64	17,000	51,000	1,140
4	230	61	15,500	62,000	1,160
5	250	20	13,000	65,000	1,200
6	260	10	11,000	66,000	1,230

Table 3. Air velocity and fan output measurements

Making matters worse is that even though the six fans were only moving the amount of air of four fans, they were using the power of six fans under a high load. If the proper amount of light trap was installed, the six fans would have used approximately 6,960 watts of power each hour. With increased restriction the six fans were using 7,380 watts of power each hour, a six percent increase. **This may not seem too bad until you realize that turning on the last two fans increased air flow by only six percent, but increased power usage by 60 percent!**

In this house the producer needs to increase both the inlet as well as fan light traps to optimize fan performance and bird cooling. Increasing just the inlet light trap and "dog house" opening will lessen the inlet restriction, but the lack of adequate fan light traps would then become the primary restriction limiting the total number of fans that could be operated efficiently to five (see Table 3). This of course would be better, but not ideal.

The lesson to be learned here is that you must have enough light trap area for all the fan you plan to operate. Looks can be deceiving. A house with six fans, may only have the air flow of four fans but the power bill of a house with almost seven fans.

Michael Czarick
Extension Engineer
(706) 542-9041
(706) 542-1886 (FAX)
mczarick@engr.uga.edu

Michael P. Lacy
Extension Poultry Scientist

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