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Poultry Housing Tips

Side wall inlet light hoods.

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Figure 1. Side wall inlets without light hoods

Figure 2. Light entering through sidewall inlets

One of the keys to implementing a successful lighting program is being able to keep the house dark during the day so that bird activity is kept to a minimum. How dark is dark? Though there is a fair amount of debate on the subject, most broiler producers find that a light intensity of somewhere between 0.2 and 0.01 ft-candles reduces bird activity to an acceptable level. To put this in perspective the light intensity at floor level in a typical house with 40 watt light bulbs operating at full intensity is approximately 0.5 ft-candles.

The primary challenge producers face when trying to keep a house dark is either direct or defuse sunlight entering through side wall air inlets. Even if the sun is high enough in the sky that there is no direct sunlight entering a house, light intensity at floor level can still easily exceed one ft-candle (roughly equivalent to what one would expect to find in a house with 75-watt light bulbs) when the side wall inlets are fully opened. If direct sunlight were to hit the upper side wall of a house early in the morning or late in the evening when the sun is closer to the horizon, light intensity in portions of the house can exceed 50 ft-candles. The net result is whether the sun is low on the horizon or high in the sky, if the side wall inlets are opened light intensity and therefore bird activity will be higher than what most producers would ideally like to see.

To reduce the amount of light entering through side wall inlets, hoods need to be installed over the inlets. Light hoods force the incoming air to make a couple of turns before entering the house (Figure 3). Since sunlight travels in a straight line, the amount of light passing through a hood is reduced with each turn the incoming air is forced to make. The downside of light hoods is that they tend to increase the static pressure the fans are working against. How much they increase static pressure depends on the size of the light hoods as well as the number of turns the incoming air is forced to make. The smaller the light hood, the greater the number of turns, the harder it is for the fans to pull air into the house.

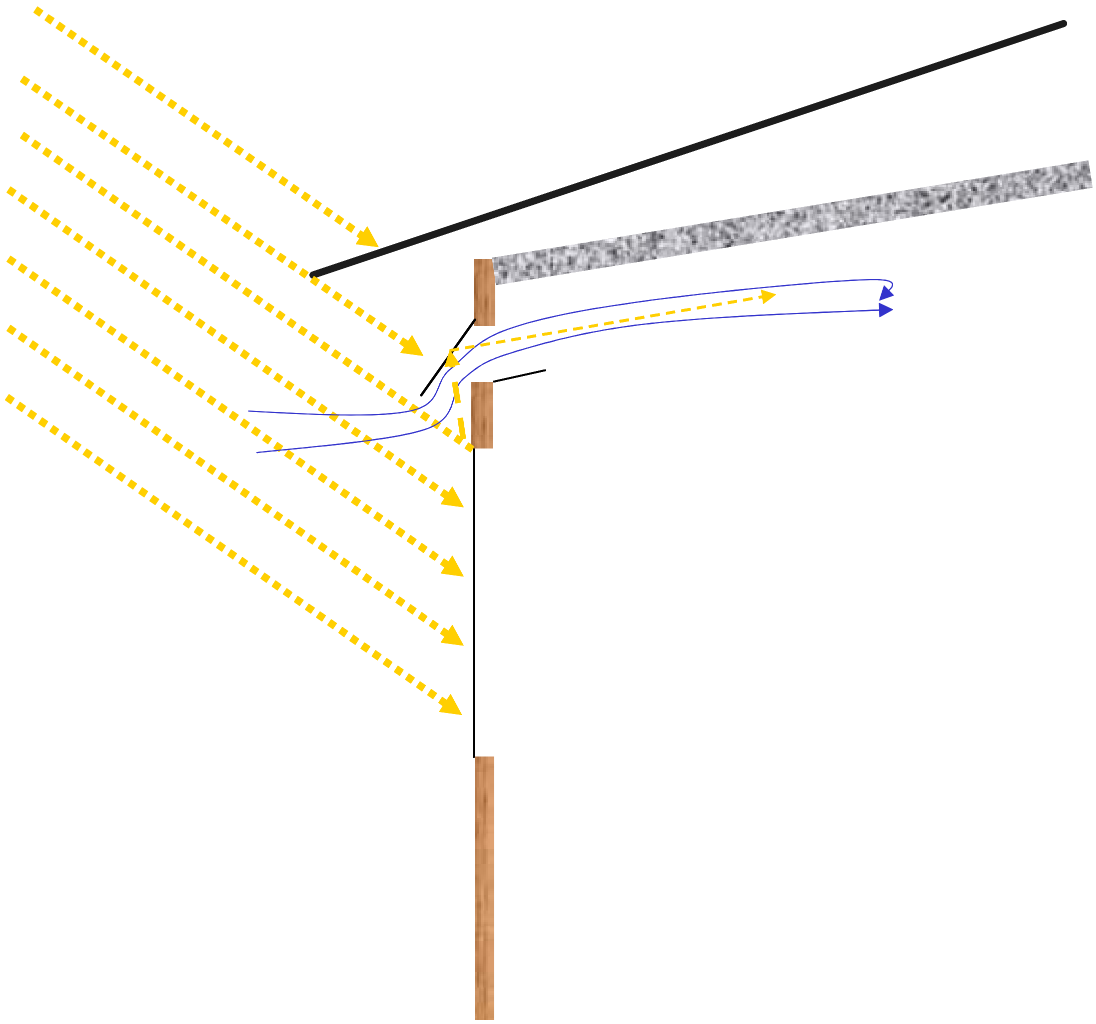

Figure 3. Air and light entering through light hood

Care must be taken when installing light hoods because there are a number of hoods on houses today that though they do a good job of reducing interior light levels, due to poor design they also reduce the air capacity of the side wall inlets by 20% or more. As a result, even though a house may have been originally designed so that the producer would be able to pull half their tunnel fan capacity (four or five 48" fans) through the inlets, they may find that after hoods are installed, that operating just a two or three 48" fans causes the static pressure to exceed 0.12". If the producer tries to turn on additional fans the static pressure goes even higher resulting in dramatically reduced fan performance, excessive electricity usage as well as placing excessive strain on dropped ceilings.

Figures 4 and 5 are an example of a restrictive light hood design. Though the opening of the hood is roughly the same size as the side wall inlet, because the hood is attached at the top of the inlet and extends downward at a 45 degree angle, the opening half way up the hood is 30% smaller than the side wall inlet opening (Figures 4 and 5). Since the cross-sectional area of the light hood is 30% smaller than the side wall inlet this reduces the amount of air that could enter through the inlet by roughly 30%.

Figure 4. House with poor light hoods

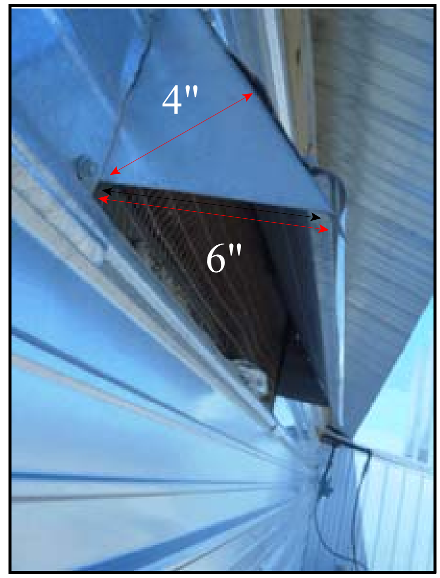

Figure 5. Light hood dimensions

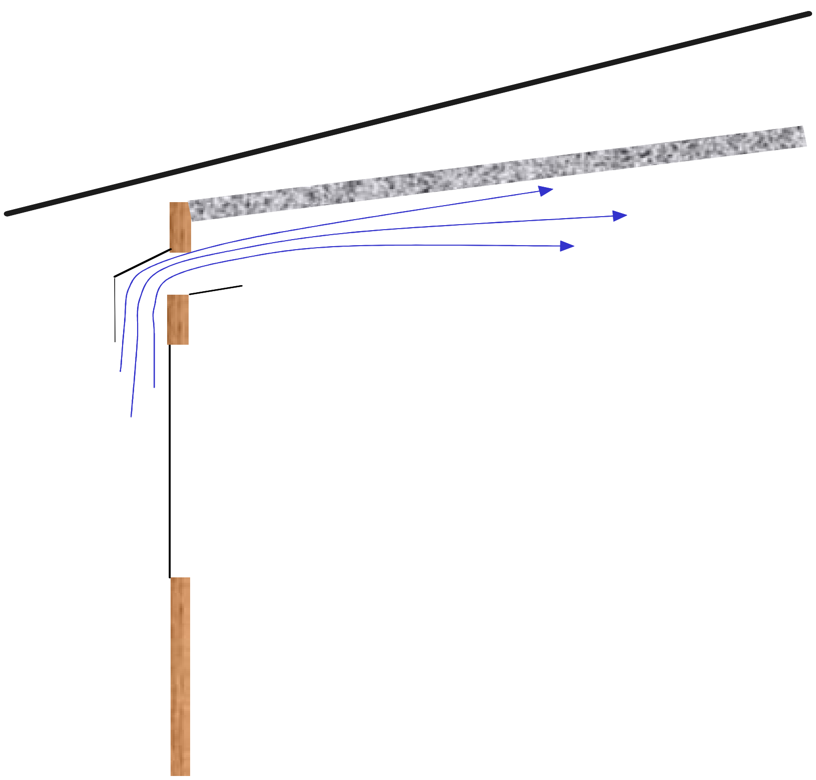

Figure 6. Air entering through a sidewall inlet with less restrictive hood.

The light hood in Figure 6 is an improvement over that in Figure 5 because the top of the hood extends down at less of an angle, it can still restrict air flow into a house if not sized properly. If the hood has roughly the same cross-sectional area as the inlet, as in Figure 6, the air velocity in the hood/inlet will tend to over 700 ft/min when there are four side wall 36" fans and a 48" fan (or three a total of 48" fans) operating in the typical house. When air is moving through the hood at speeds over 700 ft/min it tends to be thrown to the top of the inlet reducing the effective size of the inlet (Figure 6). This phenomena can be best visualized by observing the water in a river as it flows around a sharp bend. Most of the water will be flowing very quickly on the outside of the bend while at the inside of the bend the water will be traveling very slowly or even back up stream, typically referred to as an eddy current. As a result, it is not uncommon to find that there is essentially no air entering through the bottom 1/3 of the inlet when there are a large number of exhaust fans operating effectively reducing the effective size of the inlet by 10 to 30%.

Another problem with traditional light hoods is that when there are a significant number of fans operating the air entering the house will tend to be thrown toward the ceiling of the house and not to the floor even if the inlet door is wide open. Ideally, when the inlets are wide open the air will move straight into the house or even slightly downward toward the floor so there will be a little air movement over the birds just prior to going into tunnel ventilation, which tends to occur in houses without light hoods (Figure 7). But because the air tends to be thrown towards the top of the hood it will always tend to be thrown toward the ceiling and not the floor reducing a producer's ability to cool their birds on marginally hot days.

Figure 7. Air entering through wide open inlet without a light hood.

Figure 8. Large inlet and fan light hoods

To minimize the aforementioned problems with traditional light hoods the cross-sectional area of the hood should be at least 30% larger than the inlet it is covering (Figure 8). The increased hood area results in a lower air velocity within the hood so the incoming air is not thrown against the top of the inlet hood allowing a fuller flow of air through the side wall inlet. The downside of the increased hood size is that as the light hood becomes larger it is easier for light to get into the house, as well as, increasing the cost of the light hood.

Figure 9. New light hood design

Recently a new type of light hood, manufactured by East Iowa Plastics ((319) 334-2552), was tested on a broiler farm in North Georgia. What makes the new light hood different is that air can enter through both the top and bottom of the hood. The dual openings along with a "U-shaped" outer surface make it easier for air to turn into the house allowing a fuller flow of air through the sidewall inlets (Figure 9). Another advantage of the air entering from both the top and bottom of the hood is that it sits closer to the side wall (approximately 4"), thus making it more difficult for light to enter the house.

To evaluate the new light hoods' ability to reduce light levels in houses with side wall inlets, light intensity dataloggers were placed in the center of the floor in two empty side by side broiler houses, one with and one without the light hoods. The 60 side wall inlets (45" x 5 3/4") in both of the houses were opened until the inlet doors were parallel with the floor. Interior lights were turned off and the dataloggers were programmed to measure light intensity every five minutes for four days.

The new light hood significantly reduced light levels in the house they were installed. As can be seen in Figure 10, the light intensity in the house without the light hoods was well over one foot-candle for a substantial portion of August 29, while light intensity in the house with the hoods never exceeded 0.05 ft-candles. On August 30, an overcast day, light intensity in the house without hoods was approximately 0.2 ft-candles while less than 0.02 ft-candles in the house with the light hoods. The variation in light intensity seen on both days was caused by clouds periodically blocking the sun.

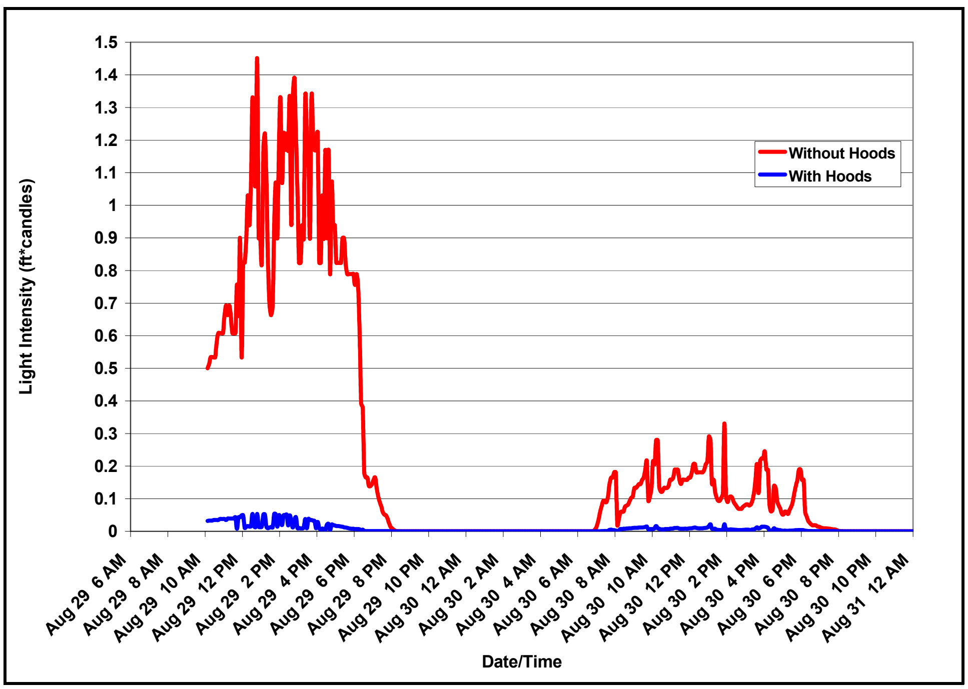

Figure 10. Light intensity at floor levels in houses with and without light hoods.

In general, when the sun was high enough in the sky that the sunlight was not hitting the inlets, the house with the hoods was approximately 10 to 20 times darker than the house without hoods. But when during the morning and evening hours when the sun was lower on the horizon and the side wall of the houses was being exposed to direct sunlight, there was much more of a dramatic difference in light intensity between the two houses. For instance on one morning the light intensity in the house without hoods was over three ft-candles while in the house with hoods was less than 0.01 ft-candles, a 300 fold difference (Figure 11). During the entire study light intensity never exceeded 0.06 ft-candles in the house with light hoods.

Though the new light hoods did a good job of limiting light intensity in the test house over the course of the study, the exact level of light reduction produced by hoods are likely to vary from farm to farm. Factors such as where the inlets are placed in the side wall, dust accumulation on the hood, ceiling color/cleanliness, and inlet size will all play a part in how effective the light hoods will be in reducing light levels.

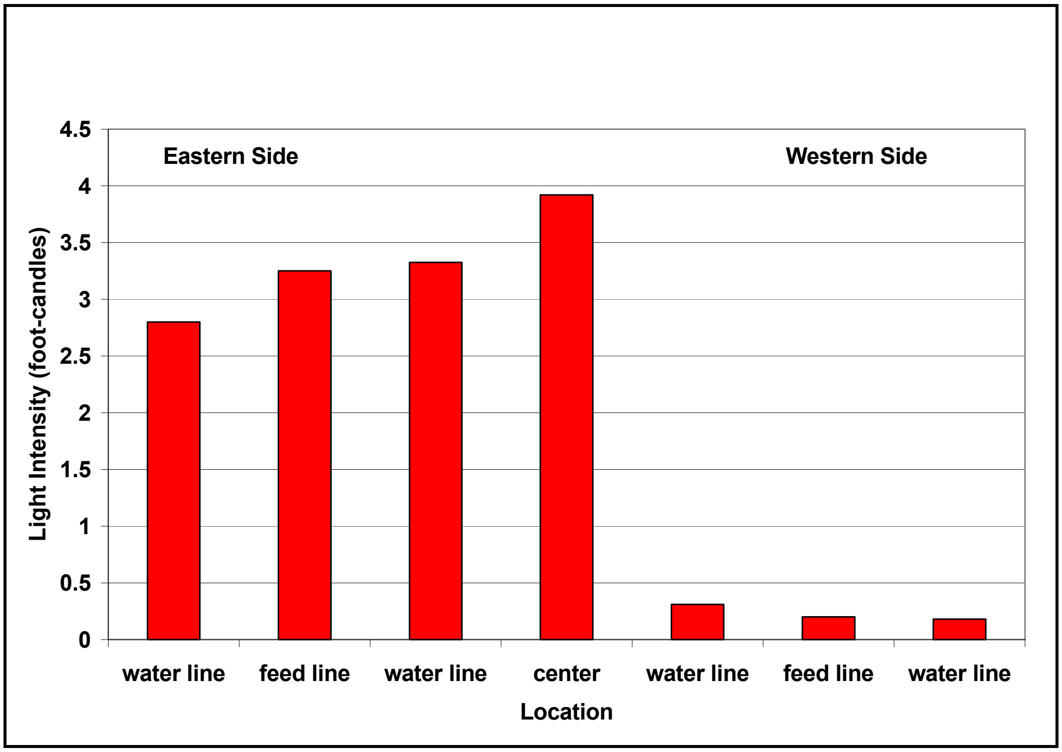

Figure 11. Early morning light intensity in house without hoods

It is important to realize that even though 0.05 ft-candles is fairly dark, light hoods should not be considered light traps. Light traps, traditionally used in pullet houses, virtually eliminate any light entering a poultry house, allowing a producer to make their houses pitch black in the middle of the day. This level of light control is needed to control the day length the pullets are exposed to in order to obtain maximum performance at the onset of egg production. In contrast, the purpose of a light hood allows a producer to maintain a light intensity below 0.1 foot-candles to control activity not perceived day length.

Though the new hood did show it could do a good job of reducing light intensity there was still another question yet to be answered: How will the new light hoods affect fan performance? Before the hoods were installed the producer could easily operate five 48" fans through his inlets. Will the same be true after the hoods are installed? To answer this question, air flow through the inlets, as well as static pressure was measured before and after the light hoods were installed with various number of fans operating.

As you might expect, with the sixty inlets wide open there was essentially no difference in static pressure when three or fewer 48" fans (22,500 cfm) were operating (Figure 12). With the fourth 48" fan static pressure in the house without hoods was 0.06" while in the house with hoods it was around 0.07". With five 48" fans operating the static pressure in the house without hoods was approximately 0.09", while in the house with light hoods it was approximately 0.11". Had six or seven 48" fans been operating the difference between the two houses would have increased significantly, but since it would be best to be tunnel ventilating at this point, this fact should not present a problem. In general, the tests indicated that the hoods did not appreciably increase static pressure under normal circumstances and therefore fan performance would not be affected by the installation of the hoods in a typical house.

What effect did the hoods have on air flow through the inlets? At a static pressure of 0.05", and the inlets wide open, approximately 1,250 cubic feet of air entered the house through each of the 60 inlets in both the houses (Figure 13). As more and more fans turned on, the difference in air flow through the inlets between the two houses increased. At a 0.09" static pressure (five 48" fans operating) there was approximately a 10% reduction in air flow through the inlets in the house equipped with light hoods. Though this difference is notable, it should not affect the overall operation of a house. Smoke tests indicated that when the side wall inlets in the house with hoods were wide open and five 48" fans were turned on the air entering through the side wall inlets moved toward the floor as was the case for the house without hoods.

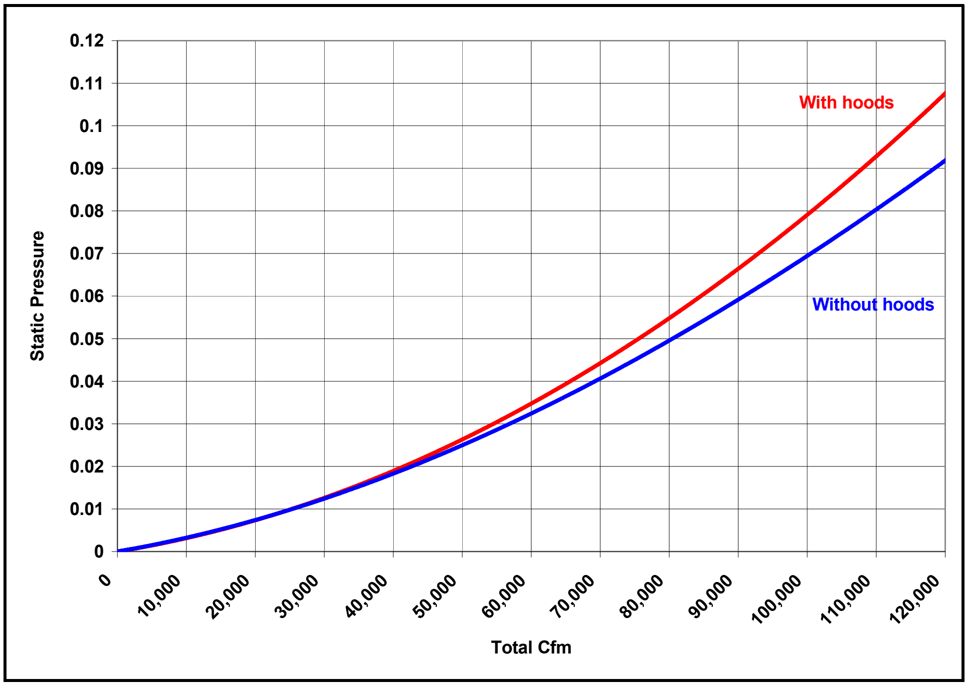

Figure 12. Total fan cfm vs Static pressure

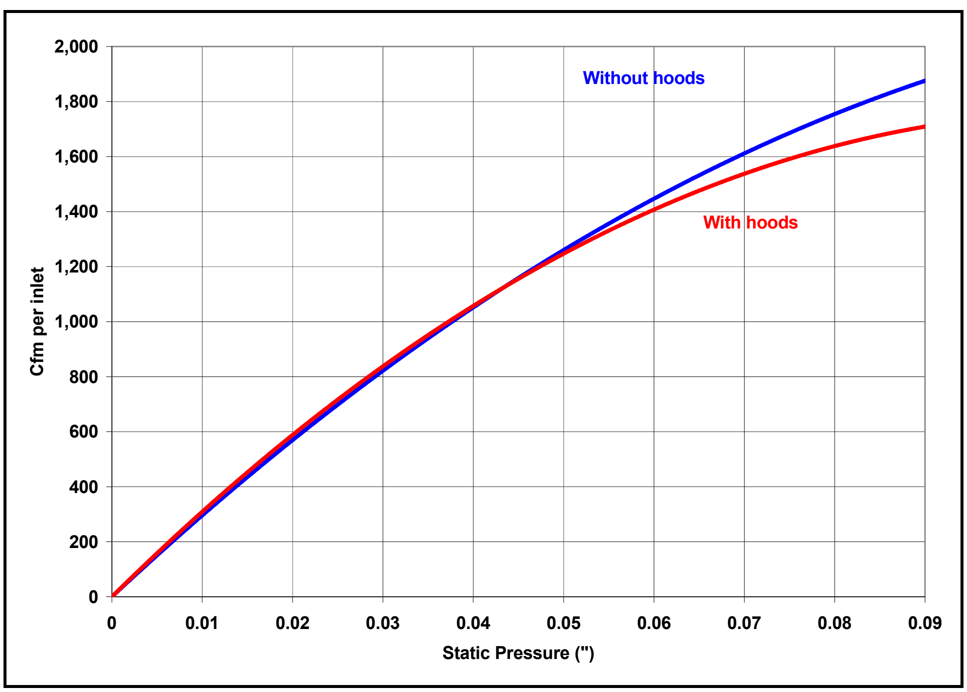

Figure 13. Cfm per inlet Vs. Static pressure

It is important to note that though the light hoods did not have a significant effect on air flow through the inlets, had the house had fewer inlets the difference between the two houses would have been significant. As seen in Figures 12 and 13, the more air however, drawn through the inlets the greater the differences between the houses. If the house had for instance only 40 inlets then the static pressure would have likely been 0.12" with four 48" fans . The addition of hoods would have likely increased the static pressure to over 0.15" and air flow through the inlets could have been reduced significantly.

In conclusion, the field tests indicated that the new light hoods did a very good job of reducing light entering the inlets. If a house has a sufficient number of side wall inlets to operate at least one half of the tunnel fan capacity without exceeding a 0.09" of static pressure, the new light hoods will have a minimal effect (less than 10%) on fan performance.

What effect will the darker house have on bird and performance? Though the light hoods would undoubtedly be effective in reducing bird activity during portions of a grow-out, the precise effect it would have on bird performance has yet to be determined.

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