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Poultry Housing Tips

Tunnel Ventilation Fan Performance Ratings

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A grower's ability to keep his birds cool and operating costs to a minimum during warm weather in a modern tunnel-ventilated broiler house is determined to a large extent by the type of tunnel ventilation fans installed. As a result, installing the "right" fan is crucial to a grower's bottom line. The problem facing a grower is figuring out which fan is the "right" fan. With more than ten manufacturers and well over 200 fan models to choose from, selecting a fan for a tunnel-ventilated house can be an overwhelming task. The air moving capacity of each of the different fans must be compared so the proper number of fans needed can be determined. The fans' energy efficiency ratings need to be compared to get an idea of which ones will keep electricity bills to a minimum. The air flow ratios of the fans need to be compared to determine how well each fan will hold up to high static pressures that may be caused by dirty shutters and pads. The construction of each fan needs to be examined to get an idea of how long each fan will last. Last but not least, a grower needs to compare the initial cost of the fans.

To help make choosing a fan for a tunnel-ventilated house a little easier, a new fan performance rating system has been developed. The new performance rating system is based on fan test data from BESS Labs and AMCA. Fans are divided into categories based on their overall performance. The performance ratings along with other pertinent information have been compiled on charts according to manufacturer so fans can be more easily compared.

A fan's overall performance rating is determined by its *Energy Efficiency Rating* as well as *Static Pressure Rating*.

Energy Efficiency Rating:

Fan efficiency is typically expressed as how many cubic feet of air a fan will move each minute per watt of power used. The higher the cfm/watt, the more energy efficient the fan. If two fans move 20,000 cfm and one has an energy efficiency rating of 20 cfm/watt while the other has a rating of 18 cfm/watt, the cost of operating the 18 cfm/watt fan will be 10% more than the fan with the 20 cfm/watt rating.

On the fan comparison charts, exhaust fans are given a rating from 0 to 5.0 based on their energy efficiency when operating at a static pressure of 0.05". If a fan has an energy efficiency of 16 cfm/watt or less, it receives a rating of zero. For every increase of 1.6 cfm/watt the rating increases by one. A fan with an energy efficiency of 24 cfm/watt or better receives an energy efficiency rating of 5.0

For fans that move the same amount of air, an energy efficiency rating difference of 1.0 will result in an approximately eight percent difference in electricity usage. For instance, a fan with an energy efficiency rating of 4.0 will use approximately eight percent less power than one with a rating of 3.0, and about 24% less power than a fan with an energy efficiency rating of 1.0. Rating differences of less than 0.5 between fans should not be considered significant.

Static Pressure Rating:

The amount of air any fan moves decreases as static pressure increases. The higher the static pressure, the harder it is for the fan to draw air into the house and the lower the amount of air moved by the fan. Reduced fan output results in decreased air speed and air exchange rates, which may lead to increased heat stress and related problems.

How much a fan's output decreases as static pressure increases varies significantly from fan to fan. One of the best ways to evaluate a fan's ability to move air as static pressure increases is by its air flow ratio. A fan's air flow ratio is determined by dividing its air moving capacity at a 0.20" static pressure by the amount of air it moves at a 0.05" static pressure:

If a fan moved the same amount of air at a static pressure of 0.20" as at 0.05", the air flow ratio would be equal to one. If a fan moved 20,000 cfm at a 0.05" and 15,000 at a 0.20", its air flow ratio would be 0.75 (A.F.R. = 15,000 / 20,000 = 0.75). In other words, the fan's air moving capacity decreases by 25% as the static pressure increases from a 0.05" to a 0.20". Air flow ratios for most fans range between 0.85 and 0.40, which means the output of most fans decreases somewhere between 15 and 60% as static pressure increases from 0.05" to 0.20"

On the fan comparison charts, exhaust fans are given a rating from 0 to 5.0 based on their air flow ratio. If a fan has an air flow ratio of 0.55 or less it receives a static pressure rating of zero. For every increase of 0.06 in air flow ratio the static pressure rating increases by one. If a fan has an air flow ratio of 0.85 or better, it receives a static pressure rating of 5.0. As with energy efficiency ratings, static pressure rating differences less than 0.5 should not be considered significant.

Balance is Very Important:

A sign of a good fan for a tunnel-ventilated house is balance, one that holds up well under high static pressures and is also very energy efficient. After all, what good is an energy efficient fan whose air moving capacity drops like a rock because of a low static pressure rating when shutters or pads get a little dirty. Conversely, a fan that holds up well under a high static pressure is great, but if it costs a fortune to operate, is not the right fan for a tunnel ventilated poultry house.

A simple award system has been developed to help distinguish fans that would perform well in a tunnel-ventilated house both from an energy efficiency and air flow ratio stand point. This system is similar to some consumer publications' tradition of awarding exceptional products various stamps, seals, or ribbons. If a fan receives a rating of at least 2.0 in both energy efficiency and static pressure, it should viewed as a very good, or Yellow Ribbon Award fan. If a fan receives a rating of at least 3.0 in both energy efficiency and static pressure it should be viewed as a excellent, or Red Ribbon Award fan. And finally, an exceptional or Blue Ribbon Award fan has a rating of at least 4.0 in both energy efficiency and static pressure ratings. Any fan which receives an award classification should be viewed as well suited for use in a tunnel-ventilated house.

It is very important to look at the actual energy efficiency and static pressure ratings when comparing fans. A fan might have a rating of 3.1 in energy efficiency and a 2.8 in static pressure and therefore just misses the "Red Ribbon Award" category. As stated previously differences of less than 0.5 in either performance category in most cases should not be considered particularly significant. Ultimately, there may be little performance difference between this fan and those that made the Red Ribbon Award category.

Other information on the fan comparison charts is provided to help to distinguish other differences between fans:

 # Fans Required:

This column indicates how many of each type of fan would be required to furnish a minimum of 170,000 cfm for a typical 40' X 500' dropped ceiling tunnel ventilated broiler house. The number of fans is determined by dividing 170,000 cfm by the air moving capacity of one fan at a static pressure of 0.05" and rounding up to the next whole fan number (i.e, 7.1 fans would be rounded up to eight fans.)

Yearly Operating Cost:

This column provides an approximation of how much electricity all the fans would consume in a year of typical operation. The cost is determined assuming that each fan will operate 3,000 hours a year with an electricity rate of $0.08 per Kw*hr. Actual operating costs may vary significantly from those listed depending on the size of bird

grown as well as local climatic conditions.

If all fans moved the same amount of air, an energy efficiency rating difference of 1.0 would result in a reduction in yearly operation costs of approximately eight percent. But, since the number of fans is rounded up to the next even number, houses with certain fans may end up with exactly 170,000 cfm of exhaust fan capacity while others may have as much as 190,000 cfm. As a result, the fans in one house may have a better energy efficiency rating but the annual operating costs may actually be a little higher than a house with fans with a slightly poorer energy efficiency rating because more air is being moved in the house with the more efficient fans.

Do not assume just because a particular fan moves more air and therefore fewer are required operating costs would be lower. For instance, when looking over the charts you will find instances where ten of one type of fan would use less power than seven of another type of fan even though they move the same total amount of air and both use one horsepower motors.

Average Air Speed:
Average air speed is calculated by multiplying the number of fans required by the air moving capacity of one fan at a static pressure of 0.05" and then dividing this product by the cross-sectional area of a typical 40' wide house with a 7 1/2' side wall (approximately 370 ft2). The actual air speed in a house will tend to be higher than the average in the center of the houses and lower near the side walls. Houses with higher ceilings will have lower air speeds, while those with lower ceilings will have higher air speeds than those listed.

If all fan models moved the same amount of air the average air speed would be the same no matter what fans were used. But again, since the number of fans is rounded up to the next whole number, houses with some fans may end up with 170,000 cfm while others may have as much as 190,000 cfm, which of course would result in some houses having more air speed than others. It is important to note that a difference of less than 40 ft/min should not be considered particularly significant

The remainder of the columns on the chart describe the fans in detail. There are columns for the amount of air the fans move at 0.05" static pressure, what the fan is constructed of (steel, fiberglass, plastic), whether the fan is belt or direct drive, whether it has a discharge cone, as well as what the shutter is constructed of (plastic, aluminum) and the shutter's location (interior vs exterior).

The last column lists the specific BESS labs test number or the fact that it may have been tested by AMCA. **It is very important that when you use the charts to compare fans that after you have made your decision that you purchase the fan that was tested, ie. same motor, shutter, pulleys etc. Changing any of these fan components can dramatically affect its performance.** Details on the specific fan tested (motor model#, rpm, etc.) can be obtained from test booklets available from AMCA (847) 394-0150 or BESS Labs (217) 333-7964

One column missing is fan quality. This is probably the most difficult comparison to make. Overall quality of construction will determine how long a fan will last as well as the amount of maintenance the fan will require. First take a good hard look at the fan. Is it put together well? Ask about types of bearings, thickness as well as type of steel/fiberglass/plastic used in the housing, shutters, and the blades, are the components bolted or welded together, etc. Find out what type of warrantee the fan has as well as what type of routine maintenance is required. Ask your flock supervisor as well as other poultry growers their experiences with the different fans you may be considering purchasing. Ask about the fan manufacturer's reputation regarding service.

You will tend to find that the better performing fans cost more. Though it is certainly important to be concerned about initial investment, saving money by purchasing a lower performing fan will cost you in the long run, both in terms of fan operation and bird performance.

Final notes:

1) Certain fan models may be listed more than once on the comparison charts due to the fact that the fan was tested with more than one type motor or shutter.
2) Not all fan models listed on the comparison sheets are currently being manufactured.
3) Recently tested fans many not be listed on the comparison charts. Performance ratings for these fans can be obtained by contacting us at (706) 542-9041.

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