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A Practical Guide to On-Farm Fan Testing

National Poultry Technology Center – Auburn University College of Agriculture
By: Dennis Brothers, Jess Campbell, Jim Donald, and Gene Simpson

The modern poultry house is indeed a technological marvel on many levels. The ability to raise 300,000 pounds of poultry in a single house in as little as 5½ weeks is quite a feat. One of the most important aspects of the technology that allows growers to maximize the bird's genetic potential is the tunnel fans. Whether a grower maintains or loses the ability to remove the bird heat (up to 12 btu per pound of live weight) in a house is often the difference between good and poor flock performance.

Poultry house fans, like any other piece of equipment, need good routine maintenance to consistently perform up to the level expected. Over time belts wear, pulleys wear, belt tensioners start to fail, fans and louvers become dirty and some types of fan blades can become metal fatigued, losing their ability to efficiently push air. There are newsletters at *www.poultryhouse.com* that address many of these issues, such as how to inspect fan components and how to know when to take action. The problem with casual visual inspection is that you may not be able to spot a less obvious problem that is costing a 5-10% loss in fan power. Yet if multiple fans in a house are losing just 5-10% of their power, it's not long before an overall reduction of 25-30% in tunnel wind speed is incurred. What does that mean? It means a house expected to pull 600 feet per minute wind speed now becomes a 420 FPM house. That decrease can easily lead to dead birds in hot weather.

It is understood that grower's time is limited and valuable, so this newsletter will propose two options to quickly and easily evaluate a poultry house's tunnel fans and recognize incremental decreases in power on individual fans. Once this is known, growers can then spend their time effectively working on the fans that are most in need of attention.

Just small losses in fan power can mean serious drops in tunnel wind speed – which hurts flock performance. Laser RPM meters offer a handy way to see if tunnel fans are still delivering the needed CFM. RPM meters come in various forms, but all are easy to use. Simply point the laser into the fan from the outside and press the button.

On this model, the readout has to be divided by the number of fan blades, so it is showing the fan running at about 500 RPM. When you take the reading, you also check the static pressure the fan is working against, then compare your test results against the fan's as-new specifications. See page 2 for the step-by-step how to do this kind of test.

Method 1: Using a Laser RPM Meter

Laser RPM meters have been on the market for some time now. They are small and very easy to use. (Go to www.poultryhouse.com to find a source for a Laser RPM meter.) As shown in the photo on page 1, you simply point the meter at a running fan (being sure your hand is outside the safety guard), press a button and see the readout. These meters use a laser to count the number of times a fan blade passes in front of it. The meters are not usually calibrated to display revolutions per minute (RPM) – that has to be calculated by dividing the meter result by the number of blades a fan has. Example: A meter reading of 1500 for a fan with three blades equals 500 RPM for that fan. With a simple walk around the poultry house and a quick metering of each fan from the outside, a grower can know each fan's current RPM.

This can be done at any time with any number of fans running; however, it is most informative when all fans are running and the house is in full tunnel with cool cells running. We want to know what the fans are doing when conditions are the harshest for them. That is, running at maximum static pressure. Assume we have metered a poultry house's fans and have recorded the following results:

Fan 1 – 472 RPM
Fan 2 – 460 RPM
Fan 3 – 510 RPM
Fan 4 – 504 RPM
Fan 5 – 500 RPM
Fan 6 – 505 RPM
Fan 7 – 495 RPM
Fan 8 – 512 RPM

We now have some information to work with. But in order to know if we have fans that need attention, we need to do a little more homework. We first need to know what static pressure our fans were working against when we did the test. It is best to do this with a Magnehelic pressure gauge close to the fan end of the house. However, it is acceptable to use the static pressure reading on the controller so long as the sensor it is taking a measurement from is somewhere past half house. If the controller static pressure tubes are in the front of the house, do not use that reading as it will not be representative of the actual pressure the fans are working against. In that case, a hand-held Magnehelic is the only way to get a true static pressure reading. For our test farm at full tunnel, the fans were working against a 0.15" static pressure in the back of the house. 0.15" or higher is common for high wind speed houses (600+ FPM). The photo on page 3 shows the test readings from a fan-end magnelic and the controller sensor in the front of the house.

Once we get an acceptable static pressure number, we need to find out what the expected RPM's of our model of fan should be at that static pressure. The best way to do this is to contact either the fan manufacturer or dealer and obtain a fan specification sheet. For many fans these specifications can be found at the manufacturer's website. Or a grower can go to the University of Illinois Bioenvironmental and Structural Systems Laboratory – Agricultural Ventilation Fans Performance and Efficiencies website (http://bess.illinois.edu/). The "BESS Lab" at the University conducts fan performance testing on most all agricultural ventilation fans available on the market. Their program is regarded as the industry standard for fan performance testing.

To find your fan on the BESS website, you click on *Agricultural Ventilation Fans*, then *Performance Tests*, then *Current* (or *Archive*) *Tests*, then *Fan Frequency* (60 hz in the U.S.), then (on one screen) *Power Supply* (most often 1 phase, 230 volts), your *Manufacturer* name, and *Fan Diameter*. At this point, you can select and choose two more fan specs (*Air Flow* and *VER*), or leave those items on this screen unchosen and just click *Submit*. In that case, you will get then see a list of all tests of that manufacturer's fans of that size and can scroll down to find your model fan. Click on the *Test #* to see your fan's test results, including RPMs for a range of static pressures. Here is one example:

TEST RESULTS

AEROTECH VX511F1CR

Test: 99223

Fan description:
1 hp belt drive, 8-181416 Aerotech motor, fiberglass housing, plastic shutter, guard and discharge cone

Static Pressure in. water	Speed rpm	Airflow cfm	Efficiency cfm/Watt
0.00	529	28,900	26.5
0.05	528	27,100	24.0
0.10	526	24,900	21.0
0.15	525	22,300	18.2
0.20	524	19,200	15.4
0.25	524	15,200	12.2
0.30	524	5,700	4.8

With this kind of test results printout, you can now compare yiour fans' current RPMs with the as-new BESS lab RPM at a similar static pressure. One thing to note, the exact static pressure may not be represented in the BESS result sheet, as they are normally only reported in 0.05 increments. For example, if my houses were tested at 0.12 static pressure, I'm always going to round up to the next static pressure on the BESS sheet – 0.15 in this case.

For our example test fan, RPM's at 0.15" static pressure should be 525 RPM. Any fan that tests slower than 5% of that number should be closely inspected for repair or maintenance. In our example house, any fan showing less than 500 RPM is suspect. That means fan #1 (472 RPM), fan #2 (460 RPM) and fan #7 (495 RPM) are going to receive special attention immediately, looking for all those things mentioned above as possible causes of slower RPM and the resulting lower performance. Once the homework is done, this method becomes very quick and easy. Growers should create a log sheet for each fan in each house and refer back to it every time this test is repeated.

A hand-held Magnehelic static pressure gauge at the fan end of the house gives the most accurate indication of the static pressure fans are actually working against. Static pressure in the front of the house will be much lower.

A static pressure sensor located at least beyond half house toward the fans, as many controller sensors are, will usually be acceptable for fan testing purposes. Note, however, that the higher the wind speed, the higher the fan pressure will be and the more difference will be seen between center house and fan end readings.

This caution applies to both Method 1 and Method 2 testing.

Method 2: Static Pressure Fan Testing

Another even simpler test that can be performed is a static pressure test. There are two ways to do this: A. Individual fan test, and B. Full tunnel fan test. Typically, no additional equipment is needed for most growers to perform one of these tests – just the house's environmental controller and its internal static pressure sensor reading (as long as the controller sensor is located at least beyond half house toward the fan end).

A. Individual Fan Testing

The individual fan test should be performed between flocks. Most growers are familiar with performing a static pressure test to determine air leakage or tightness of their houses. The same general method of testing is used to evaluate fan performance over time. Growers should close all sources of incoming air: curtains up, vents closed, inlets and doors shut and tight, being sure all fan louvers are functioning properly and in good repair. Then individually turn on one tunnel fan at a time and record the resulting static pressure that one fan creates. Once recorded, turn that fan off and go to the next in line – one at a time until all the fans are tested and recorded individually, as shown at right.

Doing this test after every flock can allow you to see when any one fan has lost some of its power. If any fan loses more than 0.02 points of pressure compared to its last test or compared to the average of the other fans, it is time for that fan to receive special attention before things get worse. In the example at right, fan #4 and fan #8 are obviously not performing properly and should be checked for repair or maintenance before the next flock arrives.

Fans 5/2012	SP
1. 48"	.10
2. 48"	.11
3. 48"	.10
4. 48"	.06
5. 48"	.12
6. 48"	.10
7. 48"	.11
8. 48"	.08

By charting the individual static pressures each fan generates, a grower can quickly identify fans that need attention. Any fan losing more than 0.02 points compared to its last test or to the average of the other fans needs attention. Fans 4 and 8 in this example are shown to be performing poorly.

It is recommended that a grower building a new house do this test on day one to establish a baseline to work from. Then over time he can evaluate how well his fans are holding their day-one power. It is also a good way to remind him once again how tight his houses are remaining. If a day-one as-new test has not been done, a grower should run the full-house test after all the fans, shutters and cooling pads have received yearly maintenance and are performing properly, so as to establish a new baseline starting point of static pressure for each fan.

It should be noted that when doing individual fan tests, whether with RPM meter or by static pressure, that the "workhorse fans" or fans most used for minimum ventilation and early stage ventilation will likely be the first to show small signs of lost power. It is recommended that these fans always receive special attention for maintenance issues – belts, pulleys, etc. In fact, it is recommended that these early stage fans get new belts annually.

B. Full Tunnel Fan Testing

To do a full tunnel static pressure test means simply to put the house into full tunnel mode with all the fans running and record the static pressure. Using the controller static pressure readout (if the sensor is somewhere past half house) is a convenient way to do this test. If the pressure goes down the next time you test, then you know something is causing your fans to lose power. This could be those maintenance issues, electrical issues or both. An individual test could then be done to help isolate the problem. If the static pressure has gone up since the last test, it tells you that there can possibly be a restriction of air flow coming into the house. This is often a restricted tunnel inlet, clogged cool cell pads or both. Once again, by recording this test every time it is performed, you can develop a feel for how your houses are performing over time. The baseline for this number can also be established on day one for a new house or after thorough cleaning and maintenance of the fans and louvers and cool pads in an older house.

Bottom Line

A modern poultry house's tunnel fans are responsible for cooling birds and this fact makes maintaining their performance over time an utmost priority for a grower. It has been well documented what an additional 100 FPM of wind speed can mean to a broiler chicken in hot weather. In a house moving air at 600 FPM, it only takes about a 15% loss of fan power to lose 100 FPM in wind speed. This small margin for error makes it imperative that a grower know what his fans are doing and take action quickly against any decrease in fan performance. Good testing over time can help a grower identify and fix fan problems before much wind speed is lost and bird performance is negatively impacted.

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Jess Campbell, Poultry Housing Specialist, National Poultry Technology Center

Dennis Brothers, Poultry Housing Specialist, National Poultry Technology Center

Jim Donald, Professor and Extension Engineer

Gene Simpson, Professor and Extension Economist