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Poultry Housing Tips

Winchill Effect

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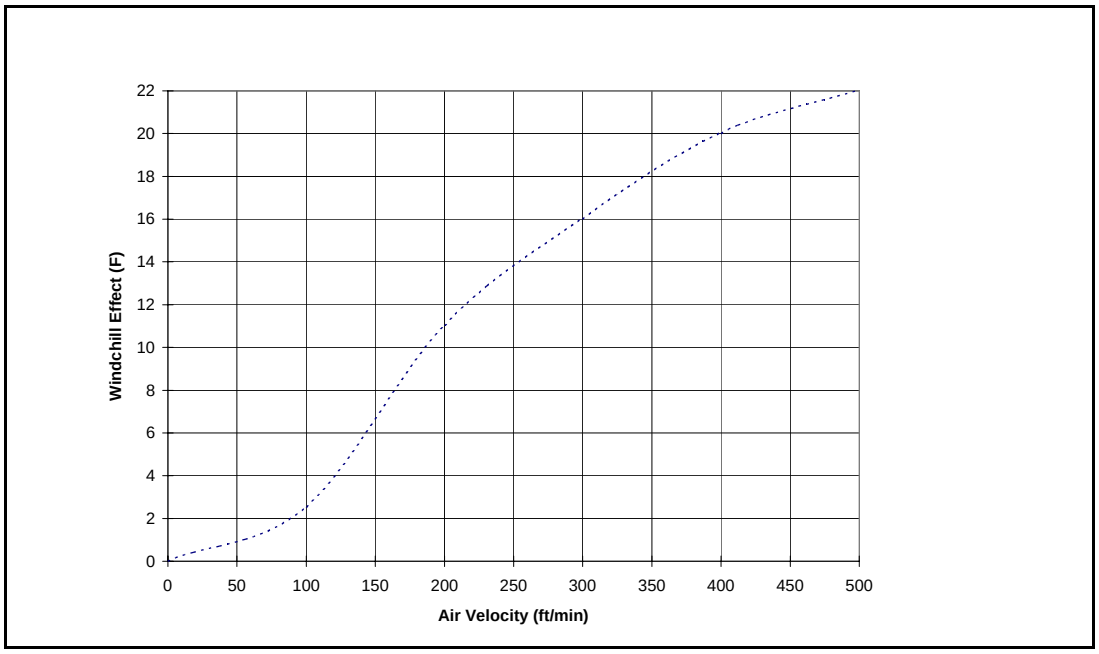

Figure 1. Windchill effect for a single mature bird in a laboratory wind tunnel.

Air movement is one of the most effective methods of cooling birds during hot weather. As air moves over a bird's hot body, heat is removed from the bird, making it feel cooler. The greater the amount of air movement, the greater the cooling effect produced. The cooling produced by air movement is real. Birds will not only think the house is cooler when exposed to air movement during hot weather, but they will continue to eat and grow as if the air temperature really is ten degrees lower than it actually is.

Cooling produced through air movement is commonly referred to as the windchill effect. Though the windchill effect is real, it is difficult to measure. This is because thermometers only indicate actual air temperature, not the windchill temperature. So even though a thermometer may indicate the air temperature is 80°F, the birds may think it is 70°F or lower if there is a lot of air movement in the house. The inability to measure effective air temperature can make it difficult to manage a house where a lot of air movement can be generated (i.e., tunnel-ventilated houses). Growers with tunnel-ventilated houses sometimes operate their houses at a lower effective temperature than is desirable because they do not take windchill effect into account.

One tool that can be very useful in determining effective house temperature is a windchill chart. A windchill chart indicates the amount of cooling produced by different amounts of air movement at a specific air temperature. For example, in Figure 1 it can be seen that in a 85°F house it is possible to produce a 20°F effective temperature drop by blowing air over a bird at 400 ft/min. If the air speed decreases to 100 ft/min, the effective temperature drop is reduced to about 2°F.

You have to be careful when using windchill charts. Most windchill charts are developed from measurements taken from a single bird in a specially designed laboratory wind tunnel (Figure 1). Air flows over and around the entire surface of the bird in these wind tunnels. But in the real world, air movement over the surface of a bird is limited by the other birds standing near it. This is especially true when the birds are older and heat stress is more of a concern. Studies have shown the heat loss from a bird in a group is only about 60 percent of that of a bird standing alone.

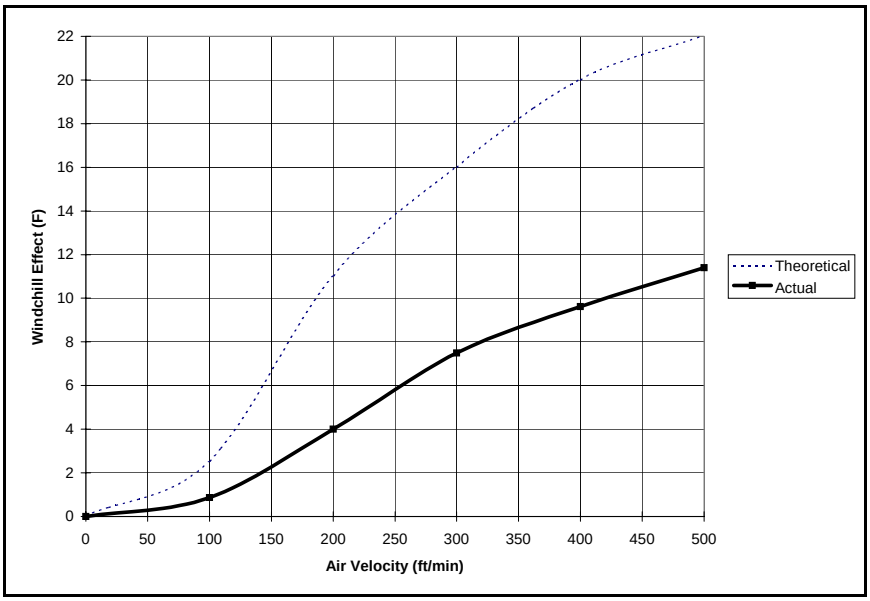

Figure 2. Windchill effect for mature bird.

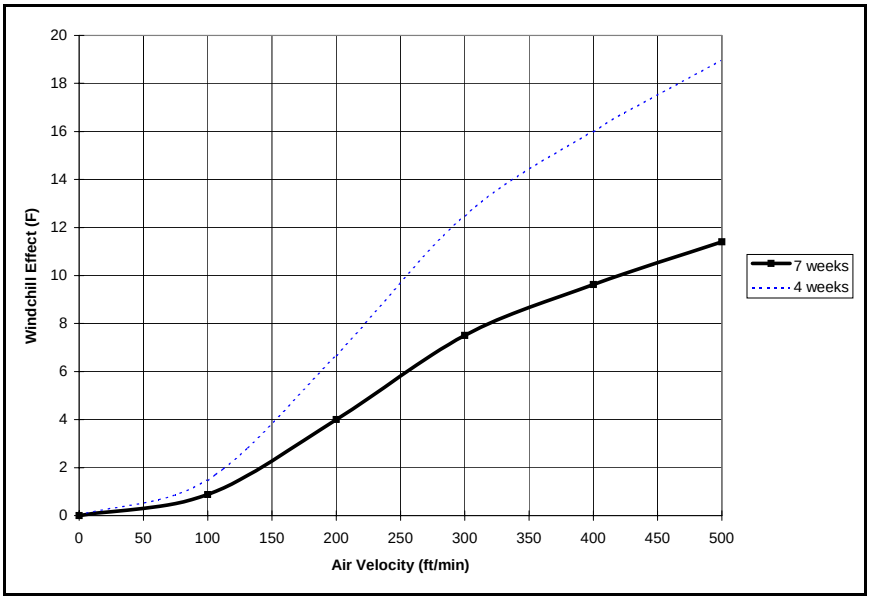

Figure 3. Windchill effect for seven and four-week-old birds.

Further corrections have to be made due to the fact that air speed near the birds is 25 percent lower than it is a few feet over their heads. For example, in a tunnel-ventilated house, air velocity is typically measured three to five feet off the floor. This is done because of the problems with air turbulence encountered when trying to get an accurate measure of air velocity near the birds. So when an air speed of 400 ft/min is measured four to five feet off the floor, air speed just above the birds is usually closer to 300 ft/min. Figure 2 estimates what the actual bird level windchill effect would be in a tunnel-ventilated house when air speed is measured four to five feet off the floor and bird density is taken into account. As you can see, the actual windchill effect is probably half of the theoretical laboratory wind tunnel values.

What about smaller birds? Smaller birds are generally less well feathered and have more space between them. These factors increase heat loss from the birds making them feel cooler than older birds subjected to the same amount of air movement. Figure 3 illustrates the estimated windchill effect for a seven-week-old bird as well as a four-week-old bird with varying wind speeds. As you can see, whereas 400 ft/min air speed is required to create a 10°F windchill effect for a mature bird, only 250 ft/min wind speed is required to produce the same amount of windchill effect for a four-week-old bird.

One last factor that has to be taken into account when using a windchill chart is that most windchill charts are for a specific air temperature (i.e., 85°F for the above charts). As the temperature decreases, the windchill effect increases because there is more of a temperature difference between the bird and the air. Conversely, as the air temperature rises, the windchill effect produced by air movement decreases. For example, the windchill effect at 100°F for a mature bird is negligible. So, if the windchill effect is 10°F for a mature bird at an air temperature of 85°F and 0°F at an air temperature of 100°F, the windchill at 93°F would be approximately 5°F.

Having an air velocity meter is ideal in helping to determine windchill effect; however, you can get pretty close just by knowing the number of exhaust fans operating. In the average dropped ceiling house, you can expect approximately 55 ft/min for every exhaust fan operating, assuming that the fans are moving 19,000 ft^3/min. In an open ceiling house, the air speed is approximately 45 ft/min per 48" fan operating. For example, five fans operating in an average dropped ceiling house could produce an air speed of approximately 275 ft/min (5 fans X 55 ft/min per fan= 275 ft/min).

Windchill charts can be very useful in determining how to operate tunnel-ventilated houses. For example, let's take a house with seven-week-old birds and a desired air temperature of 70°F. All the fans are operating, producing an air speed of 400 ft/min and the house temperature is 80°F. Is the house too warm? The answer would be no. From Figure 2 it can be seen that at 400 ft/min there will be a windchill effect of 10°F for a mature bird, making the bird feel as if the house was 72°F. Throw in a slight correction factor since the house is 80°F not 85°F, and the effective air temperature would be about 70°F. This brings up an important point. Using a windchill chart is somewhat of an art. The charts provide approximations of cooling at specific air temperatures for a birds of a specific age. If the air temperature changes or if you are not dealing with four or seven week old birds, a lot of guess work is necessary.

Let's take a look at another example. Consider a house of four-week-old birds and a desired temperature of 75°F. The house temperature is 86°F and five fans are operating producing an air speed of 275 ft/min. Is the house too warm? Again the answer would be no. From Figure 3 it can be seen that at an air speed of 275 ft/min a 11°F windchill effect is produced for a four-week-old bird, making the effective temperature 75°F.

If in the example above, all the fans were operating, they would produce an air speed of 400 ft/min and the effective temperature would be approximately 70°F. The birds would probably be a little too cool in this case, decreasing feed efficiency, and equally important increasing electricity costs unnecessarily.

Though it would be nice to have a windchill chart for every bird age at a dozen different air temperatures and air velocities, the research has yet to be conducted. The table below will provide you an approximation of how many exhaust fans it takes to provide a 10°F windchill effect for birds at different bird ages when the house air temperature is in the mid to high 80's (dropped ceiling houses, 19,000 cfm per 48" fan).

Bird Age (weeks)	Number of 48" Fans Operating
3	3 to 4
4	4 to 5
5	5 to 6
6	6 to 7
7	7 to 8
8	8 to 9

Table 1. 48" fans required to produce a 10°F windchill effect

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Provided to you by: