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Poultry Housing Tips

Drinker Line Flow Rates

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It may be difficult to comprehend, but water actually doesn't "flow" in drinker lines...it slowly drifts. In a way it is more appropriate to consider the flow of water in drinker lines as a pond more than as a rushing river. This holds true for a house with day-old birds or even market-age birds.

Drinker line flow rates are fairly easy to calculate. For instance, a flock of 50-day-old broilers will consume roughly 85 gals/1,000 per day (Watkins, 2009). If there are 20,000 birds in a house, they will consume roughly 1,700 gallons of water. If the lights are on 20 hours a day, the birds will consume on average 1.4 gallons of water each minute. If it is assumed that the house has eight drinker lines, the flow rate in each line would be 0.18 gals/min or 0.024 ft^3/min. Divide 0.024 ft^3/min by the cross-sectional area of a typical drinker line (0.0041 ft^2), and you end up with a velocity of 5.9 ft/min. To put this in perspective, most people walk at a pace of approximately 300 ft/min, approximately 50 times faster. But, it is important to realize that though water will flow *into* each of the eight drinker lines at an initial velocity of 5.9 ft/min, the velocity will decrease along the length of the line. Let's assume a 240' drinker line has 400 nipples and the birds are drinking from all the nipples equally. At the beginning of the drinker line, the water being supplied to all 400 nipples is flowing through the drinker line (0.18 gals/min or 0.024 ft^3/min). Halfway along the length of a drinker line, the volume of water will be cut in half because now the line is only supplying 200 nipples, thus reducing the flow and therefore the velocity is cut in half to 2.9 ft/min (half the volume of water flowing through the pipe, half the velocity). By the time we get three quarters along the length of the drinker line (180'), only the water required to supply 100 nipples is flowing through the line and as a result the velocity is cut in half again to 1.5 ft/min. A garden snail moves at a pace of 1.8 ft/min. Again, even with market-age birds, the water in a drinker line drifts VERY slowly along the length of the drinker line; with younger chicks when flow rates are roughly a tenth as much, it is essentially stagnate.

Recently a study was conducted in a 40' X 500' broiler house examining flow rates in individual drinker lines over the course of a flock. 25,600 birds were place in the house and grown to a weight of roughly 4.5 lbs. Ultrasonic water meters were installed on four of the house's eight drinker lines (Choretime). The water meters were sensitive enough to measure water flow down to a rate of 0.005 gals/min with an accuracy of +/-2%. The water flow meters were connected to a data logging system which recorded water usage every minute for 33 days of a 35 day flock.

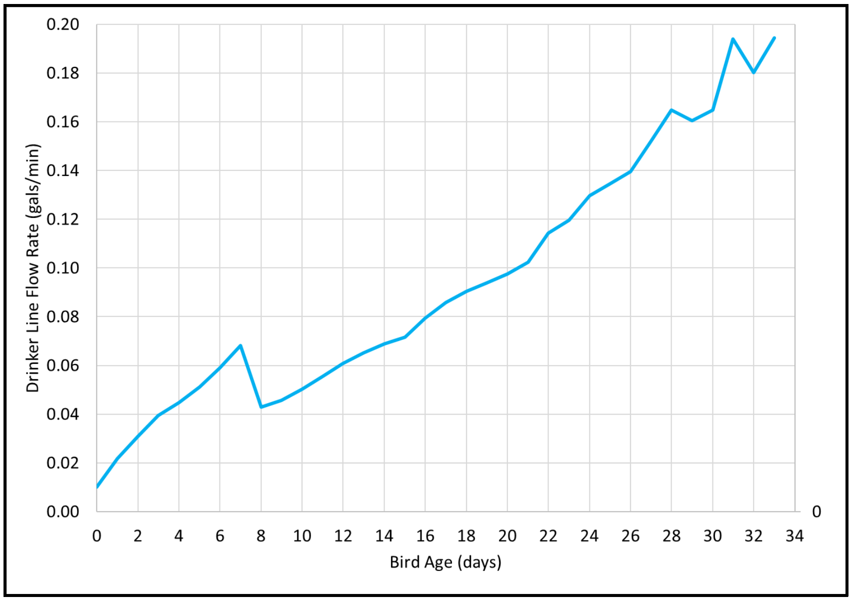

Figure 1. Average daily drinker line flow rate

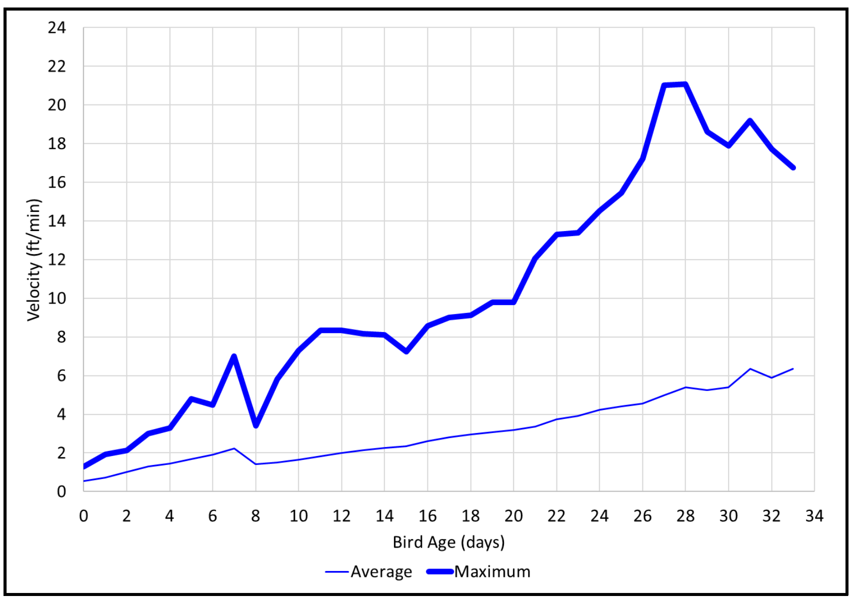

Figure 2. Average and maximum water velocity at the beginning of a drinker line

Figures 1 and 2 illustrate the average daily drinker line flow rate as well as the average and maximum water velocity at the beginning of the drinker line. The sudden drop in flow rate and velocity on Day 8 was due to the birds transitioning from half-house brooding into the full house, thereby having access to twice the number of drinker lines which cut in half the amount of water being utilized in the brooding area where the water meters were located. The average flow rate in each line starts off at approximately 0.01gal/min and increases to 0.20 gals/min at the end of the flock. To put this in perspective, water flows from the typical kitchen faucet at a rate of 2 gals/min, ten times higher. The average velocity at the entrance of the drinker line ranged between 0.5 ft/min at placement to a little over 6 ft/min at the end of the flock. Peak velocities typically occurred when the lights first came on in the morning and were between 3 and 4 times the average velocity for a given day. Peak velocities typically had a duration of less than five minutes before dropping back to the average within 30 minutes (Figure 3). The highest entrance velocity recorded was 21 ft/min, which is roughly the speed at which a black ant moves. But, keep in mind that the velocity in each drinker line will decrease along the length of the line, dropping to near to zero before the last nipple.

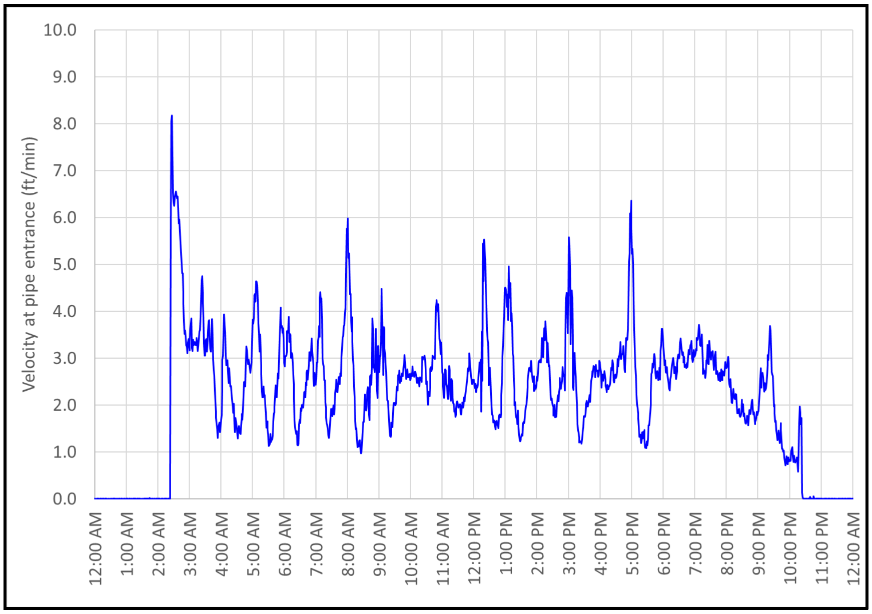

Figure 3. Drinker line entrance velocity on Day 14

With such low water flow rates a logical question would be how long does water remain in a drinker line? Since the water flow rate changes along the length of a drinker line, the length of time it takes for "fresh" water to reach a specific nipple depends upon the location of the nipple. The closer a nipple is to the beginning of a drinker line, the less time it takes fresh water to reach that nipple. A second consideration is the amount of water the birds are drinking. The younger the birds, the lower the water consumption rate, and the "older" the water tends to be in a drinker line.

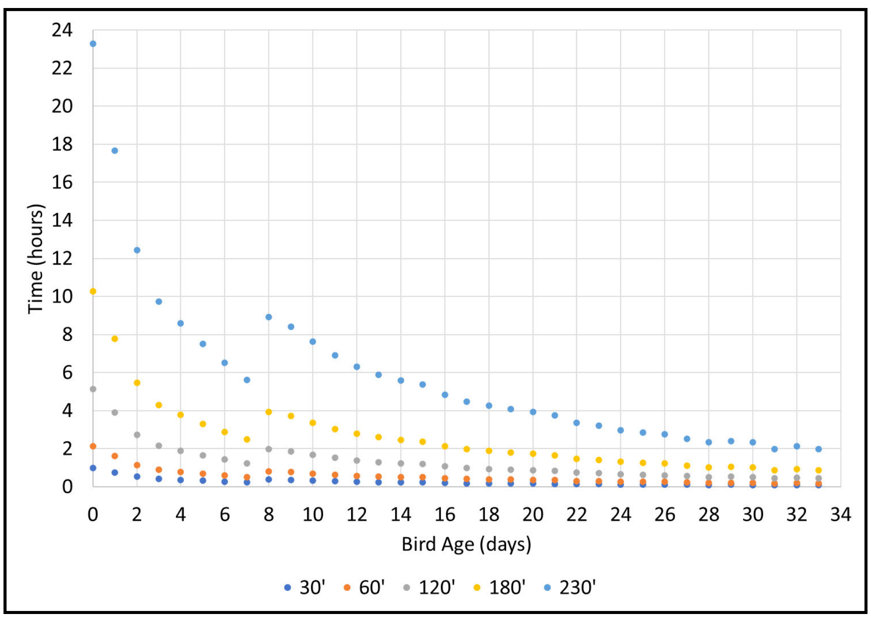

Figure 4. Time required for "fresh" water to reach various points along a 240' long drinker line (0 to 33 days)

Figures 4 and 5 illustrate the average amount of time it takes for fresh water to reach various points along the length of a 240' drinker line based on data collected in the aforementioned study. At the beginning of the flock, it was found that it took approximately an hour for the water to travel the first 30' of a drinker line. To make it half way down the length of the drinker line took five hours. To make it nearly to the end of the 240' drinker line required about a day. Again, it takes a long time for the water to get to the end of the drinker line because the farther you are along the drinker line, the fewer the number of nipples drawing water from the drinker line. For the first few feet, you have hundreds of nipples drawing water from a drinker line. The last fifty feet, only dozens of nipples are drawing water from the line, resulting in the water coming to a virtual standstill.

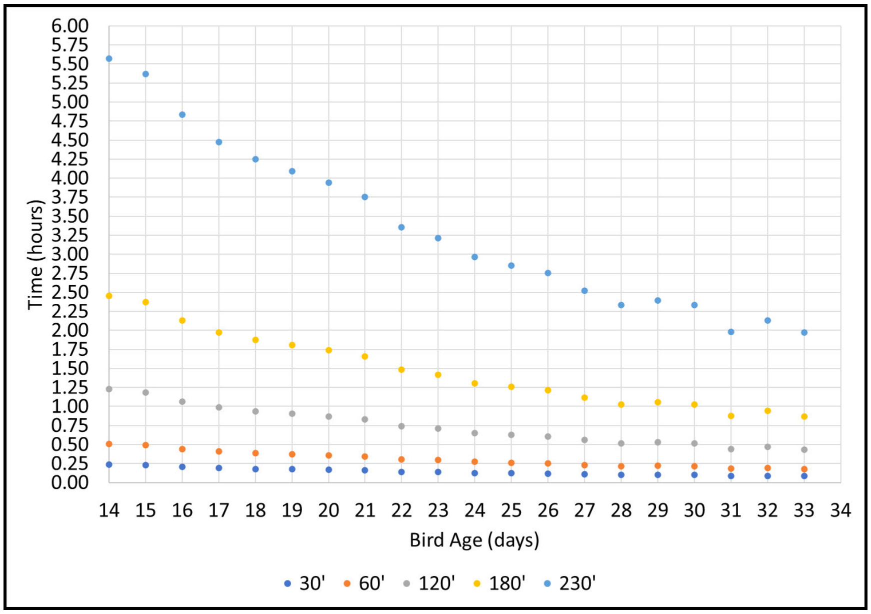

Figure 5. Time required for "fresh" water to reach various points along a 240' long drinker line (14 to 33 days)

As the birds got older, the amount of time water remained in the drinker line decreased as water consumption rates increased. By the end of the flock, it took on average five minutes for the fresh water to reach a nipple 30' from the incoming pressure regulator, 30 minutes to reach the halfway mark, and two hours to reach the last few nipples on the drinker line. Though the travel times were significantly reduced by the end of the flock, it is clear that for even market-age birds, water flow rates are such that for the majority of the birds in a house it takes 30 minutes or more for the water to travel from the incoming pressure regulator to the nipple they are drinking from.

It is important to note that values illustrated in Figures 4 and 5 are the averages for each day. At points during the day, since the flow rates can increase three times or more due to increased feeding activity, the travel times would be reduced by a factor of three or more. Conversely, during periods of low drinking activity or at night when there is essentially no drinking, the water travel times could be dramatically increased. What this research makes clear is regardless of bird age, flow rates in poultry house drinker lines are very low and therefore the amount of time it takes for fresh water to get to a bird is closer to hours than seconds.

Of course, the above figures are for a specific house and would change on based on bird density and size of bird grown, but probably not as much as you may think. Water consumption will roughly follow bird density expressed in pounds per square foot (kg/m^2). On the farm studied, the birds were grown at a maximum density of approximately 6.7 lbs/ft^2 (33 kg/m^2). Therefore in houses where birds are grown at a higher density, for instance 8 lbs/ft^2 (39 kg/m^2), we would expect the water flow rates would be roughly proportionally higher (20%) than illustrated in the above figures. What about houses with higher flow nipples, different breeds of birds, or growing birds during hot weather? Yes, these variables could change drinker line flow rates, but they wouldn't be dramatically different from the relatively low flow rates documented in this study. In the end, when envisioning drinker line flow rates it is more appropriate to imagine an extremely lazy river or a slow moving snail, than a rushing river.

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