

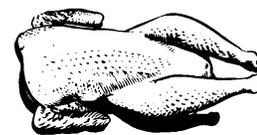


The University of Georgia

**Cooperative Extension Service**

College of Agricultural and Environmental Sciences / Athens, Georgia 30602-4356

JULY 2007



## PROCESSING TIP . . .

### HOW CAN PROCESSORS SIGNIFICANTLY IMPROVE PROCESSING YIELD AND LOWER *SALMONELLA* WITHOUT ADDED EXPENSE?

For years, poultry companies have known that they can significantly improve finished whole-ready-to-cook WOG yield by lowering scalding temperatures. However, every time companies attempt to lower scalding temperatures two problems routinely occur: 1) *Salmonella* begins to multiply in the scalding tank and 2) carcasses do not pick well. This has led to repeated assistance to companies that were having difficulty meeting the USDA-FSIS, HACCP/*Salmonella* pathogen reduction rule. After carefully assessing these plants, it was determined that the only mistake being made was that they were running the scalders at temperatures below 123°F. This should not be done because excreta (which may contain *Salmonella*), as it comes off of the surface of the birds, will sink to the bottom of the scalding tank. As the shift progresses, more and more excreta may build up in the bottom of the scalding tank. If the temperature of the scalding tank is 100 to 110°F, and there are any *Salmonella* in the excreta at the bottom of the tank, the *Salmonella* will begin to multiply rapidly. Essentially, at 110°F, the processor is operating the world's most expensive *Salmonella* incubator. In the scalding tank at low temperature, the *Salmonella* cells have all of the components they need to multiply rapidly. They have the optimum growth temperature, moisture, nutrients, pH, etc. Thus, it is recommended that poultry companies never run their scalders at a temperature lower than 123°F.

What is magic about 123°F? The maximum growth temperature for *Salmonella* is 113°F. The research literature indicates that, to preclude the growth of microorganisms, they should be kept at a temperature that is at least 10°F above their maximum growth temperature. Thus, to prevent any multiplication of *Salmonella* in scalders, the temperature should never be lower than 123°F. I have evaluated scalders in processing plants that were running at 115°F and found 100,000 *Salmonella* cells/mL of scalding water! This means that every chicken that was being processed was being inoculated with hundreds of thousands of *Salmonella* cells. Keep in mind that only 1 *Salmonella* cell results in a positive carcass post-chill and is a problem with regard to the USDA-FSIS. This makes the job of the intervention strategy that is employed downstream, such as the online reprocessing system (OLR) or the chiller, that much more difficult.

How can this problem be overcome? This problem may be avoided by introducing a sanitizer into the scalding tank. It seems easy to put a chemical sanitizer into the scalding tank, but in actual practice it is very difficult. For this reason, very few poultry companies add anything to their scalders to disinfect them. The reasons are twofold: 1) they are not used to spending money on scalding tank disinfectants and thus are reticent to spend the extra money, and 2) very few chemicals

#### PUTTING KNOWLEDGE TO WORK

have been shown to have any efficacy. Chlorine or other oxidant-based sanitizers should not be used in scalders because it is immediately deactivated by the organic load in the scald and can gas off. Sodium hypochlorite (a basic compound that raises the pH dramatically) does not significantly impact the bacterial levels on carcasses during scalding.

A benefit to adding acidic disinfectant chemicals such as Tasker Blue, FreshFx, or peracetic acid (ParaSafe and Inspexx 100) to the scald is that the scald temperature may then be lowered without the concern that *Salmonella* will begin to grow. Likewise, acids greatly improve picking. In studies in very large scale processing plants, we lowered scald pH to 2.0, 3.0, and 4.0 in scald-tanks 3, 2, and 1, respectively. We could not detect any *Salmonella* in any of the three scald tanks. Also, by doing this, we noted that all of the carcasses appeared to be completely picked upon exiting the first picker. Thus, we found that we could greatly reduce scald temperature while avoiding the two problems with low scald temperature as noted at the beginning of the article. Moreover, we found that using Tasker Blue in the scald in these studies had a dramatic impact on Aerobic Plate Counts and *E. coli* counts on chicken carcasses.

What is the logical reason why lowering scald temperatures improve yield? Chicken fat is very unsaturated, which means that it becomes liquefied at lower temperatures than saturated fat like beef fat (tallow) or pork fat (lard). This means that even with only two minutes of exposure to a scald at a temperature of 130°F and above, the fat under the skin becomes liquefied and will drain out from under the skin as the carcasses move along the line suspended upside down and especially when the carcasses are placed into the chiller, where there is tremendous agitation. This results in yield loss in the form of fat loss. This is very different than yield loss or gain because of water pick-up.

Many companies have noticed that when they switched from trisodium phosphate OLR applications, they encountered a significant yield loss, generally on the order of 1-2%. This is a huge loss and causes a great deal of consternation. However, the yield gain because of water pick-up in the chiller is a problem. The trisodium phosphate shifts the pH upward, thus making the pH of the meat slightly higher and away from its isoelectric point. This makes the water-holding capacity of the meat increase greatly. This is why phosphate is almost always used in marinades to make the meat hold the marinade that is introduced. The problem is that the meat will eventually purge some of this water into the package later on and customers do not like liquids spilling out of their packages. Therefore, yield increase due to water-weight gain is not the best option. It is much more advisable to maintain the fat under the skin of the chicken. The benefits are as follows:

1. More subskin fat equates to more WOG yield.
2. Less fat is expressed onto equipment, reducing the ability of *Salmonella* to be encased in this fat and be protected from chemical sanitizers and contaminate carcasses as they touch the equipment
3. Less fat comes out from under the skin in the chiller which reduces the organic load of the chiller, allowing chlorine and other oxidants to do a much better job.
4. Less fat must be removed from the overflow water of the chiller by the wastewater treatment system.

How much yield can you gain by lowering scald temperatures? We conducted a study in two very large poultry processing facilities. First, we had to determine the optimal scald temperatures to use. We found that it is inadvisable to lower all three scald tanks by 5 degrees. The carcasses will not pick well if this approach is taken. Instead, we found that by staggering the scald tanks, we were able to get very good picking while maintaining yield. In the first plant that processes over 320,000 carcasses per day, we were able to achieve an excellent pick while maintaining the three scald tanks at 110, 114, and 138°F, for tanks 1, 2, and 3, respectively. The plant originally ran the scald at 132, 134, and 136°F, for tanks 1, 2, and 3, respectively.

Plant managers have indicated that reducing the temperature of the scalders only a few degrees results in observable yield increases. We were able to reduce the temperatures

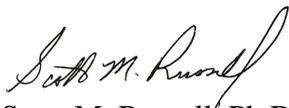
dramatically and observed unbelievable yield increases; however, we did not weigh the carcasses at the chiller exit. Thus, we conducted another study in a different processing plant which used only 1 long scald. We had to adjust the three zones of the scald to achieve our goal (see Figure 2).

We ran the scalds at normal temperatures for the control group at 132, 134, and 138°F, for zone 1, 2, and 3, respectively. For the test group, we added Tasker Blue to the scald (pH 2.0) and ran the zones at 121, 124, and 138°F, for zone 1, 2, and 3, respectively. The carcasses were evaluated by counting feathers remaining after pick and found to be equivalent for the control and treated groups of chickens. We tagged live birds (50), weighed them, ran them through the entire process, collected them after chilling, and re-weighed them for both the control and treated groups. This was conducted over 3 days of processing. The results were staggering. Over the three days of testing, the processing yield for the control group was 75.83%. However, for carcasses scalded at lower temperatures, the yield was 76.87%. This means that **an average yield increase of 1.04% was achieved**. I sincerely believe that much greater yield increases will be observed when a three-stage scald is used instead of the one scald used in this study because in three-stage scalds, we are able to lower the temperatures to a much greater degree as described above.

What conclusions can be made from this study? If an average poultry processor produces 200,000 to 250,000 chickens per day at an average weight of 3 lbs, this equates to 600,000 to 750,000 lbs. of meat. If we use a figure of \$0.70 cents/lb of meat, then the plant would be producing \$420,000 to \$525,000 worth of product a day. Thus, using these figures, a 1% yield increase equates to \$4,200 to \$5,250 a day in savings (or \$1,092,000 to \$1,365,000 per year) even when only adjusting the scald temperatures down to a moderate degree. Also, a minimum of \$500/day would be saved in energy costs resulting in a total cost savings of \$4,700 to \$5,750 per day. Therefore, using a proper acid sanitizer in the scald has been demonstrated to:

1. Make carcasses much easier to pick
2. Decrease bacterial growth and lower bacterial numbers on carcasses including *Salmonella*
3. Decrease cross-contamination of *Salmonella* from carcass to carcass
4. Reduce overscald striping of breasts
5. Reduce the cost of energy required to heat the scald water
6. Reduce the amount of sub-skin fat cook-off leading to higher yields
7. Decrease the amount of fat on processing equipment
8. Decrease the amount of fat in the chiller, allowing chlorine or other chemistries to do a much better job.

What is the cost/benefit ratio? Assuming that an acid sanitizer costs a plant \$2,500 per day to use (high estimate), **the cost benefit would be approximately \$2,200 to \$3,250 per day (or \$572,000 to \$845,000 per year)**. Hopefully, companies will begin implementing measures to reduce pathogens and save a significant amount of money at the same time.



Scott M. Russell, Ph.D.

Extension Poultry Scientist

Extension County Coordinator/Agent