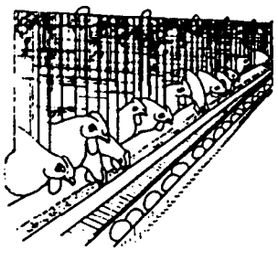


California Poultry Letter

December 1998

Results of Forced Air and Room Cooling Field Demonstration Trials

The following is a summary of egg cooling results stemming from the refrigeration experiments conducted at a California commercial egg processing plant during May and August of 1998. The field trials were conducted by Jim Thompson and Gerald Knutsen, U. C. Davis, Doug Kuney, Moreno Valley and Gideon Zeidler, U. C. Riverside.

Procedures:

These tests were designed to determine cooling times and fan characteristics needed for commercial cooling of table eggs packaged in typical materials used by the commercial egg industry in California. Tests were conducted on large-size eggs produced by flocks between 40 and 50 weeks of age and packed in pulp (view) or foam cartons or pulp flats. Cartons were placed in standard ½ case boxes with handhold openings, specially vented (5% of the side wall) ½ case boxes, or wire baskets (Table 1). In the case of forced air cooling, air flow was provided with a 1/3 horsepower, backward incline blower.

Egg temperatures in four consistent locations in each pallet were measured with small data loggers. Sensors were placed ¾ to 1 inch deep in the egg. Egg cooling times were described as the time for eggs to cool 75% of the difference between initial egg temperature and chilled air temperature in the cooler. This is commonly referred to as three-quarters cooling time and is used in order to standardize the results for different starting internal egg temperatures and variations in starting room temperature.

Results:

The forced air cooling tests showed that vented cases could be cooled to ¾ cooling temperature in 2.1-6.5 hours, depending on the packaging type and static pressure created by the fan (Table 2). Under forced air conditions, foam cartons cooled slightly slower than fiber cartons; however these differences may not be statistically significant. Higher static pressures across the pallets (causing more airflow through the cases) reduced cooling times. Static pressures of 0.74-0.79 inches of water column (w.c.) allowed ¾ cooling time in 2.1-3.4 hours. When static pressure was dropped to 0.07-0.17 inches, the cooling times increased to between 3.3-6.5 hours.

Table 1. Packaging combinations studied

Tmt/case type	Foam carton	Fiber carton	Fiber flat
Forced air			
Vented box	x	x	x
Wire basket		x	
Room cooled			
Vented box	x	x	
Non-vented box	x	x	x
Wire basket		x	

Table 2. Forced air cooling results for large eggs

static pressure (in. w.c.)	air flow (cfm/lb)	¾ cooling time (hrs)	start temp. (^{0}F)	avg. air temp. (^{0}F)	¾ cooling temp. (^{0}F)
Fiber cartons in wire baskets					
0.07	2.3	1.6	76.8	51.4	57.9
Fiber flats in vented boxes					
0.79	1.8	2.3	81.1	47.5	55.9
0.17	0.9	3.3	73.8	46.4	53.2
Foam cartons in vented boxes					
0.74	1.7	3.4	81.9	48.7	57.0
0.17	0.4	6.5	70.2	45.3	51.4
Fiber cartons in vented boxes					
0.75	1.7	2.1	77.2	48.4	55.6
0.07	0.4	4.7	66.9	45.3	50.7

Table 3. Room cooling results for large eggs

carton/case type	¾ cooling time (hrs)	start temp. (^{0}F)	avg. air temp. (^{0}F)	¾ cooling temp. (^{0}F)
Boxes without vent holes				
fiber flats	55.2	76.5	45.7	53.4
fiber cartons	50.2	75.4	45.7	53.1
fiber cartons	54.3	79.3	50.0	57.4
foam cartons	55.5	80.6	50.0	57.7
Boxes with vent holes				
fiber carton	24.8	73.8	45.7	52.7
fiber carton	27.9	78.4	50.0	57.2
foam carton	21.9	77.0	50.0	56.8
Wire baskets				
fiber carton	10.1	80.2	50.0	57.6

Room cooling tests resulted in ¾ cooling times between 10 and 55 hours depending on the carton type (Table 3). Standard boxes without ventilation cooled in 50-56 hours while vented boxes cooled in about half that time, 22-28 hours. Wire baskets reached ¾ cooling temperature in only 10 hours regardless of packaging material (flats, fiber carton, or foam carton). Figure 1 shows the cooling times for fiber cartons.

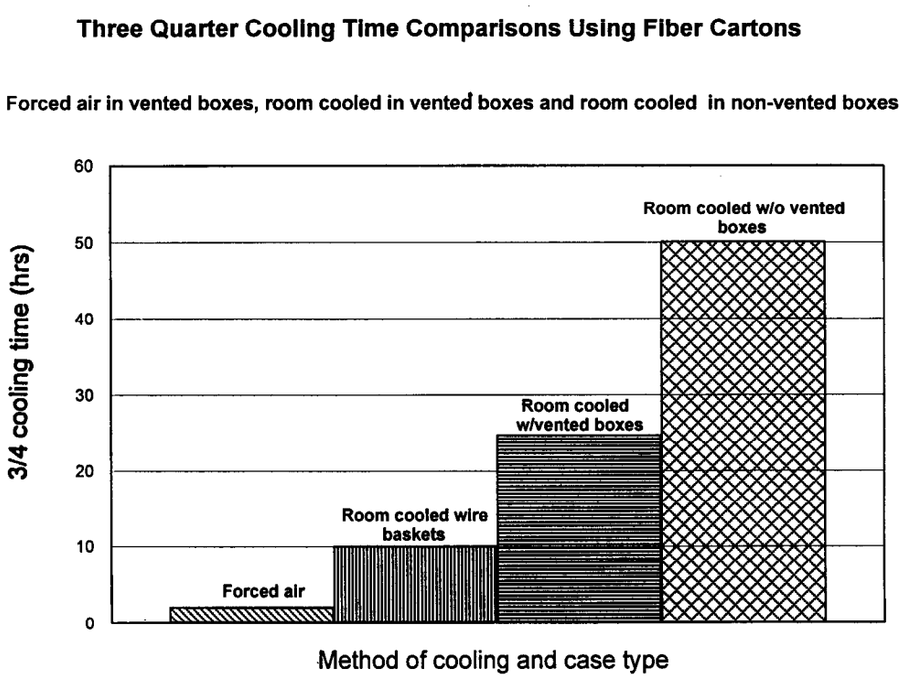
Discussion and conclusions:

The time that it takes to reach any given temperature depends on a variety of factors including, amount of air flow, cool room air temperature, starting egg temperature, packaging material and whether wire baskets or corrugated cardboard boxes are used. In this study, the starting internal egg temperatures ranged from 66.9 to 81.9 ^{0}F. Under normal commercial conditions, many times eggs are packed at higher internal temperatures and would therefore take a longer time to cool to a specific temperature. The results were reported in terms of ¾ cooling times to standardize for these differences.

While rapid cooling of eggs using forced air and ventilated case material can be achieved, if all eggs in a processing plant were cooled at these accelerated rates, additional cooling capacity would be required since the same amount of heat will be lost over a shorter period of time.

Our study suggests that forced air cooling can provide a relatively inexpensive way of cooling eggs when rapid cooling is desirable. Further studies have demonstrated that eggs that are rapidly cooled have better albumen quality and lose less weight than conventionally cooled eggs (California Poultry Letter, October 1998).

Figure 1.



Cooling rate differences due to packaging material may occur under forced air conditions. Foam cartons, which are totally enclosed, appear to cool at a slower rate than fiber cartons with view windows. A separate set of replicated laboratory tests verified the effects of packaging and also revealed that orientation of cartons in a case affects cooling times. Generally, eggs packed in fiber flats or vented fiber cartons cool faster than eggs in non-vented foam cartons. But if the cartons are oriented so that they are perpendicular to the air flow, cooling times are significantly longer. In fact fiber cartons oriented perpendicular to air flow will require as much time to cool as foam cartons oriented parallel to the air flow. Tests with alternating carton orientation showed an intermediate cooling time between parallel and perpendicular carton orientation. The air flow data suggest that the reason for these differences is that cartons oriented perpendicular to air flow reduce flow causing longer cooling times.

Standard room cooling times can be reduced by about 50% by packing cartons into cardboard boxes that have 5% of their side wall area ventilated. However, eggs packed in wire baskets cool the fastest. Cooling rates did not appear to be affected by carton material when eggs were subjected to room cooling.

D. R. Kuney
Area Farm Advisor
Southern Region

Poultry Health Symposium

A Poultry Health Symposium is being planned for March 4th 1999. The keynote speaker will be Dr. Craig Riddell of the University of Saskatchewan. Dr. Riddell is a recognized world authority on poultry diseases and an outstanding speaker. He will discuss the J virus and other poultry disease problems.

Field Research Plans

The EPA is taking a hard look at pesticides used in the agricultural industries, including the poultry industries. An in-depth survey of California's poultry industries was recently begun to provide the EPA with accurate information about what pest control practices are being used to control specific pests, which practices have no viable alternatives and which pests are costing the industries the most to control. This information will be used to help the EPA make practical decisions about the removal of certain pesticides and will help to direct future research to areas where more information is necessary.

Preliminary results of the pest control practices survey indicate that the egg industry spends a great deal of time and money trying to control Northern Fowl mites, and several were concerned about mite resistance to pesticides. A study will begin in December that will scientifically document the extent of resistance to certain pesticides that may have been developed. This information will form the basis for alternative recommendations and future research.

Several egg-producing companies within California are in the process of or are planning to build new poultry housing. Various environmental control designs are available but they don't all perform equally. A project is planned to evaluate as many types of mechanically ventilated layer houses as possible for environmental quality and uniformity during the summer and winter seasons.

Public health agencies have taken a hard look at the commercial table egg industry whenever there has been a human outbreak of *Salmonella enteritidis* (SE). In order to demonstrate to these agencies the true prevalence of SE in laying hens, a study has begun to systematically sample the manure from layers throughout the state. **It is very important that <u>all</u> egg-producing companies participate in this study so that the public health agencies will feel confident in the results.**

D. R. Kuney
Area Farm Advisor
Southern Region

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Calendar

***January 12, 1999,** California Egg Quality Assurance Plan Advisory Committee, Host Hotel at Sacramento Airport. For registration contact PePa (916) 441-0801.

January 20-22, 1999, International Poultry Exhibition, Georgia World Congress Center, Atlanta. For more information contact U.S. Poultry and Egg Association 770/493-9401.

February 9-10, 1999, Australian Poultry Science Symposium. University of Sydney, Sydney, NSW, Australia, Contact D.J. Farrell, Queensland Poultry Research and Development Centre. Alexandra Hills, Queensland 4161, Australia. Fax: 61 7 3824 4316.

***February 22-26, 1999,** PePa 75th Annual Convention, Palm Springs Hilton, Palm Springs, CA. For information call 916/441-0801.

March 9-10, 1999, International Symposium on Avian Coccidiosis, Iguassu Falls - PR BRAZIL. The FACTA-APINCO Foundation on Poultry Science and Technology will be organizing this technical event. The FACTA is a non profit organization that makes science and technology diffusion on poultry production. See more details in their home page: http://www.dglnet.com.br/facta or email: facta@dglnet.com.br

***April 25-27, 1999,** 48th Western Poultry Disease Conference, Landmark Hotel and Conference Centre, Vancouver, British Columbia, Canada. For information contact Lina Layiktez, Conference & Events Services, 530/757-3331.

***May 17-19, 1999,** National Egg Quality School, Ashville, NC. More details in future newsletters.

August 15-19, 1999, 12th European Symposium on Poultry Nutrition, Veldhoven, The Netherlands. Organized by the WPSA Working Group No. 2, Secretariat WPSA 12th European Symposium on Poultry Nutrition, c/o Wageningen Agricultural University, Animal Nutrition Group, Dr. Rene P. Kwakkel, P.O. Box 338, 6700 AH Wageningen, The Netherlands. Telephone: +31 317 482468/ 484082; Fax: 31 317 484260.

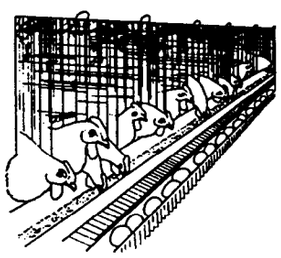
Programs approved for California Quality Assurance Program credit.

Douglas R. Kuney, December Editor
Area Poultry Farm Advisor
U.C. Cooperative Extension
21150 Box Springs Road
Moreno Valley, CA 92557
Tel. 909/683-6491, Ext. 226
Fax 909/788-2615
e-mail: drkuney@ucrac1.ucr.edu

Ralph A. Ernst, Technical Editor
Poultry Specialist
U.C. Cooperative Extension
Animal Science Department
University of California
One Shields Avenue
Davis, CA 95616-8521
Tel. (530) 752-3513
Fax (530) 752-8960
e-mail: raernst@ucdavis.edu

Department of Animal Science
University of California
Davis, CA 95616-8521

COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA



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In This Issue

Results of Forced Air and Room Cooling Field Demonstration Trials
Poultry Health Symposium
Field Research Plans
Calendar