1999 U.C. Poultry Symposium and Egg Processing Workshop

Poultry Symposium Program

Chairperson: Riverside - Doug Kuney, Area Poultry Advisor, Southern California
Modesto - Francine Bradley, Extension Poultry Specialist, UC Davis

8:00 a.m. Registration (coffee available)

8:30 **Economic Aspects of Controversial Layer Management Programs (caging, beak trimming, molting)**
Don Bell, Poultry Specialist, UC Riverside

9:15 **Planning an Appropriate Response to an SE Positive Environmental Sample**
George West, CDFA
Carol Cardona, UC Extension Veterinarian - Poultry
Mark Bland, Veterinary Consultant

10:00 **Break**

10:15 **Pullet Flock Management 15 Weeks to Peak Lay**
Moderator: Ralph Ernst, Poultry Specialist, UC Davis - Lighting Programs
Neil O'Sullivan, Hy-Line International - Genetic Considerations
John Kuhl, Nest Egg Nutrition - Nutritional Recommendations
Gregg Cutler, Veterinary Consultant - Flock Health Aspects
Don Bell, Poultry Specialist, UC Riverside - Economic Factors

11:30 **Hen Behavior - What Can It Tell Us?**
Neil O'Sullivan, Hy-Line International

12:00 **Lunch**

Egg Processing Workshop Program

Chairperson: Don Bell, Poultry Specialist, UC Riverside

1:00 p.m. **Update on Egg Safety Issues**
Jill Snowdon, Director of Food Safety Programs, Egg Nutrition Center

1:30 **Present and Future Trends in Egg Products**
Mo Samimi, Food Science and Engineering Consultant

2:00 **Personal Hygiene and Food Safety**
Gideon Zeidler, Extension Food Scientist, Eggs & Poultry, UC Riverside

2:30 **Break**

2:45 **Egg Refrigeration - Compliance and Enforcement**
Moderator: Don Bell, Poultry Specialist, UC Riverside
Don Dixon, USDA, AMS, Modesto
John Wiley, CDFA, Egg Inspection
Doug Kuney, Area Poultry Advisor, Southern California
Jim Thompson, Extension Engineer, UC Davis
Bruce Morden, Dept. Health Services, Food and Drug Branch
Jeff Lineberry, Dept. Health Services, Food and Drug Branch

ECONOMIC IMPLICATIONS OF CONTROVERSIAL LAYER MANAGEMENT PROGRAMS

by

Donald Bell, Poultry Specialist
Cooperative Extension, University of California

ABSTRACT

Economics plays an essential role in the choice of management programs in the poultry industry as well as in most businesses. Economics drives the selection of systems, products, and procedures among a long list of alternative options. Costs, values, profit margins, competition, overhead, performance, efficiencies, etc. are all economic subjects and are of vital importance in their effect on the management of today's modern agricultural enterprises.

Management programs are chosen only following careful consideration of their relative worth compared to alternative programs. Managers are charged with choosing sound programs, enacting them in detail, monitoring their applications and continuing their evaluation when new alternatives come along or when price/cost conditions change.

This paper emphasizes some of the economic implications of program selection in the controversial areas of: caging systems for laying hens, beak trimming and induced molting. Analysis of relative biological performance is stressed with cost/price calculations emphasized to discover the economic impact on the operation. The impact of imposed regulations on systems is discussed.

INTRODUCTION

Commercial management practices for laying chickens are chosen on the basis of their ability to perform a basic task with a minimum of detrimental effects to the flock or to the environment in a cost-effective manner (ref #29). For example, feed must be delivered to a flock frequently and in an adequate quantity and quality to satisfy each chicken's basic needs for nutrients. The delivery system must be well designed, competitive in price, free of defects, and low in maintenance costs if it is to be selected. This same principle is followed for the selection of every management system in use today.

Obviously, there are many alternative systems which can do a comparable job and individual farmers have different needs which may require different systems. This is why we see a variety of systems and practices. Owners use different strains of chickens, different feeding programs, different poultry houses, and a wide range of other management techniques. Farmers strongly defend their choices and justify them on the basis of their own experience. They get good responses from their flocks, the help finds the systems easy to work with, and ownership believes they are cost-effective and yield the highest returns on their investments.

Some of the practices in use today by the commercial table-egg industry are being criticized by observers of the industry. These practices are perceived as being harmful to the flocks or ones which fail to address the specific behavioral needs of the chickens. They include:

1. the use of animals in any way.
2. the caging of chickens.
3. the use of beak trimming.
4. the use of induced molting
5.. transportation and handling systems
6. and others.

This list includes items which may require absolutely no change from current procedures, others which may need some modification to eliminate problem areas, and some which might justify major changes or even elimination from the list of choices. The industry, as well as individual producers, must take a hard look at their systems to determine whether on not adjustments should be made in areas of flock welfare and health without adversely affecting the economics of the operation.

This paper will address three areas from the list above which have drawn the most criticism in recent years - caging, beak trimming and induced molting.

CAGES FOR TABLE EGG LAYING FLOCKS

The commercial application of cages for egg production began in the 1930's, became widespread in the 1940's and 1950's and is currently thought to represent 70-80% of the World's production. Today, we would estimate that 98% or more of the commercial production of the United States is in cage systems.

During this 50 or more years of use, cages and their associated equipment have been improved and modified, cage density has increased (more hens per cage and/or less space per hen), strains of birds have been developed to perform more efficiently in current management systems, and other programs (feeding, health, beak trimming, lighting, etc), have been adjusted to conform to the needs of birds in cage situations.

Concern has been expressed that chickens should not be caged. The argument is that birds are not able to express their "natural behavioral needs". They can't "nest" their eggs, dust their plumage, choose their feed, run around, or attempt to fly. In becoming domesticated and managed, the caretaker has either eliminated some of these practices or changed the way these needs are addressed. Originally, these concerns were not expressed as layers were housed in single-bird cages. Cages were applauded for removing chickens from their own feces and for eliminating the centuries-old problems of internal worms and parasites. Eggs were cleaner, working conditions for the farm laborers were better and general management was easier. But, most importantly, egg farmers made money with these new systems. Under these conditions, crowding was not a concern and single birds did not develop anti-social tendencies therefore beak trimming was not necessary when pen-mates were not present.

The original single-bird cages provided each layer with 150 to 200 in.^{2} of floor space and 5 to 10 inches of feeder space. As time passed, egg producers found they could add additional birds to their cages with little if any performance losses. As space allowances were reduced, performance was lost to the extent that further crowding could no longer be justified..

University of California research with the cage density issue dates back to 1961 when we studied the effects of adding a third bird to a standard 2-bird cage. The reduction from 108 to 72 in.^{2} did not affect hen-day egg production, but mortality due to prolapse-pick out increased from 1.4% to 7.4%.

A second study in 1963 added a fourth bird to this same cage size and compared it to a 3-bird cage (72 vs 54 in^2). In this case, hen-day egg production was reduced from 64.0% to 61.7% and prolapse-pick out mortality was doubled from 3.4% to 7.8%. Obviously, this density was approaching an un-economic level.

During the 1960's and 1970's cage densities gradually increased until today, when 48 and 54 in.^{2} per bird have become the standard space allowances for laying hens in the US (white-egg strains). This compares to the 70 in.^{2} (450 cm^2) standard in Europe and other countries for predominately brown-egg birds. Current discussions in Europe center around the questions of increasing allowances to 124 in.^{2} (800 cm^2) or complete elimination of the cage altogether. Interestingly, government officials recognize the need to "block the import of eggs from countries with weaker animal welfare standards otherwise Economic Union egg farmers would be put out of business by cheap eggs from elsewhere in the world".

Also during this same time period, numerous research studies have demonstrated time and again that additional birds decrease hen-housed egg production and increase mortality. Our analysis of 45 different experiments conducted across the US and Europe show 14 fewer eggs and 3.9% higher mortality rates for each addition of one bird per cage.

Even though performance is adversely affected by increasing cage densities, egg producers can often justify the more crowded cage densities at different cost/egg price relationships. With many producers, current levels of egg prices and feed prices will not justify the lower space allowances. On the other hand, some producers can justify crowding under almost any cost/price relationship because of their ability to manage such situations..

In the last 20 years, the laying cage has gone through many modifications. Whereas the original cages commonly held 1-4 birds, today's cages are designed for 6-10. As a result of University of California research relative to cage design and other factors, more emphasis is now placed on feeder space allowances with most systems allowing 3-4 in. per bird (ref #3). Cages have become more "square", thus allowing each chicken more feeder space. Multiple drinkers are recommended to avoid problems when an individual drinker becomes inoperative. Manure systems are designed to store wastes in a different level of the building or to be removed on a daily basis.

Today, we use larger cages than in the 1950-1960 period and the most popular cages are for 6 birds with space allowances of about 54 in.^{2} per bird. In 1994 a large scale experiment was set-up on a commercial California farm to measure the performance and economic differences in placing 5, 6, and 7 birds per 16" wide by 20" deep cage (ref #10). This experiment was conducted over a 38 week experiment (to 58 weeks of age) with 53 thousand DeKalb Delta White Leghorn hens. Data was based upon 24 rows of 2200 birds each. Results are listed in Table 1.

Table 1. Performance results - Univ. of California Cage Density Experiment - 1994

Trait	5/cage *	6/cage *	7/cage *
Hen-housed eggs	198.0	194.3	185.2
Av. egg weight (g/egg)	59.8	60.1	60.3
Total weight of egg mass/hen housed (kg)	11.84	11.65	11.16
Mortality (%)	6.5	8.4	9.4
Daily feed intake (g)	105.6	101.4	99.4
Profit index/hen-housed ($)	3.97	4.08	3.79
Profit/cage (high costs) ($/cage) **	4.68	6.18	5.32
Profit/cage (low costs) ($/cage) ***	11.98	14.66	15.06

Cage size = 16 in. (40.6 cm) wide x 20 in (50.8 cm) deep.
** High costs = $2.50 per pullet, $7.50/100 pounds of feed, $.50/dozen eggs.
*** Low costs = $2.00 per pullet, $6.00/100 pounds of feed, $.50/dozen eggs.

Table 1 illustrates that the highest returns per bird were obtained in the 6-bird cage. This was due primarily to a reduction in feed usage. The highest return on investment was also obtained in the 6-bird cage during low profit years, but with high profit years, the higher density (7 birds per cage) maximizes returns on investment. A fixed high density choice over time, might result in company failure during periods of extended low profit margins.

The choice of cages (design, size, shapes, etc.) and their management systems have many economic implications as discussed above, however, the proposed legislated elimination of cages in Europe will have even greater economic effects for egg producers throughout the region, to their suppliers and to the consuming public. The current proposal to eliminate cages within the next ten years is a major step backwards in the way flocks are managed. Flock health will be severely affected with major food safety implications. The current non-washing policy for eggs will likely have to be changed to adjust to the dirtier eggs produced by litter or free-range systems. Higher flock mortality rates are likely to occur thereby offsetting some of the claimed welfare advantages for non-cage systems. One European legislator was quoted as saying "Changing from battery to free-range eggs would cost the average consumer less than £2 a year". This would represent $850 million per year in the US - not a small amount of money!

Cages have many advantages that should not be discarded in exchange for the one presumed disadvantage of " the flocks' inability to express their natural behavior". The scientific community must communicate the net losses and gains which accrue when husbandry practices are abruptly and totally changed. Total effects are much broader and more complex than a mere £2 ($3.20) increase in costs to the consumer.

Caging is a pro-welfare system of housing laying hens. It results in **improved livability, healthier flocks and higher profitability.**

BEAK TRIMMING

Beak trimming is a management practice used to reduce cannibalism, feather pecking, and other anti-social behavior in chicken flocks. Its benefits are widely acknowledged in the commercial chicken industry. Benefits include:

1. Reduced mortality from pecking.
2. Reduced injuries and sub-normal performance.
3. A general calming of the flock.
4. Reduced feed wastage and feed usage.

Today's methods date back to the early 1940's when the University of California developed a technique using a sharp edged device capable of being heated to cauterize the beak (ref. #11). Dozens of experiments and field trials subsequently refined the practice as we know it today. Beak trimming involve a complex set of decisions which describe in detail the process:

1. Age of birds to be trimmed
2. Timing relative to other management practices
3. Amount of beak to remove
4. Shape of the cut
5. Blade type and sharpness
6. Blade temperature
7. Time of cauterization

Failure to monitor and control any of these can give less than desirable results. Even though, there are methods to reduce the severity of this problem, beak trimming still appears to be justified when one considers the advantages and disadvantages of this issue.

Lower light intensities in controlled environment houses will tend to reduce the problem of cannibalism and thus may eliminate the need to beak trim for cannibalism control per se. Some strains of birds have very low levels of anti-social behavior, but advantages can still be demonstrated for beak trimming. Reduced cage densities will lessen mortality problems associated with crowding, but economics may still dictate the use of beak trimming to control costs.

Commercial-scale experiments comparing beak trimming vs non-trimmed controls are difficult to conduct as farmers are reluctant to risk the increase in mortality they expect by not trimming a large number of their birds. In addition, proper experiment design requires replication of treatments and large numbers of hens in each replicate are required to make meaningful assessments of mortality effects.

In 1994 an experiment was set up on a large commercial farm in California to measure the differences in performance between beak trimmed and non-trimmed birds. (Table 2) (ref. #14).

Table 2. Performance results - University of California Beak Trimming Study - 1993/94[1]
(40 weeks of results with projection of economic results to 78 wk.).

Trait	Beak trimmed	Not trimmed	Statistical Significance[2]
Hen-housed eggs	191.5	195.7	***
Av. egg weight (g/egg)	58.9	59.7	***
Total weight of egg mass/hen housed (kg)	11.27	11.68	***
Mortality (%)	3.39	4.73	***
Daily feed intake (g)	96.0	101.3	***
Profit index/hen-housed ($)	3.99	4.00	not significant
Profit (projected to 78 weeks of age) ($)	+ $.24/hen housed [3]		

[1] 71 thousand Hy-Line W-36 White Leghorn hens (18-58 weeks of age)
Non-trimmed versus 7-week trimmed.

[2] * ($P < 0.05$), ** ($P < 0.01$), *** ($P < 0.001$)

[3] Projected profits to 78 wk of age is based upon 1.25 ¢/wk profits during the 51-58 wk period.

The California experiment included 71 thousand birds placed in 32 - 2200 bird rows. Cages were 16" wide by 20" deep and 6 birds were placed in each cage. The experiment was conducted for 40 weeks beginning at 18 wk. of age and ending at 58 wk. Because the birds were to be molted at 60 wk., the last 20 wk. of results were projected from performance levels during weeks 51-58. Economic differences at that time were due mainly to feed consumption savings for the beak trimmed birds

Significantly higher egg production and egg weight was observed in the non-trimmed birds, but they also experienced more mortality and consumed more feed. Mortality in this experiment was exceedingly low in both treatments due to the strain of birds used. The 1.34% difference in mortality in favor of the beak trimmed birds was highly significant ($P< 0.001$) and would have probably been missed in traditional smaller experiments. The 5.3 gram per day reduction in feed consumption in the beak trimmed birds was associated with lower body weights (105 grams/bird) and a slightly lower production of egg mass. Eighty percent of the differences in feed consumption were associated with these two factors. Waste did not appear to be a major contributor to the differences noted.

A similar experiment in 1997 by Anderson and Davis at North Carolina State University compared two beak trimming methods with a non-trimmed control. This experiment included 3160 pullets for 64 weeks of production. This experiment was unique in that "fearfulness" and feathering were evaluated. Results are listed in table 3.(ref #16)

Table 3. Performance results - North Carolina State University Beak Trimming Study - 1996/97

Trait	Non - trimmed	6 day precision method	11 wk severe method
Hen-housed eggs	316	335*	333*
Hen-day egg production (%)	79.8	81.2*	80.9
Av. egg weight (g/egg)	61.1	61.5	60.5
Fearfulness score[1]	2.95	2.50*	2.20*
Feather score[2]	3.00	4.80*	5.75*
Mortality (%)	26.3	18.7*	17.1*
Daily feed intake (g)	122	114*	107*
Egg income minus feed cost ($/hen-housed)	8.38	9.87*	10.23*

[1,2] The higher the number the greater fearfulness and greater feather cover.

* Significantly different than the non-trimmed birds.

Unlike the California study, higher hen-housed egg production was observed. This was due principally to high mortality and major differences in mortality between beak trimmed and non-rimmed treatments. Similar trends to the California research for feed consumption were seen with a marked reduction exhibited by the trimmed groups.

The fearfulness score was significantly higher for the non-trimmed treatment indicating a further advantage for beak trimming. And finally, the feather coating was markedly superior in beak-trimmed birds. This may be a significant contributor to the lower feed consumption observed.

Individual beak trimming methods also show dramatic differences in flock performance as seem in Table 3. Even though the 6 day precision and 11 wk severe method birds laid practically the same number of eggs, feed consumption, feather score and economics favored the 11 wk severe beak trimming method.

Performance differences between beak trimming methods have always been seen in University of California experiments dating back to 1972 (Table 4). Interestingly, similar to the North Carolina research, the more severe (apparent) methods commonly outperform the less severe methods. No economic analysis was made in this experiment.

Table 4. Beak trimming methods and performance - University of California - 1972[1]

Trait	7 day precision	12 wk moderate[2]	12 wk severe[3]
Hen-day egg production (%)	69.7	69.4	72.8
Hen-housed eggs	216	213	231
Mortality (%)	13.9	16.5	12.0
Egg weight (g/egg)	55.5	56.0	55.9
Daily feed intake (g)	116	113	114

[1] 22 tō0 wk. of age.
[2] Top beak to 1/4 inch of nostril, bottom beak 1/3 trimmed.
[3] Top beak to 1/4 inch of nostril, bottom beak 2/3 trimmed.

A significantly higher egg production rate was observed in the severely trimmed groups. The 18 eggs improvement was unexpected because of the apparent severity of the method.

A similar experiment was conducted in 198 1 to verify the moderate/severe beak trimming comparison. A third method was added - a one cut technique for both beaks. All trimming was done at 12 weeks. This experiment was also designed to determine if results were different with different colony sizes. Results are shown in table 5.

Table 5. Performance results - University of California Beak Trimming Study - 1981[1].

Trait	Moderate 3/cage	Moderate 4/cage	Severe 3/cage	Severe 4/cage	One cut 3/cage	One cut 4/cage
Hen-day egg production (%)	77.1	71.5	78.0	76.0	74.8	74.9
Hen-housed eggs	246	217	243	244	232	216
Daily feed intake (g)	104	105	103	103	103	105
Mortality (%)	7.3	18.0	11.5	8.6	15.6	24.2
Egg income minus feed cost ($/hen-housed)	3.24	2.35	3.18	3.11	2.84	2.63

[1] 20 to 68 wk of age.

Results of this experiment verify the results of the previous experiment by demonstrating the superiority of the severe beak trimming method but primarily in the more crowded environment. Feed consumption was similar for all methods, but mortality differences were large. In summary, the more severe method was the method of choice, especially in the more crowded condition. Mortality was reduced and profitability was higher.

Beak trimming is a practice that no one likes, but it does prevent higher levels of cannibalism and appears to be of major economic importance to the industry. The selection of the best method is also an important decision for poultry flock managers. But, of equal importance, the monitoring of the practice is essential to be sure that techniques are applied evenly across the entire flock.

Beak trimming is a pro-welfare management technique and is done to **reduce mortality** and to **improve profits in egg production.**

INDUCED MOLTING

Induced molting (forced molting) is a procedure used to rejuvenate laying flocks for a second cycle of egg production. Molting, as applied by the farmer, has been used off and on in the commercial egg industry for almost one hundred years. Early mention was made in Professor Rice's book in 1905. It was revived in the 1930's in the Pacific Northwest region and has been practiced at a high rate there ever since. Its second re-birth occurred in the late 1950's in Southern California and has been incorporated in a high percentage of replacement programs throughout the country.

Induced molting usually involves removal of feed for periods of 5 to 14 days followed by a low nutrient ration for the remaining days in a 28 day molt program. Molting, in nature or induced by the farmer, have the same effect - rejuvenation of the flock with resulting higher egg production, renewal of feathering, and improvements in egg quality.

Molting programs involve an estimated 75-80% of the commercial flocks in the US. At any point in time, 25-30% of the nation's layers are either in a molt or have been molted earlier - this represents some 70 million layers out of a total of 250 million.. Molting is considered a part of the normal replacement policy on the majority of farms in the US today. Options for the farmer include 1, 2, or 3 cycle programs with disposal ages ranging from 75 to 140 weeks of age.

It's estimated that replacement programs that include molting result in at least 15% higher profit margins for the egg producer compared to all-pullet programs (1999). Model building computer software is available to construct typical 1,2, and 3 cycle flocks. Such models are based upon individual owner experiences or can be developed from breeder standards. Although developed to determine optimum replacement policies, they can also be used to determine "what if" situations for different cost/price situations or for conditions unique to a particular region of the world.

An example of performance, cost, and income for a typical molt and non-molt program is shown in table 6.

Table 6. Comparison of a single cycle program with a two cycle program - 1999

Trait	Single cycle (80 wk sale)	Two cycle (110 wk sale)[1]
Av. hens (%)	95.6	93.4
Av. wkly mortality (%)	.150	.154
Hen-day egg production (%)	77.9	72.9
Eggs per hen housed	312.9	428.7*
Large & above eggs (%)	76.9	81.1
Total egg mass (lbs/hen housed)	41.7	58.1*
Undergrade eggs (%)	5.5	5.6
Av. eggalue (¢/dozen)	52.7	53.4
Daily feed consumption (g)	101.6	98.9
Feed perozen (lbs)	3.45	3.60
Feed cost (¢/dozen)	25.0	26.0
Pullet cost (¢/dozen)	9.6	7.0
Feed + pullet (¢/dozen)	34.6	33.0

[1] Molted at 65 weeks of age
* Longer period of time.

In this example, after exclusion of other costs, the annual income per hen housed from the molt program is estimated to be $1.32 compared to $1.15 for the one cycle non-molted program - an increase of 15% in profits. With lower egg prices or higher feed prices, even greater differences would exist. Molting is more justified under low margin conditions (low egg prices or high feed prices).

As one can see, molting is an important tool for optimizing profits in the egg industry. Much of the controversy about molting is not about the practice itself, but is directed at the **methods** used to molt a flock. Practically all methods require some degree of feed or nutrient restriction and this is not acceptable to many. There are methods which limit specific nutrients (calcium, sodium and protein) which are used in countries that do not allow feed withdrawal. Most of the research with these methods has not proven them to be as satisfactory compared to traditional feed removal methods (ref. #19).

The elimination of induced molting in the egg industry would have far-reaching effects on egg producers, their suppliers and the general public. US egg industry's cost and egg price conditions result in very narrow profit margins and the choice of replacement programs has a major impact on a farm's profitability.

Technology is usually adopted slowly and the total effect is spread over the entire industry over a several year period. This prevents massive over-night changes in egg supplies and resulting disruption of the egg market. From time to time, different developments have come along that have dramatically change the performance characteristics of the nation's flock and major changes in the industry's profitability have occurred. Examples of this include: major disease epidemics, large changes in feed prices, and significant changes in the performance characteristics of different strains of chickens. Eliminating a primary management technique (molting) arbitrarily, is an example of an extremely disruptive problem. It would result in:

1. The nation's laying flock would increase in size by about 3% as a result of higher house utilization.
2. All-pullet flocks would lay at a 4% higher rate than two-cycle flocks do today. (Both of these would have a major negative effect on egg prices)
3. Higher costs of production
4. Approximately 47% more:
    a. Additional chicks to hatch
    b. More breeding farms and breeding flocks
    c. More hatcheries
    d. More male chicks to be destroyed
    e.. More spent hens to market
5. Higher percentages and numbers of medium and small eggs

Induced molting is a vital component of the replacement programs used throughout the industry. Without molting, flocks would be kept beyond the optimum age for high egg quality, costs to the industry would be prohibitive and the age at disposal for flocks would be shortened from the current 105 to 110 weeks to 75 to 80 weeks.

Induced molting is a pro-welfare management technique and is done to **lengthen the productive life of flocks** and to **improve profits in egg production.**

SUMMARY

The well-being of commercial laying flocks is the result of the systems chosen and the quality of management to make them work as intended. Oftentimes, simple changes can be made to improve these systems which result in both improvements in the well-being of the flock and the profitability of an operation. Careful monitoring of caging, beak trimming and induced molting procedures will minimize the risk of hurting our flocks and their performance. High reproductive performance is an excellent indicator of overall good management.

The choices the farmer makes are driven mostly by economics and economics can not be arbitrarily dismissed from its important position. Most welfare issues are incremental ones:

* more birds per cage reduces performance
* more days off feed increases mortality
* the more beak removed, the greater the damage
* and so on

Regulations either eliminate practices altogether (no cages) or place numeric restrictions (450 cm^2 per hen) on a practice. Such regulations are usually enacted to address the exceptional problems but are imposed upon all. If the regulatory route is chosen, it must be based upon scientific fact and not the expedient approach of totally disallowing a practice for political reasons.

SELECTED REFERENCES AND WORLD'S POULTRY SCIENCE REVIEWS

Caging

1. Bell, D.D., M.H. Swanson, 1975. Crowding Chickens in Cages Reduces Your Profits. University of California leaflet 2273.
2. Bramhall, E.L., W.F. Rooney, and D.D. Bell, 1976. How Many Hens in a Cage. University of California leaflet 2652.
3. Hughes, B.O., 1983. Conventional and shallow cages: A summary of research from welfare and production aspects. World's Poultry Science Association, Vol. 39, No. 3, pages 218-228.
4. Craig, J.V., and A.W. Adams, 1984. Behaviour and well-being of hens (Gallus Domesticus) in alternative housing environments. World's Poultry Science Association, Vol. 40, No. 3, pages 221-240.
5. Nicol, C., 1990. Behaviour requirements within a cage environment. World's Poultry Science Association, Vol. 46, No. 1, pages 31-33.
6. Elson, H.A., 1990. Recent developments in laying cages designed to improve bird welfare. World's Poultry Science Association, Vol. 46, No. 1, pages 34-37.
7. Appleby, M.C., and B.O. Hughes, 1990. Cages modified with perches and nests for the improvement of bird welfare. World's Poultry Science Association, Vol.46, No. 1, pages 38-40.
8. Wenger, R., 1990. Experience with the get-away cage system. World's Poultry Science Association, Vol. 46, No. 1, pages 41-47.
9. Appleby, M.C., and B.O. Hughes, 1991. Welfare of laying hens in cages and alternative systems: environmental, physical and behavioural aspects. World's Poultry Science Association, Vol. 47, No. 2, pages 107-128.
10. Bell, D.D., 1995. A case study with laying hens. In: Proceedings of Animal Behavior and the Design of Livestock and Poultry Systems Conference. Northeast Regional Agricultural Service, NRAES-84, pages 307-319.

Beak Trimming

11. Newlon, W.E., and J.R. Tavernetti, 1944. Debeaking poultry. University of California, Agricultural Experiment Station Misc. Publication.
12. Gentle, M. J., 1986. Beak trimming in poultry. World's Poultry Science Association, Vol. 42, No.3, pages 268-275.
13. Hughes, B.O., and M. J. Gentle, 1995. Beak trimming of poultry: its implications for welfare. World's Poultry Science Association, Vol.51, No. 1, pages 51-61.
14. Bell, D.D., 1996. Can egg producers afford to not beak trim their flocks? In Proceedings of the Forty-fifth Western Poultry Disease Conference, pages 92-93.

15 Bell, D. D., 1998. Beak trimming in caged layers. University of California Cooperative Extension misc. leaflet.
16. Bell, D.D., and R.A. Ernst, 1998. Performance and fearfulness during the production phase of Leghorn hens reared utilizing alternative beak trimming techniques. California Poultry Letter, January, pages 6-7.

Induced Molting

17. Wakeling, D.E., 1977. Induced moulting - A review of the literature, current practice and areas for further research. World's Poultry Science Association, Vol. 33, No. 1, pages 12-20.
18. Wolford, J.H., 1984. Induced moulting in laying fowls. World's Poultry Science Association, Vol. 40, No. 1, pages 66-73.
19. Bell, D.D., 1996. Moulting technologies - welfare issues. Speech given at: The Tenth Australian Poultry and Feed Convention, Melbourne, Australia, October..
20. Hussein, A.S., 1996. Induced moulting procedures in laying fowl. World's Poultry Science Association, Vol. 52, No. 2, pages 175-187.

General Welfare and Behavior

21. Freeman, B.M., 1976. Stress and the domestic fowl: A physiological re-appraisal. World's Poultry Science Association, Vol 32, No. 3, pages 249-256.
22. Bell, D.D., 1986. Stress research in California. Speech given at Colorado State University Poultry Symposium, June.
23. Freeman, B.M., 1988. The domestic fowl in biomedical research: physiological effects of the environment. World's Poultry Science Association, Vol. 44, No. 1, pages 41-60.
24. Wegner, R., 1990, Poultry welfare - problems and research to solve them. World's Poultry Science Association, Vol. 46, No. 1, pages 19-30.

Transportation and Handling

25. Freeman, B.M., 1984. Transportation of Poultry. World's Poultry Science Association, Vol. 40, No. 1, pages 19-30.
26. Broom, D.M., 1990. Effects of handling and transport on laying hens. World's Poultry Science Association, Vol. 46, No. 1, pages 48-50.
27. Scott, G.B., 1993. Poultry handling: a review of mechanical devices and their effect on bird welfare. World's Poultry Science Association, Vol. 49, No. 1, pages 44-57.
28. Sparrey, J.M., and P.J. Kettlewell, 1994. Shackling of poultry: is it a welfare problem? World's Poultry Science Association, Vol. 50, No. 2, pages 167-176.

Other

29. Bell, D., D. McMartin, F. Bradley, R. Ernst, 1998. Egg-type Layer Flock Care Practices. California Poultry Workgroup, University of California, Cooperative Extension.

Note: Extensive reference lists are also included in the following papers by the author: Cage design and density - item #10, beak trimming - item #14, molting - item #19.

ECONOMIC IMPLICATIONS of CONTROVERSIAL LAYER MANAGEMENT PROGRAMS

by
Don Bell, Poultry Specialist
University of California
Riverside, CA

"Economics drives the selection of systems, products, and procedures among a long list of alternative options".

Managers are charged with:

- choosing sound programs
- enacting them in detail
- monitoring their applications
- continuing their evaluation when new alternatives come along or when price/cost relationships change

Controversial Mangement Practices Used by the Table Egg Industry:

Using animals in any way

2. Caging of chickens
3. Beak trimming
4. Induced molting
5. Transportation and handling systems
6. Day-old male disposal methods at the hatchery
7. Slaughter practices

Cages for Table Egg Laying Flocks

Cages for Table Egg Laying Flocks

- ✓1930's: commercial application began
- ✓1940's and 50's: widespread use
- oday
  - ▸Worldwide 0-80%
  - ▸US: 98+%

Arguments Against Cages

- ✓ Birds can't express their "natural behavioral needs"
  - ▸ Nesting
  - ▸ Dusting
  - ▸ Choose their feed
  - ▸ Run around
  - ▸ Attempt to fly
- ✓ Cages are too small and are harmful to birds
  - ▸ Space per bird
  - ▸ Feeder space
  - ▸ Height
  - ▸ Wings and legs get caught
- ✓ Social pressures are intensified
  - ▸ Birds can't escape aggressive pen-mates
  - ▸ Increased densities encourage pecking

Other Disadvantages of Cages

- ✓The investment per bird is usually higher
- ✓The handling of manure may be a problem
- ✓Flies are generally a greater nuisance
- ✓Eggs from caged hens usually have a higher incidence of blood spots
- ✓The bones of caged layers are usuallly more fragile and are more easily broken

Arguments For Cages

- ✓Birds are removed from their own feces
- ✓Eggs were cleaner, food safety risks are reduced
- ✓Internal parasites are eliminated
  - ▸round worms
  - ▸coccidiosis
- ✓Working conditions are improved
- ✓Management is easier
- ✓Environments are improved
- ✓Feeding programs can be optimized
- ✓General flock health can be controlled

Other Advantages for Cages

- ✓It is easier to observe and care for the birds; no birds are underfoot
- ✓culling and handling of the is expedited
- ✓Chickens in cages consume less feed
- ✓Broodiness is eliminated
- ✓More birds can be placed in a given house or on a given parcel of ground

Trends in Cage Space Allowances

(square inches)

216 (1393 cm)
↓
108 (697 cm)
↓
72 (464 cm) EEU = 450 cm (1999)
↓
US (1999) 54 (348 cm)
↓
48 (310 cm)

EU Bans Battery Cages (1/28/99)

The European Union has voted to ban battery hen cages across Europe, starting in 2009. The European Commission had called for an increase in the size of battery hen cages from 450 sq cm minimum floor area to 800 sq cm by 2009.

But MEPs went a step further and agreed by a two-thirds majority to ban such cages altogether by then.

But Conservative MEP Robert Sturdy warned that the abolition of the battery system must also be backed by rules blocking the import of eggs from countries with weaker animal welfare standards.

45 Cage Density Studies

The effects of adding one more hen per cage:

Egg production: minus 14 eggs/bird/year

Mortality: plus 3.9%/year

SEE ATTACHMENT "A"

University of California
Cage Density Experiment - 1994

- 16" wide x 20" deep cage
- 5,6,and 7 birds per cage
- 53,000 DeKalb Delta White Leghorns
- 20 to 58 weeks of age
- 24 rows of 2200 birds each (av)

SEE ATTACHMENT "B"

The current proposal to eliminate cages within the next 10 years in Europe la a major step backwards in the way flocks are managed.

- ✓Flock health will be severely affected
- ✓Food safety will be jeopardized
- ✓Current no-wash egg cleaning policies may have to be changed
- ✓Higher flock mortality is likely to occur thereby offsetting some of the claimed advantages
- ✓"Changing from battery to free-range eggs would cost the average consumer less than $3.20 a year." This would represent $850 million per year in the US - not a small amount of money!

Caging is a pro-welfare system of housing laying hens.

It results in improved livability, healthier flocks and higher profitability.

Beak Trimming

Beak trimming is a management practice to reduce cannibalism, feather pecking, and other anti-social behavior in chicken flocks.

Benefits from beak trimming:

- ✓Reduced mortality from pecking
- ✓Reduced injuries and sub-normal performance
- ✓A general calming of the flock
- ✓Reduced feed wastage and feed usage

Today's beak trimming methods date back to the early 1940's (University of California)

Decisions to be made about beak trimming:

- ✓Age of birds to be trimmed
- ✓Timing relative to other management practices
- ✓Amount of beak to remove
- ✓Shape of the cut
- ✓Blade type and sharpness
- ✓Blade temperature
- ✓Time of cauterization

University of California Beak Trimming Experiment - 1993/94

(40 weeks plus 20 weeks of projected performance)

- 71,000 Hyline W-36 White Leghorn hens
- Non-trimmed vs 7 wk trimmed
- 18-58 weeks of age
- 6 birds per 16" wide x 20" deep cages

SEE ATTACHMENT "C"

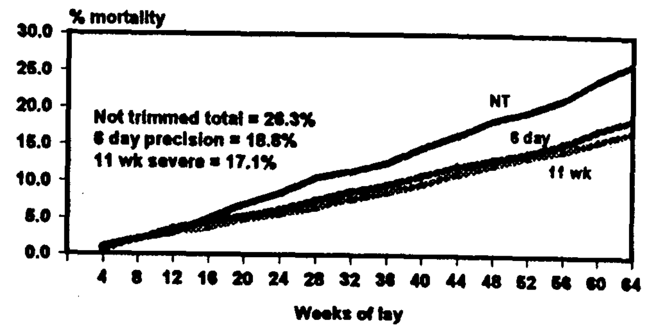
North Carolina State University Beak Trimming #1 Experiment - 1997

3 60 White Leghorn hens

- Non-trimmed vs ≤ day precision vs 11 wk severe
- 64 weeks of egg production

SEE ATTACHMENT "D"

Mortality Effects of Beak Trimming
North Carolina State University - 1997



SEE ATTACHMENT "E"

SEE ATTACHMENT "F"

Beak trimming is a pro-welfare management technique.

When done properly, it results in reduced mortality and improved profitability.

Induced Molting

Induced molting is a procedure used to rejuvenate laying flocks for a second or third cycle of production.

Molting, in nature or induced by the farmer, have the same effect - rejuvenation of the flock with resulting higher egg production, renewal of feathering and improvements in egg quality.

75-80% of US flocks are molted during their lives.

At any point in time, 25-30% of the nation's layers are either in a molt or have been molted earlier.

At any point in time, this represents some 70 million layers (out of 250 million).

"It is estimated that replacement programs that include molting result in at least 15% higher profit margins for the egg producer compared to all-pullet programs (1999)."

SEE ATTACHMENT "G"

Annual Profits:

2 cycle program = $1.32/hen housed
1 cycle program = $1.15/hen housed

Improvements = +15%

Disallowing the use of molting as a management technique would result in:

- ✓An increase in size (3%) of the nation's layer flock due to higher house utilization.
- ✓All-pullet flock would lay at a 4% higher rate than 2 cycle flocks.
- ✓(Both of these would have a major negative effect on egg prices)
- ✓Higher costs of production - at least 1.5 cents per dozen
- ✓Compared to a full 2 cycle program, a mandated 1 cycle program would result in:
  - ▸47% more chicks to hatch
  - ▸47% more breeding farms and flocks
  - ▸47% more hatcheries
  - ▸47% more male chicks to be destroyed
  - ▸47% more spent hens to market
- ✓Higher percentages and numbers of medium and small eggs
- ✓Reduced age at disposition - 105-110 to 75-80 weeks

Induced molting is a pro-welfare management technique.

It is done to lengthen the productive life of flocks and to improve profits in egg production.

"The well-being of commercial laying flocks is the result of the systems chosen and the quality of management to make them work as intended."

Careful monitoring of caging, beak trimming and induced molting procedures will minimize the risk, of hurting our flocks and their performance. High reproductive performance is an excellent indicator of overall good management.

The choices the farmer makes are driven mostly by economics and economics can not be arbitrarily dismissed from its important position.

Donald Bell
Cooperative Extension
University of California
Riverside, CA

"A

Performance results - UC experiment - 1994

Trait	5/cage	6/cage	7/cage
Hen-housed eggs	198	194.3	185.2
Av. egg weight (g/egg)	59.8	60.1	60.3
Total egg mass (kg/hen-housed)	11.84	11.65	11.16
Mortality ($)	6.5	8.4	9.4
Daily Feed Intake (g/hen)	105.6	101.4	99.4
Profit index/Hen Housed ($)	3.97	4.08	3.79
Profit/cage (High Costs) ($/cage)	4.68	6.18	5.32
Profit/cage (Low Costs)	11.98	14.66	15.06

"B"

Comparison of Housing and Equipment Costs

US (today) vs European Alternative Housing

Measurement	US (today)	Equipment (2x$)	Equipment (2x$)	Equipment (2x$)
Density (in)	54	54	70	124
Density (cm)	348	348	452	800
House capacity	100,000	100,000	77,000	43,548
House cost ($)	900,000	1,440,000	1,440,000	1,440,000
Cost per bird	$9.00	$14.40	$18.70	$33.07
B & E (cts/doz)	3.30	5.70	7.10	12.20
Interest (cts/doz)	2.00	3.30	4.10	7.00
Total B & E	5.30	9.00	11.20	19.20
COP (cts/doz)	42.30	46.00	48.20	56.20

"C"

Performance results - beak trimming experiment

University of California - 1993/94

Trait	Beak Trimmed	Not Trimmed	Statistcal Significance
Hen-housed eggs	191.5	195.7	High
Av. egg weight (g/egg)	58.9	59.7	High
Total egg mass (kg/hen housed)	11.27	11.68	High
Mortality (%)	3.39	4.73	High
Daily feed intake (g)	96	101.3	High
Profit index/hen housed ($)	3.99	4.00	Not significant
Profit (projected to 78 weeks of age) advantage	$.24/hen housed		

"D"

Performance results - beak trimming experiment

North Carolina State University - 1997

Trait	Non - Trimmed	6 day precision	11 week severe
Hen-housed eggs	316	335*	333*
Hen day egg production (%)	79.8	81.2*	80.9
Av. egg weight (g/egg)	61.1	61.5	60.5
Fearfulness score) (high score = fearful)	2.95	2.5*	2.2*
Feather score (high score = more feathers)	3	4.8*	5.75*
Mortality (%)	26.3	18.7*	17.1*
Daily feed intake (g)	122	114*	107*
Egg income minus feed cost ($/hen housed)	8.38	9.87*	10.23*

*** significantly different than non-trimmed birds**

"E"

Performance results - beak trimming experiment

#2 University of California - 1972

Trait	7 day precision	12 wk moderate	12 wk severe
Hen-housed eggs	216	213	231
Hen day egg production (%)	69.7	69.4	72.8
Av. egg weight (g/egg)	55.5	56.0	55.9
Mortality (%)	13.9	16.5	12.0
Daily feed intake (g)	116	113	114

22 to 70 wks of age

"F"

Performance results - beak trimming experiment

#3 University of California - 1981

Trait	Moderate 3/cage	Moderate 4/cage	Severe 3/cage	Severe 4/cage	One cut 3/cage	One cut 4/cage
Hen-housed eggs	246	217	243	244	232	216
Hen day egg production (%)	77.1	71.5	78.0	76.0	74.8	74.9
Daily feed intake (g)	104	105	103	103	103	105
Mortality (%)	7.3	18.0	11.5	8.6	15.6	24.2
Egg income minus feed cost ($/hen housed)	3.24	2.35	3.18	3.11	2.84	2.63

20 to 68 wks of age

"G"

Comparison of a single cycle program with a two cycle program - 1999

Trait	Single cycle (80 wk sale)	Two cycle (110 wk sale)
Average hens (%)	95.6	93.4
Average wkly mortality (%)	0.15	0.154
Hen day egg production (%)	77.9	72.9
Eggs per hen housed	312.9	428.7
Large & above eggs (%)	76.9	81.1
Total egg mass (lbs/hen housed)	41.7	58.1
Undergrade eggs (%)	5.5	5.6
Av. egg value (cts/dozen)	52.7	53.4
Daily feed consumption (g)	101.6	98.9
Feed per dozen (lbs)	3.45	3.60
Feed cost (cts/dozen)	25.0	26.0
Pullet cost (cts/dozen)	9.6	7.0
Feed + pullet costs (cts/dozen)	34.6	33.0

RESPONSE TO AN SE POSITIVE ENVIRONMENT TEST

George B.E. West

The request for a guided response by participants in the event of an Se Positive test of the environment suggest need for a review of the process by which testing has been incorporated into the plan, definition of the test and reason for its employment together with interpretation.

Testing as a component of the Plan was adopted by your Directors as a means of VALIDATING the appropriate performance standards for a given HACCP-like objective. It was NOT designed to qualify eggs or other product.

The test itself is prescribed in the voluntary owner/manager developed Egg Quality Assurance Program. Nominally it provides for an environmental test for presence of Se in each flock/fill of birds for each lay period..

It is applied through protocols developed by the industry, CDFA, and the University. It has been approved by both CDFA and CDHS. Test results are confidential.

The exact timing, frequency of application, and interpretation is prescribed in the Flock Plan which was developed with professional guidance. Test INTERPRETATION is by the same or competent professional guidance and requires careful review of required records and continuing professional observation of actual farm operations.

This means that preparation for a possible positive test is required from the very first:

1. Acquire adequate professional guidance in both design and implementation of your Plan.

2. Maintain valid, complete, and meaningful records of performance at each of the designated HACCP-like points.

3. Insure the professional you employ is provided adequate opportunity to observe, critique, and evaluate all production operations including adequate laboratory access.

The test requirement itself is a voluntary assumption of responsibility. The location, timing, and implementation of environmental testing is voluntary and the results of tests are confidential.

We will continue with panel presentation and discussion of how such tests can be most usefully applied and interpreted by Doctor Cardona and with specific accounts and recommendations by Doctors Bland and Cutler.

Approaches to SE environmental monitoring programs

General:

Each farm situation is different and hence, a recipe is not possible. But there are some general points that can apply to all producers.

1) Use environmental testing as a way to monitor your farm plan's effectiveness
    a. Tests are for your benefit
    b. They are an opportunity to make changes in your farm plan before there is a traceback
2) Manage your flocks as if they are already SE positive
    a. Clean out between flocks completely
    b. Control all pests
        i. Insects
        ii. Mammals
        iii. Birds
    c. Maintain farm biosecurity at top level
    d. Provide adequate sanitary facilities for workers and educate them about their use
3) Keep accurate records of all activities
    a. With names and dates
    b. Without records, your efforts will go unnoticed in the event of a traceback!
4) Maintain an ongoing relationship with a poultry veterinarian or professional poultry advisor and follow their advice
    a. They can help you develop a plan for your farm
    b. They can monitor your program and make changes as needed
    c. Be on their team and get the most from that relationship-it's a joint effort
    d. They can help to show that you have been reasonable and prudent in your actions in the event of a traceback

Pullet Management at Sexual Maturity: Lighting Programs

Ralph A. Ernst, Poultry Specialist
Department of Animal Science
University of California
Davis, CA 95616

Early Lighting

Lighting from placement to 16 weeks of age is not the main emphasis of this discussion. However, a pullet's response to stimulatory lighting, as it approaches sexual maturity is influenced by the light regimen used during the entire growing period. Any decrease in day length (photoperiod) during the growing period will have the effect of delaying the pullet's response when exposed to a stimulator-y photoperiod. This effect is more pronounced when the decrease occurs close to introduction of the photostimulatory photoperiod.

Recent reports have indicated that chicks exposed to continuous light (24 hour photoperiod) have a decreased immune response when compared to chicks reared on a photoperiod of 16L:8D (16 hours of light followed by 8 hours of darkness). This finding has caused us to change our recommendation of starting chicks on a photoperiod of 23L:1D. I now recommend starting chicks on a photoperiod of 16L:8D.

Why Control Sexual Maturity?

The lighting program is a tool which allows us to stimulate egg production at the optimum for the genetic strain. This should result in a more uniform age at first egg, good egg size, minimum problems with prolapse and pick outs, and more effective coordination of sexual maturity with feeding and management programs.

Biological Response to Light

The red, yellow and orange portions of the spectrum are most photostimulatory. All of the commonly used lamps have a reasonable light output in these ranges. The light pathway is directly through the scull to the brain and the eyes are not necessary for this response. The rate and direction of changes in photoperiod have important effects on the pullets' responses to stimulatory photoperiods. In general, short or decreasing photoperiods retard sexual maturity, long or increasing photoperiods stimulate earlier sexual maturity. Remember intermittent light can replace continuous light to produce the desired photostimulation of pullets or hens. Intermittent lighting programs must be used with caution because they may reduce eating time and feed intake. They are generally not recommended during the period of the pullets life that we are discussing today. Chickens have a photosensitive phase which occurs 11 to 16 hours after dawn or lights on. To be photostimulatory a light regimen must provide significant light during this portion of the 24 hour cycle.

How Much Light Intensity?

For practical purposes the minimum light intensity necessary for maximum egg production by a flock is usually considered to be 0.5 foot candle or 5 lux. This intensity needs to be present at the feed trough in the darkest part of the house. Lighting systems should be designed with more intensity than this as lamps become dirty and older lamps have reduced light output. For energy efficiency and optimum stimulation, it is desirable to design the system to provide at least 7 lux when the lamps are new and clean. A flocks response to light intensity is probably influenced by the light intensity in the contrasting dark cycle and by the intensity experienced in the growing period.

Factors Affecting Lighting Programs

Of course, seasonal day length affects programs in open housing. In closed housing the light intensity when the lights are off during daylight hours affects the intensity needed to get good light entrainment in pullets. Experimental evidence also indicates that the season affects how a pullet will respond to a step-up lighting program. Chickens have an innate seasonal rhythm in their response to day length changes. This means that an increase from a 10 to an 11 hour photoperiod would be more stimulatory if given in January as compared to June.

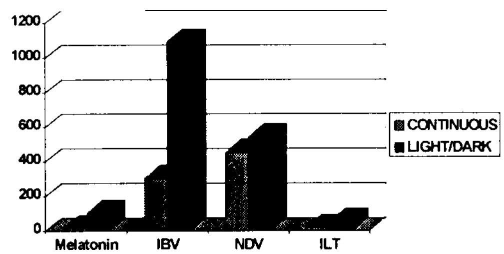
Stimulatory Programs

The two most common programs used to stimulate egg production in chickens are step-up or abrupt increases in photoperiod. In the early 50's step-up programs were advocated based on unreplicated tests which were published in the popular literature. Later research did not confirm this benefit from step-up lighting and in fact clearly showed that there was no benefit to either step-up lighting or photoperiods longer than 14 hours (or equal to the longest natural day length in open houses). I do not recommend step-up lighting because I believe that the response of pullets to step-up programs will vary with season and is less predicable than the response to an abrupt increase in photoperiod.

Pullet Management at Sexual Maturity: Lighting Programs

Ralph Ernst
Poultry Specialist
Dept. Animal Science, UC Davis

Affect of Lighting Program on Immune Responseof Leghorn Chicks



Why Control Sexual Maturity?

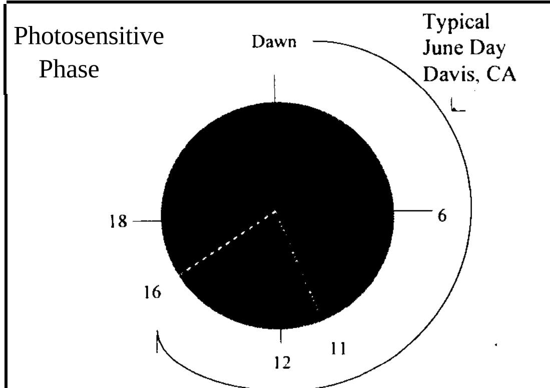
- Stimulate at optimum age for strain
- Increase early egg size
- Reduce prolapse/pick outs
- Bring flock into lay uniformly
- Allows coordination of feeding and management programs with onset of egg production

Biological Response to Light

- Light pathway is directly through the skull to the sensitive neurons in the brain
- Blue light is most stimulatory to neurons but does not penetrate effectively
- The yellow, orange, and red portions of the spectrum are most stimulatory
- All commonly used lamps are useful

Biological Response to Light

- Rate and direction of changes in photoperiod are important
- Short or decreasing photoperiods retard gonadal development
- Long or increasing photoperiods stimulate gonadal development
- Any decrease in daylength before light stimulation will affect onset of sexual development
- A continuous photoperiod is not required



Definitions

- ◆ Foot candle - intensity of light 1 ft. from a standard candle
- ◆ Ft. candle = 10.8 iux

How Much Light is Enough?

- 5 lux or .5 ft. candles are considered minimum intensity for maximum egg production
- ◆ Output of lamps declines with lamp age so start with at least 7 lux

Factors Affecting Lighting Programs

- ◆ Seasonal daylength in open housing
- ◆ Degree of light control in housing
- ◆ Seasonal affect on light sensitivity

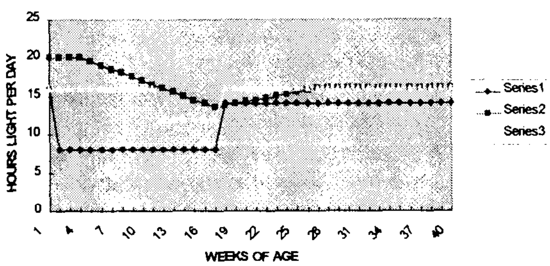
Lighting Programs to Control Sexual Maturity

- ◆ Seasonal daylength, if decreasing
- ◆ Short day programs; 6 to 10 hour photoperiods starting before onset of sexual maturity in light-controlled houses
- Decreasing daylength used in open houses during periods when natural daylength is increasing
- ◆ Constant daylength (e.g. 14 hours)

Stimulatory Programs

- Step up to constant daylength
- ◆ Abrupt increase to constant daylength

FIGURE 1. LIGHTING SCHEDULES FOR COMMERCAL LAYING PULLETS



PULLET/EARLY LAY NUTRITION

H. John Kuhl, Jr., Ph.D.

MAIN TOPICS

- The Critical Time 15 Wks to Peak
- Nutritional Differences Among Strains
- The Affect of Environment on Pullet Nutrition
- Performance Indicators

THE CRITICAL TIME 15 WEEKS TO PEAK

- Skeletal Condition
- Egg Shell Thickness
- Mortality Rate
- Body Weight
- Future Egg Size
- Egg Production

THE CRITICAL TIME 15 WEEKS TO PEAK

1. **Skeletal Condition**
- During Pre-lay Skeletal Weight Increases
- 5 gram of calcium storage
- An Egg Contains 1.5 to 2.2 Grams of Ca
- 55% of Ca is available for eggshell
- 3.65 grams of Ca per day per large egg
- 19 lbs of feed intake requires 4.23% Ca

THE CRITICAL TIME 15 WEEKS TO PEAK

2. **Mortality Rate**
- Soft Bones
- Cage Layer Fatigue
- Egg Bound Syndrome

THE CRITICAL TIME 15 WEEKS TO PEAK

3. **Body Weight**
- Tough to put weight on in production
- Low initial feed intake to peak

THE CRITICAL TIME
15 WEEKS TO PEAK

4. Egg Size
- Body weight or size and fat content
- Calorie intake
- Fatlevelofthefeed
- Amino acid levels and ratios
- Straincharacteristks

THE CRITICAL TIME
15 WEEKS TO PEAK

5. Egg Production Rate
- Body weight will influence feed intake
- Skeletal condition affect flock health
- Eggs are lost due to poor shell
- Early molt mat be required

STRAIN DIFFERENCES

1. Early Maturity Strains
- Babcock B300
- Hy-Line W98

2. Later Maturity Strains
- Hy-Line W36

AFFECT OF THE ENVIRONMENT

Temperature
- 5 degrees (F) equals 0.75 lbs

Housing Density
- Competition for feed
- Local temperature (where the hen lives)

PERFORMANCE INDICATORS **PULLETS**

- Body Weight
- Feed Intake
- Mortality

PERFORMANCR **INDICATORS** LAYERS

- Feed Intake
- Egg Production
- Body Weight
- Egg Grade Outs
- Case Weight
- Mortality

MANAGING THE SEXUALLY MATURING REPLACEMENT PULLET FLOCK

BY
Don Bell, University of California Poultry Specialist
Riverside, California 9252%

Much has been said about the optimum management conditions for the growing pullet and the adult layer but one of the most critical periods in the life of a chicken is that associated with her transition from being an adolescent pullet to a sexually mature layer. Both the pullet grower and laying flock owner must be involved in a series of immensely important management decisions which must occur on time for optimum lay house results.

The breeder has provided us with very detailed management guides which are designed to outline the optimum management programs for their specific strains. In addition, these guides tell us what to expect in regards to performance during both the growing and laying stages. These well documented guides inform us of space requirements feeding programs, lighting programs, and disease management tips. They also provide us with body weight, egg production and egg size information.

PULLET QUALITY

The term "pullet quality" means different things to different people. To some it is measured by body weight, skeletal structure or physical appearance. But, to the ultimate user, it has to mean:

"A flock with undiminished capacity to perform to
the limit of it's genetic potential".

We commonly quantify measurements associated with quality such as: body weight, frame measurements, fat estimates, nutrient intake, and blood titers. These must be done to measure the flock's progress, but they are not in themselves assurances of success for lay house performance. Other measures are of a more qualitive nature, for example: lighting, beak trimming and immunization programs. These must be based upon sound principles, well documented research and personal experience.

Above all, programs must be applied equally to every single bird and uniformity of results measured by observing the individual bird reactions in terms of body weight uniformity, blood titer uniformity, frame measurements, etc.. A program that results in a wide spread of results between individual birds has not been successfully applied.

DETERMINING THE OPTIMUM AGE TO INITIATE SEXUAL MATURITY

From an economic standpoint, the age at sexual maturity can be defined as that age when we want the flock to get to work doing it's intended job --

producing eggs for a profit. Biologically, it has been defined as the age of first egg for the individual bird or the age at which 5% or 50% production is reached for the flock.

The age selected or recommended by the breeder usually is a specific age associated with a specific body weight. Some breeders place more emphasis on age, some place more emphasis on body weight. In reality, though, both must be considered and in most countries, the season of the year must be a third factor to consider.

In general, sexual maturity should be initiated somewhere between 16 and 22 weeks of age. This represents body weights between 2.75 and 3.00 pounds (1250 to 1360 grams). Winter housed flocks are usually larger and may be stimulated at earlier ages since there is usually less penalty for producing the smaller egg sizes at this time of the year. Summer housed flocks are usually smaller and, therefore, stimulation should be delayed until suitable body weights are achieved. Smaller egg sizes are severely penalized and early eggs are just not worth anything.

Where eggs are sold by weight and each increment of average egg weight is compensated for at the same unit price (or higher), body weight at initiation of sexual maturity stimulation becomes extremely important. Every attempt must be made to stimulate maximum egg mass at the best feed conversion on a weight of feed to weight of eggs basis.

BODY WEIGHT AND UNIFORMITY

Body weights must be taken throughout the rearing period to evaluate the flock's progress and the timeliness of ration changes. Group body weights, though, do not tell us how well the individual birds have responded to treatment nor do they measure the potential for rapid and high sustained peaks following stimulation. Individual bird variation must be evaluated.

Several measures of uniformity have been developed and adopted by the industry. All measure the proportion of the flock around a central average weight.

The researcher uses the term "standard deviation" to measure the normal distribution of weights within a flock. The general expectation is for 68% of a flock to be within + or - one standard deviation of the average weight. The standard deviation figure is stated in terms of weight and, of course, varies with the age sampled.

The poultry industry has adopted the concept of "percent within + or - 10% of the average weight". This number measures the same tendency to group around the average and is typically seen at around 70 to 80% for typical flocks depending upon the weighing system used.

We've suggested using the method of "percent within + or - 10% of the breeder's standard" as one which would more accurately assess the growers success in reaching optimum weights as identified by the breeder in a high percentage of his birds.

Uniformity in itself is neither good or bad. It may merely measure, though, the grower's ability to raise uniformly small or uniformly large pullets -- neither of which may be economically optimum,

SEXUAL MATURITY

As stated earlier, the productive potential of the flock can be markedly affected by what takes place at the juncture between the growing pullet and the mature layer. For the individual pullet, this critical period may be anywhere between 16 and 30 weeks of age. As the flock lays its first egg, only one pullet can be considered to be sexually mature but as egg production rises, a higher and higher percentage of the flock is considered to be mature until peak production is reached somewhere between 27 and 32 weeks of age.

UNIVERSITY OF CALIFORNIA FLOCK LIFE HISTORY STUDIES

In 1980 to 1983 some 114 commercial California laying flocks were studied relative to life-long performance. This study represents some 11 strains of White Leghorns raised by 20 different growers. University personnel measured body weights, egg weights, and shell quality throughout the lives of each flock. Weekly computer flock records were also analyzed concerning egg production, feed intake, mortality, etc. All data were assigned common economic values and result were analyzed by standard statistical procedures for averages, trends and correlation of factors. Some of this data has been published in various University of California publications, and the popular press. Much of the material presented in this discussion has not been published before.

A highly significant seasonally related body weight curve was observed. Lowest body weights were obtained in late spring and early summer hatched flocks. Highest body weights were obtained in our late fall and early winter hatched flocks. These body weight relationships were highly correlated with early egg size.

EFFECTS OF 18 WEEK BODY WEIGHT ON LAYER PERFORMANCE

Absolute weights at 18 weeks of age when correlated with various layer performance factors are shown in Table 1. This factor though, measures body weight per se and, therefore, is not only a comparison of light and heavy weight effects within flocks but also between strains of different inherent weight characteristics.

Table 1. The effect of 18 week body weight on layer performance to 60 weeks of age. (one-third of flocks in each class)

Trait	light	medium	heavy	P*	r**
Body weight (18 wk) (lbs.)	2.47	2 66	2 8	--	--
% uniformity (18 wk)	71.3	69.7	7i.f:	--	0.011
Wkly. mortality (%)	0.248	0.240	0.321	0.014	0.258
Hen day egg production (%)	72.1	74.0	72.6	0.283	0.122
Hen housed eggs/60 weeks	191.8	197.7	192.7	--	0.100
Av. egg weight (g)	57.4	57.5	58.5	0.001	0.377
Total egg mass (kg)	11.00	11.40	11.25	0.057	0.214
Daily feed (lbs.)	0.226	0.234	0.234	0.099	0.190
Feed/dozen (lbs.)	3.43	3.54	3.65	0.012	0.287
Feed:egg (ratio)	2.17	2.23	2.27	0.092	0.195
Profit ($ egg income minus feed cost)	4.49	4.60	4.38	--	-0.020

* = Probability factor (.05 or less is considered significant)
** = Coefficient of correlation (a correlation of 1 .O indicates a perfect relationship between the two factors. The smaller the factor, the more other factors are involved). Both P and r were measured using all flocks where common data were available. All regression analyses were tested linearly only.

Of the factors analyzed, mortality rate, average egg weight and feed conversion (lbs.doz.) were shown to be affected by 18 week body weights. Additionally, adult body weights were also positively affected by 18 week weights.

Interestingly, daily feed consumption, egg production nor profitability were significantly affected by 18 week body weight.

BODY WEIGHT RELATIVE TO BREEDER STANDARD

Because each breeder has a different body weight standard, the question of body weight and it's relationship to layer performance should be examined using the optimum weight for each strain. Table 2 illustrates these relationships.

Table 2. The effect of 18 week body weight divided by breeder standard on performance to 60 weeks of age. (one-third of flocks in each class)

Trait	light	medium	heavy	P*	r**
Body weight/standard (18 wk.) (%)	91.0	100.7	108.2	--	--
% uniformity (18 wk)	73.7	70.2	69.0	0.015	-0.232
Wkly. mortality (%)	0.225	0.285	0.305	0.038	0.218
Hen day egg production (%)	72.3	73.0	73.6	0.122	0.174
Hen housed eggs/60 weeks	193.2	193.5	195.7	0.191	0.148
Av. egg weight (g)	57.3	57.9	58.3	0.001	0.331
Total egg mass (kg)	11.07	11.22	11.37	0.035	0.237
Daily feed (lbs.)	0.230	0.230	0.234	0.061	0.215
Feed/dozen (lbs.)	3.51	3.47	3.64	0.021	0.265
Feed:egg (ratio)	2.22	2.17	2.28	0.093	0.194
Profit ($ egg income minus feed cost)	4.43	4.58	4.48	0.821	0.026

See footnotes in Table 1.

When flocks were compared to their breeder standard, several important relationships emerged. The lighter weight flocks had significantly higher uniformity, lower layer mortality rates, smaller eggs, and lower total egg mass. But, as before, neither egg production nor profitability could be shown to be affected.

A linear regression analysis measures progressively higher or lower trends. In an analysis of "optimum" weights a curvilinear analysis would better define these relationships. Our presentation of results by one-third groupings is done to show where median weights may prove to be optimum. Curve fitting for other than linear relationships have not been done at this time.

24 WEEK RATE OF LAY AND LAYER PERFORMANCE

When flocks were analyzed using their 24 week rate of lay as a measure of "sexual maturity", a new set of relationships emerged. Table 3 lists these.

Table 3. The effect of 24 week egg production rates on performance to 60 weeks of age. (one-third of flocks in each class)

Trait	low	medium	high	P*	r**
Hen day (%) at 24 wks.	29.1	59.2	75.3	--	--
% uniformity (18 wk.)	73.8	71.0	69.0	0.001	-0.348
Wkly. mortality (%)	0.200	0.258	0.28	0.003	0.327
Hen day egg production (%)	69.4	73.9	75.6	0.001	0.715
Hen housed eggs/60 weeks	186.5	196.2	199.6	0.001	0.569
Av. egg weight (g)	57.6	58.1	57.7	0.305	0.115
Total egg mass (kg)	10.75	11.39	11.51	0.001	0.545
Daily feed (lbs.)	0.229	0.235	0.229	0.306	0.117
Feed/dozen (lbs.)	3.52	3.59	3.50	0.701	0.044
Feed:egg (ratio)	2.21	2.24	2.22	0.635	0.055
Profit ($ egg income minus feed cost)	4.28	4.53	4.71	0.001	0.430

See footnotes in Table 1.

Flocks which have reached higher levels of egg production at earlier ages are shown to experience higher rates of adult mortality but prove to have significantly higher egg production rates and hen housed egg production, more total egg mass and finally, greater egg income after feed costs are subtracted.

AGE AT PEAK PRODUCTION

A significant number of flocks today are reaching 90% hen day production before 28 weeks of age. Even though industry average peaks occur at 30 weeks, the evidence presented in Table 3 indicates justification for attempting to meet earlier sexual stimulation ages. This must take into consideration all the factors previously mentioned.

MAJOR CONSIDERATIONS WHEN INITIATING SEXUAL MATURITY

Obviously, sexual maturity cannot be initiated before the flock is physiologically able to lay. Research by breeders indicated that this may be possible before 16 weeks and maybe as early as 14 weeks. From a practical standpoint, 16 weeks should be considered as the earliest we can now recommend. On the other hand, some research has shown intentional delaying to 24 weeks or older may have economic benefits in some regions. Because of the results shown in Table 3, we would urge extreme caution before following this procedure.

The management of the flock at this age must be suitable to make the transition from growing bird to layer as smooth as possible without harming the individual bird or jeopardizing her future performance as a layer. The areas of principle concern include: handling, lighting and feeding programs.

HANDLING

As flocks are prepared to be moved into new facilities, care must be taken to keep associated stresses to a minimum. The physical handling of the birds during the catching, crating and moving process is a major stress in itself and it must not be done concurrently to other imposed conditions such as vaccination, beak trimming or bad weather conditions.

The adjustment to new housing and equipment must be handled with care. Feed and fresh water must be available upon arrival. The birds may have trouble finding them and cups and troughs should be full of water and feed. If watering systems are different from the grow equipment, they should be hand-filled and birds should be watched to make sure they adjust to the new system.

- Avoid multiple stresses
- Do not trim beaks within 2 weeks of moving or vaccination
- Do not vaccinate and move at the same time
- Do not move later than 18 weeks of age
- Avoid crowding crates and moving racks
- Don’t delay deliveries after birds are crated
- Remember that multiple stresses are additive

LIGHTING

At sexual stimulation, lighting programs must be changed. Flocks which have been grown on constant daylength or decreasing patterns will now be exposed to a step-up in hours to either a constant higher number of hours or a gradual step-up program.

Programs must recognize the normal daylength patterns existing in the area where pullets are grown and to be kept as layers. The longest day of the year in Northern latitudes is June 21; the shortest day is December 21. The higher North, the longer the daylength and the greater the weekly change. Maximum weekly changes approach 30 minutes at 50 degrees N. latitude, while they are less than 10 minutes at 20 degrees N. latitude. Lighting programs are designed to simulate the positive aspects of natural light conditions.

In general, the growing pullet should never be subjected to a decreasing pattern of daylength and the adult layer should never be given decreasing daylengths. Breeders differ in their recommendations relative to starting into lay. We suggest a minimum of 13 hours and a maximum of 15 to 16 hours depending upon the latitude.

Pullets should be targeted to receive either a minimum of 13 hours at stimulation age or if placed in open housing, an increase of at least 1 hour if natural daylengths are at or above 13 hours. Timeclocks should be adjusted upwards by 15 to 30 minutes per week until the 15 or 16 hour adult program level is reached. This should allow at least 2 or as many as 12 consecutive weeks of increasing daylengths.

UNIVERSITY OF CALIFORNIA AGE AT SEXUAL STIMULATION EXPERIMENT

In 1987/88 research was conducted in Southern California to compare stimulation at 16, 18 and 20 weeks of age. Three popular White Leghorn strains were included in the experiment which ran for 44 weeks between 20 and 64 weeks of age. Stimulation was initiated by feeding a pre-lay ration for 2 weeks and immediate increase of artificial lights when birds were moved at each age.

Table 4 compares some of the more significant results of this experiment.

Table 4. The effect of sexual stimulation age on performance to 64 weeks of age

Trait	16 wks	18 wks	20 wks	P*
Hen housed eggs	230.6	224.0	218.0	0.010
Hen day (%)	78.1	76.3	74.3	0.001
Mortality (%)	6.9	8.0	7.6	n.s.
Av. egg weight (g)	60.2	60.2	59.7	n.s.
Total egg mass (kg)	13:s	13.5	13:o	0.004
Feed/day (g)	102.9	102.7	102.1	n.s.
Feed/dozen (kg)	1.59	1.62	1.66	0.001
Feed:egg (ratio)	2.19	2.24	2.31	0.001
Profit ($ egg income minus feed cost)	5.56	5.30	5.07	0.002

• Linear regression

Egg production, both hen day and hen housed, were significantly higher in the earlier stimulated groups. Average egg weight and daily feed consumption were not affected by age at stimulation. Feed conversion and feed to egg ration were both favorably affected by stimulation age. Most importantly, the profitability analysis showed a significantly higher income was the result of early stimulation.

FEEDING PROGRAM

Egg producers commonly place too much importance on feed consumption and nutrient intake during early stages of production. Because of significant differences in feed intake between non-layers and layers during the 20 to 30 week period, low feed intake calculations are meaningless relative to the needs of the birds actually in lay.

Breeders have expressed different recommendations regarding the feeding program to be used during the first few weeks of lay. Some recommend a pre-lay period of intermediate calcium levels while others suggest the flock be placed immediately on layer diets.

Some nutritionists have suggested a pre-lay diet consisting of half coarse particles and half fine particles would allow the precocious pullets to balance their own diets by selecting the larger particles to supplement the finely ground basal diet. The slower pullets would nof be forced to eat a high calcium diet since they could avoid eating the larger particles.

A University of California experiment to elucidate this issue was conducted in 1984 with results which tended to support the concept of pre-lay diets but when tested statistically failed to substantiate the recommendation (see Table 5).

Table 5. The effect of calcium particle size during early lay*

Trait	100% grd. limestone	50% oys. shell	50% oys. shell (4 wks.)
Hen housed eggs	157.2	153.5	161.9
Mortality (%)	8.0	9.8	5.4
Egg income minus feed cost ($)	3.02	2.88	3.20

* 32 week test. Results were not significantly different.

Even though this experiment failed to demonstrate a statistically significant reason to recommend this procedure, we still feel the trends shown in this experiment justify the procedure.

At first egg, feed 2% calcium - half coarse, half fine
At 5% production, feed 3.5 to 4.0% calcium - half coarse, half fine.

SUMMARY

The transition period from growing pullet to mature layer is extremely critical to layer performance. It involves many decisions and accurate follow-through if optimum performance is to be realized.

IT MUST BE DONE RIGHT!

DB:jb 3/90

Rate of Lay at 22 Weeks
- Its Effect on Layer Performance and Profits

Rate of Lay at 22 wks	20%	30%	40%	50%	60%
Egg Wt (30 wks) (lbs/cs)	45.5	45.6	45.6	45.6	45.7
Egg Wt (20-60 wks) (lbs/cs)	47.5	47.6	47.6	47.7	47.7
Egg production at peak (%)	92.2	92.2	92.3	92.3	92.4
Egg production (20-60 wks)	78.5	79.3	80.1	80.9	81.6
Egg production at 60 wks	77.3	77.1	77.0	76.8	76.7
Eggs/HH to 60 wks	219.0	221.1	223.2	225.3	227.4
Egg production slope (%)	0.45	0.46	0.46	0.47	0.47
Total egg mass to 60 wks (kg)	13.00	13.11	13.23	13.35	13.47
E.I. minus F.C./HH	5.09	5.15	5.20	5.26	5.32

Source: 203 National flocks (1998)

Summary of 355 National Flocks - 1998

Egg production at 22 wks %	No. of Flocks	% Died at 22 wks %	HD EP at 22 wks %	Egg Wt at 22 wks lbs/case	Feed Cons. at 22 wks lbs/100	Flock Index thru 22 wks $/HH
0 to 10	15	0.048	5.5	36.3	16.1	-0.172
10 to 20	32	0.095	15.1	36.0	16.3	-0.131
20 to 30	41	0.104	25.3	36.9	16.4	-0.104
30 to 40	45	0.117	34.7	37.4	16.4	-0.072
40 to 50	47	0.143	45.3	37.3	16.7	-0.045
50 to 60	52	0.196	55.2	37.8	16.8	-0.004
60 to 70	58	0.129	65.1	38.4	16.7	0.040
70 to 80	51	0.155	75.0	38.9	16.2	0.087
80 to 90	14	0.181	84.7	39.2	16.5	0.177
	Avg.	0.136	47.6	37.7	17.9	-0.021

Prepared by Don Bell, University of California (November, 1999)

Flock Performance Associated with Age and Month of the Year (25 to 29 weeks of age).

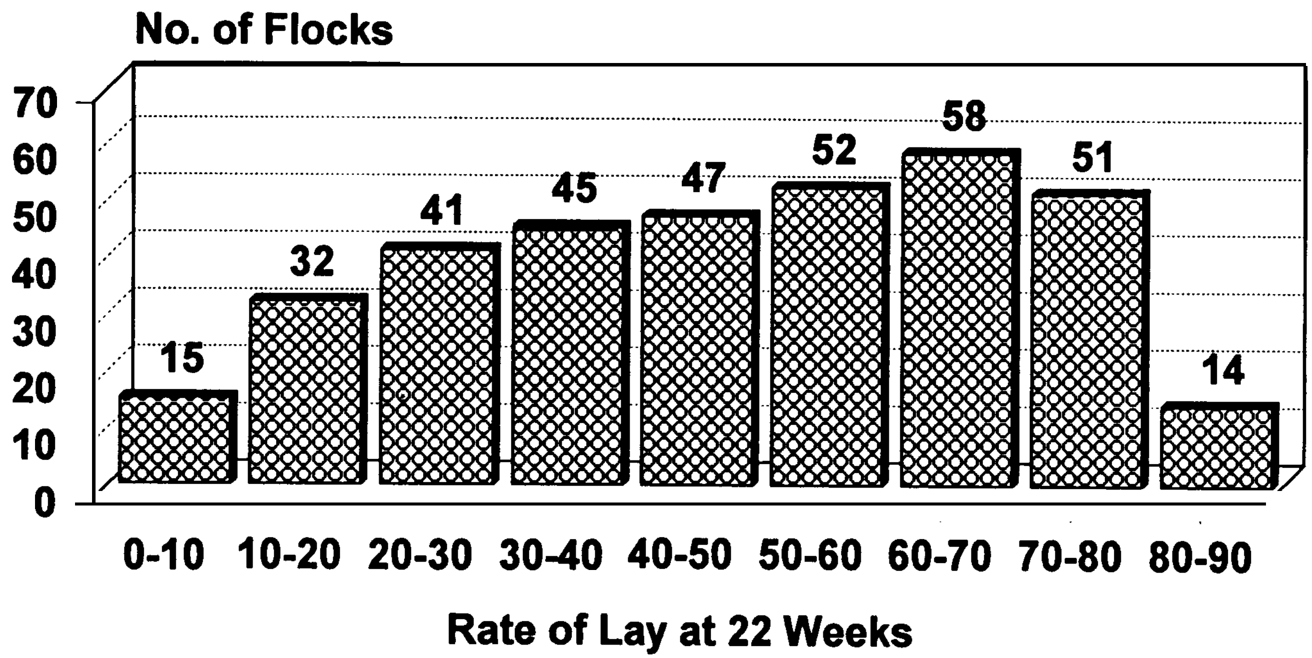
National Flock Study - 203 flocks - controlled environment housing

Age	Month of lay	Flock weeks	HH PROFIT PER WK	DIED %	H.D. %	EW LB/CS	EM G	BW LBS	FD LBS	F/DZ LBS	F/E RATIO	ME CAL	AV F	WATER INFORMATION GAL/100	W:FD RATIO	W:EMASS RATIO	WATER/BW %
25 to 29	Jan	82	0.151	0.136	90.1	44.6	50.7	3.38	22.4	2.98	2.01	295.7	71.3	4.78	1.71	3.43	11.34
	Feb	67	0.151	0.147	89.9	44.3	50.2	3.46	22.1	2.95	2.00	292.5	70.6	4.82	1.75	3.50	11.12
	Mar	82	0.146	0.146	90.7	44.0	50.3	3.47	22.9	3.03	2.06	301.0	71.6	5.05	1.79	3.63	11.67
	Apr	67	0.147	0.143	90.7	44.2	50.5	3.52	22.6	2.99	2.03	296.5	73.1	4.89	1.76	3.53	11.21
	May	79	0.152	0.131	91.2	44.4	50.9	3.48	22.4	2.95	2.00	297.2	75.0	5.12	1.84	3.65	11.96
	Jun	120	0.150	0.131	90.2	43.7	49.7	3.43	21.3	2.83	1.95	276.4	77.8	5.22	1.99	3.82	11.87
	July	79	0.153	0.154	90.1	44.1	50.0	3.48	21.3	2.84	1.94	277.5	79.3	5.32	2.00	3.86	12.25
	Aug	85	0.150	0.131	90.2	44.0	50.0	3.39	21.8	2.90	1.98	285.2	77.9	5.03	1.86	3.67	11.74
	Sep	65	0.150	0.119	89.3	43.9	49.5	3.43	21.5	2.89	1.97	282.3	75.3	5.00	1.86	3.66	11.54
	Oct	86	0.148	0.110	89.4	44.0	49.6	3.43	21.8	2.93	2.00	284.9	72.3	4.88	1.80	3.57	11.38
	Nov	100	0.146	0.104	89.4	43.8	49.4	3.44	22.1	2.97	2.05	289.0	71.6	5.02	1.82	3.68	11.67
	Dec	102	0.150	0.121	89.8	44.0	49.8	3.42	21.7	2.90	1.99	288.0	71.9	4.84	1.78	3.52	11.29
	All	1014	0.150	0.130	90.1	44.1	50.0	3.44	22.0	2.93	2.00	288.4	74.1	5.01	1.84	3.64	11.60

Note: Flock index assumes equal egg prices for all months, but calculations are based upon egg weights.

Prepared by Don Bell, November 5, 1999

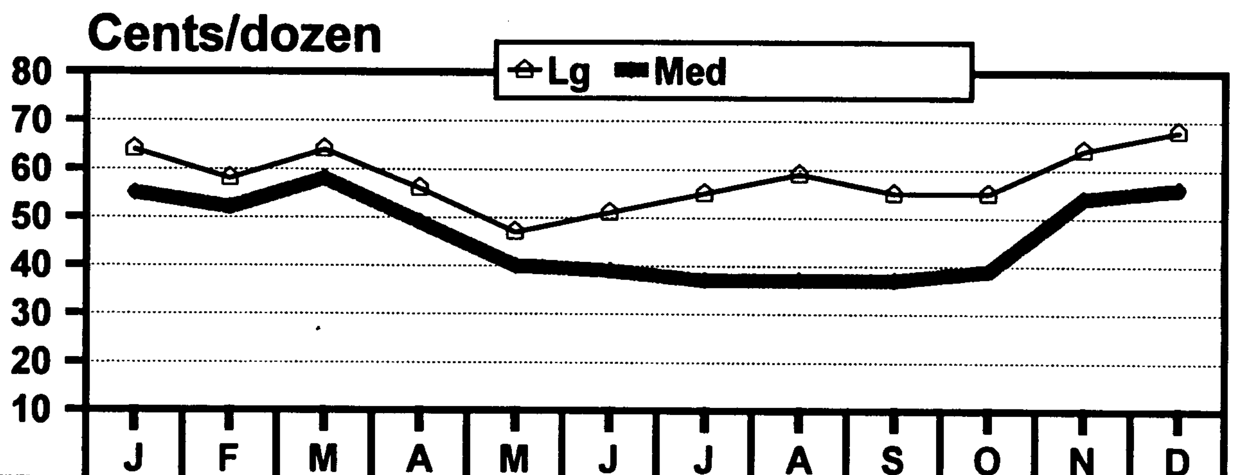
Frequency of Rate of Lay at 22 Weeks of Age



Source: 355 National Flocks (1998)

Changing Spread Between Large and Medium Prices

1993-1997 data



	J	F	M	A	M	J	J	A	S	O	N	D
Spread	9	6	6	7	7	12	18	22	18	16	10	12

Month

Av prices = Lg: 57.9 Med: 46.0

Flock Behavior

Neil O'Sullivan Ph.D.
Hy-Line International

Flock Behavior

What You Can Learn From Your Chickens to Make You a Better Manager

QUESTIONS A POULTRYMAN SHOULD ASK

- **Do chickens need to be socialized?**
- **Does beak trimming protect chickens or profits?**
- **Do chickens communicate?**
- **Do chickens sing?**
- **Why ask these questions?**

THE CHICKEN AS A SOCIAL ANIMAL

1. Chickens given a choice will live in social groups.

THE CHICKEN AS A SOCIAL ANIMAL

2. Chickens need to be socialized.

- **To each other.**
- **To the opposite sex if being bred.**
- **To human caregivers.**
- **To all aspects of their future environment.**

THE CHICKEN AS A SOCIAL ANIMAL

3. Social deprivation, social ostracizing, abnormal behavior.

CAGE ADAPTION SYNDROME

- Freeze or flight response to stress.
- Sexual maturity.
- Changing environments.
- Age at moving.
- Change in bird density.

STERILE VS. ENRICHED ENVIRONMENT

- Are cages sterile environments?
- Should cage environments be enriched?
- Can birds grown on the floor be housed in cages?
- Is the floor a "safe environment"?
- Group size 5 vs. 9 vs. 25, vs. 10,000

CHICKEN COMMUNICATION

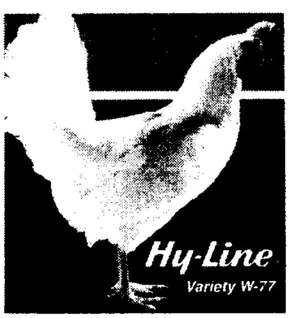
As an example, mating behavior:

- Birds must be brooded intermingled.
- What is normal communication.
- Catching her eye!
- Normal sequence of mating behavior.
- Abnormal behavior and the environment.

A FUTURE FOR BEAK TRIMMING?

- Can breeders breed a chicken that is non aggressive.
- Is aggression and displaced ground pecking the main reason for beak trimming?
- Is control of feed usage more important then behavior modification.
- Can birds be left with intact beaks?
- Protection or profit.
- Special circumstances. Therapeutic beak trimming.

ARE THERE ANY QUESTIONS?



Update on Federal Egg Safety Issues

Jill A. Snowdon, Ph. D., Director of Food Safety Programs, Egg Nutrition Center

I. INTRODUCTION

- Egg Nutrition Center
- Current trends in food safety policy

II. CHRONOLOGICAL OVERVIEW -- 1999

- Re-packaging
- Food Safety Council created
- Egg Safety Hearing (Sen. Durbin)
- Hearing on single food safety agency (Sen. Durbin)
- Regulation on refrigeration during storage and transit goes into effect
- Labeling & retail refrigeration proposed
- Egg Safety Task Force created, public meeting held
- UEP's integrated plan
- Release of CDC report on incidence of foodborne disease
- Bill on Egg Safety (Sen. Durbin)

III. PENDING ACTIVITIES

- Farm-to-table plan to be announced
- Labeling & retail refrigeration
- HACCP for pasteurized egg products
- Molting
- Genetically modified feed
- Refrigeration – rapid or early, time-temperature indicators
- Date stamping
- ARS research
- Vaccines

IV. OUTBREAKS

V. CONCLUSION

SELECTED WASHINGTON OFFICE ACTIVITY

June-October 1999

Labeling

On July 6, the Food and Drug Administration proposed to require a safe handling label on all eggs sold at retail, as well as requiring a 45 ° ambient temperature requirement for retail stores. UEP strongly objected to the wording in the proposed safe handling label. UEP took the following actions among others:

✓ Conducted an emergency meeting to discuss the problem and formulate alternative label wording.
✓ Worked with AEB to coordinate consumer testing of the FDA proposed label and alternatives.
✓ Under the guidance of UEP leadership, selected the wording to be proposed as an alternative to FDA.
✓ With the help of objective scientific information provided by the Egg Nutrition Center, formulated and framed arguments for use in UEP's formal comment letter and in communications with the media and Capitol Hill.
✓ Worked with Aronow & Pollock in preparing media strategies and responses to articles and comments about the labeling proposal and related egg safety issues.
✓ Extensively discussed strategy with Congressional staff sympathetic to UEP's point of view in order to explore various legislative and regulatory options.
✓ Drafted a letter for members of Congress to send to FDA supporting UEP's position.
✓ Alerted all UEP members to the letter and requested contact with their Congressmen.
✓ Conducted a briefing for Congressional staff to seek support for UEP's position and signatures on the letter.
✓ Provided information and draft comments to other agricultural and agribusiness groups, requesting their comments in support of UEP.

The comment period ended September 20. A final rule could be issued in the near future.

Comprehensive Grading and Inspection Program

In response to the Administration's announcement that it will formulate a comprehensive egg safety strategy by November 1, UEP has explored a comprehensive system for grading and inspection, incorporating quality assurance parameters and aimed at ensuring a safe supply of eggs and egg products, applicable to all egg producers. The proposal is summarized separately on pages 28-29 of the Government Relations Report. Since the basic concepts were developed, UEP has –

- ✓ Secured board approval to present the concept to federal officials;
- ✓ Prepared documents describing the proposal in detail;
- ✓ Participated in a public meeting August 26 at which the UEP proposal was extensively discussed;
- ✓ Provided the proposal to all UEP members for their comments:
- ✓ Met with federal officials to answer questions about the proposal and gauge their reaction;
- ✓ Answered questions from the media about UEP's proposal and the Administration's strategy; and
- ✓ Continued to consult with federal officials to ascertain the progress of the Administration's strategic plan and the UEP proposal's relation to that plan.

Other Issues

As documented in the Government Relations Report, UEP has been active on a variety of other issues since May, including –

- Supplying three witnesses for a July 1 Senate **hearing on egg safety,** preparing testimony and coordinating media strategy with Aronow & Pollock;
- Meeting with USTR and USDA officials and **initiating a Congressional letter on inedible** egg trade barriers in Europe;
- Participating in the **Seattle Round Agriculture Coalition** to prepare for new world trade talks; and
- Submitting comments on the Agricultural Marketing Service's proposal to **ban repackaging and define eggs of current production** as no older than 15 days from date of lay (UEP supports 21 days).

Refrigeration of Shell Eggs

Don Dixon
Federal-State Supervisor
Modesto, California

Refrigeration

- What are the requirements?
- Who will be enforcing the requirements?
- How will requirements be enforced?

Refrigeration

- What will happen if a violation is found?
- What are we finding in the field?

Requirements

- ✓ Shell eggs be stored and transported at 45 degrees.
- ✓ Labeling - Keep Refrigerated.
- ✓ Imports are to comply also.

Who and What's Exempt

- ☑ Producer-packers with fewer than 3,000 birds.
- ☑ Unprocessed eggs - Nest run.
- ☑ Restricted eggs.

Enforcement

- FSIS is responsible for monitoring compliance with refrigeration and labeling.
- AMS will monitor industry compliance at shell egg packing plants.
- FDA will monitor refrigeration at retail level.

Verification Procedures

- Digital Pacer thermometer.
- Pre-cool 10 minutes in cooler.
- Temperatures at five locations.
- Average temperature of each cooler reported on the PY-156.

Verification Procedures

- October, November, December
- January, February, March
- April, May, June
- July, August, September

Violations

- ❑ Whenever the average cooler temperature exceeds 45 degrees.
- ❑ Missing labeling - Keep refrigerated.

Enforcement Procedures

- AMS notifies the Assistant District Manager for Enforcement (ADMA) at the appropriate District Office.
- FSIS may issue letter of information, of warning, present your view.
- ADMA will determine whether to seek criminal or civil penalties.

Violations - non USDA

- ❑ Thirteen registrants - six complied temperature range from 37.40 – 42.64.
- ☑ Seven non compliances temperature range 47 – 66.80.

Violations USDA Plants

- Nine registrants – eight complied with temperatures from 37.48 to 42.64.
- One non compliance – temperature was 45.46.

Labeling Violations

- Five USDA plants four had violations on non-USDA labels.
- Eight labels total – 5 dozen over wrap, 18 pack, 1 dozen cartons.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOOD SAFETY AND INSPECTION SERVICE
WASHINGTON, DC

FSIS DIRECTIVE	8840.1	6/18/1999

ENFORCEMENT OF REFRIGERATION AND LABELING REQUIREMENTS FOR SHELL EGGS PACKED FOR CONSUMER USE

I. PURPOSE

This directive provides the procedures FSIS program employees should follow when enforcing shell egg refrigeration and labeling requirements. Note: bargaining unit employees will not be involved in any of these activities.

II. REFERENCES

Egg Products Inspection Act, as amended

9 CFR 590.5, 590.28, 590.50, 590.132, 590.134, 590.410, 590.915, 590.950, and 590.955

III. BACKGROUND

On August 27, 1998, FSIS published a final rule and request for comments implementing the 1991 amendments to the Egg Products Inspection Act (21 USC 1041). The amendments require that shell eggs packed into containers destined for the ultimate consumer be stored and transported under refrigeration at an ambient temperature not to exceed 45 °F (7.2 °C). FSIS defined the "ultimate consumer" as any household consumer, restaurant, institution, or any other party who has purchased or received shell eggs or egg products for consumption. Therefore, the requirements apply to table eggs rather than hatching eggs or nest run, ungraded eggs. In addition, the amendments require that these packed shell eggs be labeled to state that refrigeration is required. Finally, the amendments require that any shell eggs imported into the United States packed into containers destined for the ultimate consumer include a certification that the eggs have been stored at an ambient temperature of no greater than 45 °F (7.2 °C) at all times after packing. U.S. Customs Agents will verify the presence of the certification. The final regulations become effective August 27, 1999.

Distribution: District Offices, Compliance Officers **OPI: OPPDE**

IV. The Role of AMS

A. The Agricultural Marketing Service (AMS) or AMS representatives will check the ambient air temperature of shell egg storage facilities in accordance with paragraph VII and will check the labeling of shell egg containers to verify compliance with labeling requirements during surveillance inspection activities. Producer-packers having 3,000 or fewer hens are exempt from the refrigeration and labeling requirements and are also exempt from surveillance inspections. All producer-packers that have more than 3,000 hens and all grading stations are subject to AMS surveillance inspections. Therefore, all plants that are covered by this regulation are covered by AMS surveillance inspection.

B. When AMS finds violations of the refrigeration or labeling regulations, it documents the violations and informs the plant management. If a plant has significant or repeated violations, AMS notifies the Assistant District Manager for Enforcement (ADME) at the appropriate District Office (DO) and provides the dates and a description of these violations.

C. When AMS finds that shell egg containers destined for the ultimate consumer are not labeled to indicate that refrigeration is required, it documents the violations and informs the plant management. Also, AMS places a USDA retention tag on the containers to prevent them from being transported until they are properly labeled. AMS returns to check the containers to ensure that they are properly labeled and to remove the tag.

V. Role of FSIS at Producer-Packers and Grading Statidns

After AMS notifies an ADME of significant or repeated violations of the refrigeration or labeling regulations at producer-packers or grading stations, the ADME or other appropriate FSIS program employee determines whether follow-up visits to the producer-packers or grading stations are necessary, or whether other action is appropriate.

VI. Role of FSIS in Distribution

A. If FSIS program employees are at a warehouse or other distribution location that stores shell eggs packed into containers destined for the ultimate consumer, they determine the temperature of the storage facility. If the temperature of the storage facility is higher than 45 °F, FSIS program employees document the finding and report to the appropriate ADME or appropriate FSIS program employee. The ADME or other appropriate program employee determines what further action is necessary.

B. When FSIS program employees find that shell egg containers destined for the ultimate consumer in warehouses or other in-distribution locations are not labeled to indicate that refrigeration is required, they document the finding and, when appropriate, hold or detain them from being transported until they are properly labeled.

C. If vehicles transporting shell eggs packed into containers destined for the ultimate consumer are present at warehouses when FSIS program employees are present, FSIS program employees determine the temperature of **the transport vehicle.** If temperature is higher than 45 °F, FSIS program employees document the finding and report to the appropriate ADME or appropriate FSIS program employee. The ADME or other appropriate program employee determines what further action is necessary.

VII. Checking Temperatures

A. FSIS program employees checking the temperatures of shell egg storage and transport facilities will be provided thermometers equipped with air probes or other devices.

B. In shell egg storage facilities containing eggs packed into containers destined for the ultimate consumer, FSIS program employees:

1. Take temperatures in one or more areas of each cooler, excluding areas within **a** five-foot radius of open doorways or directly in front of cooling units;

2. Take temperatures near packaged product, at a five (5) to six (6) foot height above the floor;

3. If taking more than one temperature in the cooler, average the results to determine the ambient air temperature in the'cooler.

C. When checking the temperature of the transport vehicle, FSIS program employees:

1. Place the thermometer in an appropriate location(s) in the transport vehicle and close the door;

2. Leave the thermometer in the truck long enough to obtain an accurate temperature reading;

3. If taking more than one temperature in the transport vehicle, average the results to determine the ambient air temperature in the transport vehicle.

D. If shell egg handlers covered by this regulation have installed thermometers or temperature recording devices in storage facilities or transport vehicles, FSIS program employees will verify ambient temperatures with their own calibrated thermometers for comparison **purposes.**

VIII. Enforcement Actions

If facilities are found to be at temperatures above 45°F, they are in violation of the regulations. After finding violations of the temperature or labeling requirements, FSIS may issue letters of information, warning, present-your-views, or take other appropriate action. In addition, FSIS will determine whether to seek criminal or civil penalties in accordance with the Egg Products Inspection Act, as amended (21 U.S.C. 1041). When seeking civil penalties, FSIS will take into account the gravity of the violation, degree of culpability, and history of prior offenses.

Philip S. Derfler

Deputy Administrator
Office of Policy, Program Development
and Evaluation

ENFORCEMENT OF REFRIGERATION AND LABELING REQUIREMENTS FOR SHELL EGGS PACKED FOR CONSUMER USE

WHAT ARE THE REQUIREMENTS?

On Aug. 27, new federal regulations will require that shell eggs packed in containers destined for the ultimate consumer be stored and transported under refrigeration at an ambient temperature not to exceed 45° F. In addition, these packed shell eggs must be labeled to state that refrigeration is required. The requirements also state that any shell eggs imported into the United States which are packed in a container that is destined for the ultimate consumer include a certification that the eggs have been stored at an ambient temperature of no greater than 45° F at all times after packing.

WHO ENFORCES THE REQUIREMENTS?

The Food Safety and Inspection Service (FSIS) is responsible for monitoring industry's compliance with the shell egg refrigeration and labeling requirements. FSIS employees will check the ambient temperature of the storage facilities and transport vehicles at distribution centers.

The Agricultural Marketing Service (AMS) has primary responsibility for monitoring industry compliance at the plants in which shell eggs are actually packed. AMS personnel will check the ambient air temperature of storage facilities at packing plants and the labeling of shell egg containers to verify compliance with labeling requirements during surveillance inspection activities. AMS will report significant and repeated violations to FSIS for possible regulatory action.

WHAT HAPPENS IF A VIOLATION IS FOUND?

When violations of the refrigeration or labeling regulations are found during inspections, they are documented and the plant or facility management is notified. If a plant or facility has significant or repeated violations, FSIS may take other appropriate regulatory action. This action may include seeking criminal or civil penalties in accordance with the Egg Products Inspection Act. When seeking criminal and/or civil penalties, FSIS will take into account the gravity of the violation, degree of culpability, and history of prior offenses.

FOR FURTHER INFORMATION CONTACT:

Thomas Hoffman, District Enforcement Operations, Food Safety and Inspection Service, U.S. Department of Agriculture, 1255 22nd Street NW, West End Court Building, Room 300, Washington, DC 20250-3700; (202) 418-8866.

California Food and Agricultural Code - Sections 27643 and 27644

21643. (a) It is unlawful for an egg handler, as defined in Section 27510, to hold, store, transport, or display eggs that are packed or graded for human consumption unless the eggs are held, stored, transported, or displayed consistent with all of the following requirements:

(1) At an average ambient temperature of 45 degrees Fahrenheit, or lower.

(2) At a temperature equal to or less than the temperature requirement for holding, storing, transporting, or displaying eggs established by regulations of the United States Department of Agriculture in Title 7 of Part 56 of the Code of Federal Regulations governing the grading of shell eggs.

(b) Retail outlets that are regulated by this chapter, except for retail outlets located in shell egg packing or distribution facilities, are exempt from subdivision (a).

(c) Certified farmers' markets, as defined in Section 113745 of the Health and Safety Code, are not required to comply with subdivision (a).

(d) Transport vehicles may exceed the 45 degree Fahrenheit maximum temperature required pursuant to subdivision (a) when eggs are either being loaded into the transport vehicle or unloaded from the transport vehicle. A transport vehicle shall be deemed to be in compliance with subdivision (a) if the transport vehicle is equipped and has in operation when eggs are in the transport vehicle a refrigeration unit delivering air at a temperature of 45 degrees Fahrenheit or lower.

21644. (a) It is unlawful for an egg handler, as defined in Section 27510, to sell, offer for sale, or expose for sale eggs that are packed or graded for human consumption unless at least one of the following conditions is met:

(1) The consumer container is plainly, legibly, and conspicuously labeled "KEEP REFRIGERATED" or with words of similar meaning.

(2) A conspicuous sign is posted at the point of sale for eggs on bulk display advising consumers that the eggs are to be refrigerated as soon as practical after purchase.

(b) Except as provided in subdivision (c), it is unlawful for an egg handler to sell, offer for sale, or expose for sale eggs that are packed for human consumption unless each container intended for sale to the ultimate consumer is labeled on one outside top, side, or end with all of the following:

(1) (A) The words "Sell-by" immediately followed by the month and day in bold type, for example "June 30" or "6-30." Common abbreviations of months shall be permitted.

(B) The sell-by date shall not exceed 30 days from the date on which the eggs were packed, excluding the date of packing.

(C) If the eggs are repacked but not regraded, the original sell-by date shall apply.

(2) A Julian pack date. As used in this paragraph, the Julian pack-date is the consecutive day of the year on which the eggs were packed.

(3) The identification number of the plant of origin.

(c) Paragraph (1) of subdivision (b) does not apply to eggs that are packaged for export, including export to other states and territories of the United States, and foreign countries, and eggs that are packaged for military sales.

(d) All eggs returned from grocery stores, store warehouses, and institutions shall not be reprocessed for retail shell egg sales.

PROPOSED CHANGES TO THE REGULATIONS OF THE
DEPARTMENT OF FOOD AND AGRICULTURE
PERTAINING TO EGGS,
TITLE 3, SUBCHAPTER 3. EGGS.

DRAFT

1 o-4-99

Amend Section 1354(d)(2) to read:

(2) Terms such as "organic" and "organically produced" or similar description relating to production, qualities or nature of the product or are prohibited. Oother accurate descriptive terms, if determined by the director department not to be misleading or deceptive, may be used.

Note: Authority cited: Section 407 and 2753 1, Food and Agricultural Code. Reference: Section 275631, Food and Agricultural Code.

Amend Section 13 57 to read:

(a) Brand Registration. Any certification of registration granted pursuant to this regulation and Section 27661 of the Food and Agricultural Code, shall be valid until canceiled by the director department.

(b) Registered Brand - Change of Ownership. A person who acquires by purchase or other lawful means, egg master containers, other than corrugated fiber, with a registered brand, shall notify the ~~director~~ denartment and submit evidence which supports the transaction. Such notice constitutes transfer of the brand and container ownership.

(c) Brand Alterations. To obliterate, erase, cover-up, remove or conceal any registered brand, other than his own, without first notifying the ~~director~~ department and receiving approval, is prohibited.

(d) Licensed Container Exchange Operators. Licenses issued to persons engaged in the container exchange business for master containers of eggs shall be valid until suspended or revoked by the ~~director~~ denartment.

(e) Court Proceeding - Registered Container. Upon representation of any interested party, the ~~director~~ denartment may institute proceedings in any court of competent jurisdiction to recover for the owner any container which is marked with a brand that is registered pursuant to this section. Whenever the ~~director~~ denartment prevails in such an action, he it shall ask the court to assess costs against the party found to have been in unlawful possession of the containers.

Note: Authority cited: Sections 407, 2753 1 and 27666, Food and Agricultural Code.

Reference: Sections 27661, 27663 and 27668, Food and Agricultural Code.

Amend Section 1358(c) to read:

(c) Advance Payment. A handler who provides information satisfactory to the ~~director~~ department indicating the handler's estimated annual mill fee liability, may pay that amount in advance. Such advance payment shall cover the period from July 1 through June 30, whereupon the handler shall report actual mill fee liability and a recapitulation will be made. A refund will be made in case of overpayment, or the balance, if any, may be applied to the next year's estimate. In the event of underpayment, the mill fee shall become due and payable on June 30, and becomes delinquent after close of the first reporting period of each fiscal year. Any handler, choosing not to make an estimated advance deposit, as described above, shall submit the fee at the end of each four-week reporting period.

Note: Authority cited: Sections 14, 407, 2753 1 and 27553, Food and Agricultural Code.

Reference: Sections 2753 1, 27551 and 27553, Food and Agricultural Code.

Amend Section 1358.2 to read:

(a) Any handler providing satisfactory information that the handler owes no mill fee for any fiscal year, and anticipates no mill fee liability to be incurred, may be exempted by the ~~director~~ denartment from filing a mill fee report. Should the handler later make sales requiring payment during the fiscal year, the handler shall file a report pursuant to Section 1358(a) or 1358(c), as applicable.

(b) The ~~director~~ department may require special or periodic reports from any handler pursuant to this section and may require a statement in such detail as the ~~director~~ denartment deems necessary to support the payment or exemption. The ~~director~~ denartment may require the report to be made, or confirmed, under penalty of perjury.
Note: Authority cited: Sections 14,407, 2753 1 and 27553, Food and Agricultural Code.
Reference: Sections 2753 1, 2755 1 and 27553, Food and Agricultural Code.

Amend Section 1358.4(a) to read:

(a) Each egg handler shall maintain business records of egg transactions for three years, subject to audit by the ~~director~~ denartment. The records shall indicate the date, egg quality and quantity, and identity of purchaser and seller. For small quantities of restricted eggs sold by egg handlers directly to consumers under provisions of Section 1356.2, or incidental sales of consumer grade eggs, the name of purchaser is not required.
Note: Authority cited: Sections 14,407, 27521 and 2753 1, Food and Agricultural Code.

DRAFT

Reference: Sections 2753 l, Food and Agricultural Code.

Adopt Section 1358.5 to read:

Section 1358.5. Eggs, Procedures For Determining Ambient Air Temnerature. Air flow temnerature of egg transnort vehicles and ambient room temneratures of storage rooms, retail outlets and disnlav units. located in packing plants or distribution facilities. shall be determined at least auarterlv in accordance with this section.

(a) Ambient or air flow temperature shall be determined bv use of an approved thermometer or a 24 hour temnerature recording instrument having a temnerature gradation of one-half demee Celsius (one degree Fahrenheit) and having; an accuracy of plus or minus one-half degree Celsius (one demee Fahrenheit).

(b) Prior to taking an initial temperature reading. the thermometer shall be brought to eauilibrium within the location being insnected.

(c) When a location is determined to be in violation. each temnerature reading taken and the location within the enclosure where the temperature is taken for enforcement of this section shall be recorded. The cooler or vehicle shall be clearly identified.

DRAFT

(d) If a transport vehicle is eauinned with a thermometer or recording; device where accuracv is not in auestion. insnectors mav use them to determine compliance with temnerature reauirements.

If not eauinned with a thermometer or recording device or if an inspector chooses to utilize an authorized thermometer. two temnerature readings shall be taken on transport vehicles. When units are accessible. the readings shall be taken in the air flow discharge at the refrigeration unit, one reading; on the right side and one on the left side of the unit. The vehicle shall be accented or rejected on the basis of the average of such readings. If the refrigeration unit is not accessible, the reading; shall be taken in the air flow as near as possible to the refrigeration unit in a manner consistent with the foregoing instructions. If the average air flow temperature is more than 7 degrees Celsius (45 degrees Fahrenheit), the handler mav unload the vehicle to make the refrigeration unit accessible for two additional temnerature readings which shall be averaged to determine the basis for accenting or rejecting the vehicle.

(e) If a cooler is equipped with a 24 temnerature recording device. whose accuracv is not in auestion. insnectors may use it to determine comnliance with temnerature reauirements. To be considered in comnliance. the recorder shall indicate a temnerature of 45 degrees Fahrenheit or less for at least 12 hours of the prior 24 hours.

DRAFT

If not equipped with a thermometer or recording device or an inspector chooses to utilize an authorized thermometer. five temnerature readings shall be taken in storage rooms or display units. The readings should be taken approximately 4 to 5 feet from the floor. and as far from warm eggs as practicable. The readings shall be taken awav from door wavs and the refrigeration unit's air flow and at senarate locations. The readings shall be averaged to determine compliance.

(f) Compliance Time Period.

(1) Storage Rooms and Disnlav Units. Locations in which eggs are placed or stored and which are found to have an average ambient air temnerature above 7 degrees Celsius (45 degrees Fahrenheit) shall be brought into compliance within 24 hours from the time of rejection. If compliance cannot be accomplished within such time. the eggs shall be removed and nlaced in a transport vehicle or storage facility which complies with temnerature reauirements of 7 degrees Celsius (45 degrees Fahrenheit) or below.

(2) Transport Vehicles.

A transport vehicle in which eggs are placed for shinment or storage and which is found to have the refrigeration unit discharging an average air flow temnerature above 7 degrees Celsius (45 degrees Fahrenheit). the unit shall be brought into compliance within four

DRAFT

hours from the time of rejection. If comnliance cannot be accomplished within such time, the transnort vehicle shall not be used. and the eggs shall be removed and placed in a transnort vehicle or storage facility which is in comnliance.

(3) If a transnort vehicle. store room. or display unit is found to be in noncompliance and is to be used for transporting or storing eggs. the resnonsible party shall renair the refrigeration unit and submit a copy of the repair tag to the state insnector or county agricultural commissioner. The renair tag shall include:

I. The name. address and telenhone number of the nerson or company that made the repairs.

ii. The date and time or renair.

iii. The refrigeration unit's delivery temnerature by the reuair uerson. following the unit's repair.

Unless otherwise instructed by a state insuector or county agricultural commissioner. the responsible party may place the store room. disulav unit. or transport vehicle back in use upon reuair and submission of the reuair tag;. The tag may be submitted by facsimile.

The state inspector or countv agricultural commissioner may approve the continued use verballv. in writing or bv facsimile.

(g) Tolerance.

In order to allow for circumstance variations and samulinn. inspectors shall allow a plus or minus one degree Celsius (two degrees Fahrenheit) tolerance.

(h) Good Faith Effort.

Inspectors shall take into consideration refrigeration efforts of an industrv egg handler or transuorter when determining anv uunitive action.

Note: Authoritv cited: Sections 407 and 2753 1, Food and Amicultural Code. Reference: Sections 2763 1 and 27643. Food and Agricultural Code.

Effect of Cold Room and Starting Egg Temperature on Cooling Times

D. R. Kuney

1999 Egg Processing Workshop

Egg Cooling Time May Be More Important Than Ever Before!

- Changes in the law---45^0 F requirement
- Will markets demand cooled eggs?
- Do markets demand eggs with specified post-processing age?
- Will storage capacity allow slow cooling rates?
- Will refrigeration capacity allow cooling of eggs to 45^0 F? If so, at what cooling rates?

Worst Case Scenario
"The Double Whammy"

- Markets require cooled eggs (45^0 F)
- Markets require eggs no older that 2-3 days of pack date

"The Double Whammy"
At a Minimum Will Require

- Decreased Cooling Times
- Increased Cooling Capacity
- Increased Cold Storage Capacity?

Cooling Time

Some Factors Involved

- Target Temperature Prior to Shipping
- Cold Room Temperature
- Number of Eggs Cooled
- Egg Temperature Prior to Cooling
- The Way Eggs are Packaged
- The Way Eggs are Stored in the Cooler
- The Way the Cold Room is Managed
- Physical Properties of the Cold Room

Cooling Time

Factors

- ✓ Cold Room Temperature
- ✓ Starting Egg Temperature
- ✓ The Way Eggs Are Packaged

Rapid Cooling of Packaged Sheil Eggs

J. F. Thompson, G. Zeidler, D. Kuney, R. A. Ernst,
H. Riemann, S. Himathongkham and J. Knutson

Funded by the U. S. Egg & Poultry Association

1998 Forced Air & Room Cooling Studies

- Forced air vs room cooling rates
- Rapid cooling effects on shell integrity
- Rapid cooling effects on quality
- Rapid cooling effect on bacterial penetration
- Egg packaging and cooling rates

Procedure

- **Large Eggs**
- **Temp. Data Logger Probes Inserted Into Eggs**
- **Four Probes per Pallet**
- **Average Temperature Used**

Calculation of Cooling Times

Data collected allows calculation of 1/2 cooling times:

The time it takes to cool the egg 1/2 of the way from the starting egg temperature to the average cold room temperature.

Example of 1/2 Cooling Time

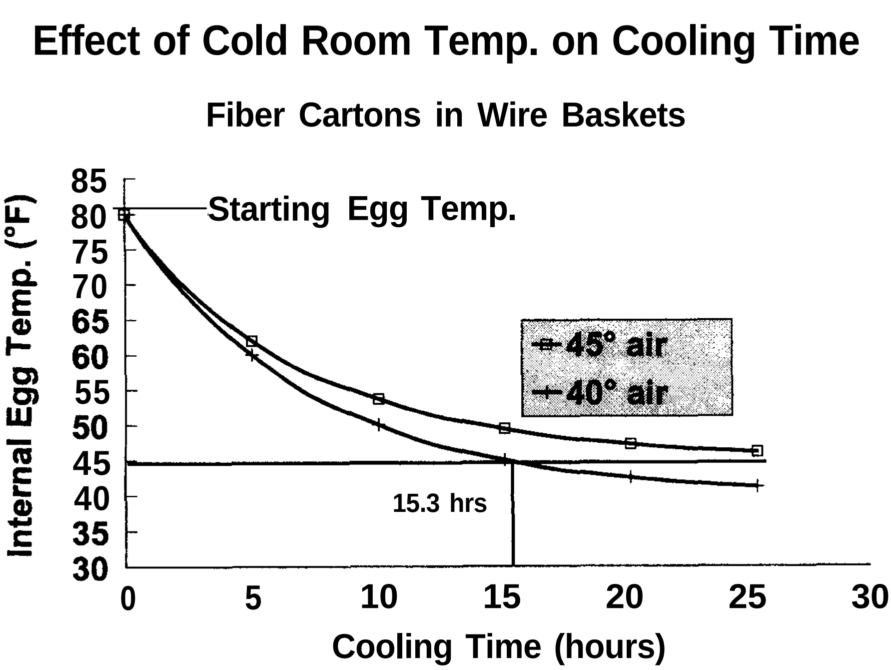
Egg Temp. = 80^0 F
Cold Room Temp. = 40^0 F
1/2 Cooling Time = Time to Cool to 60^0 F

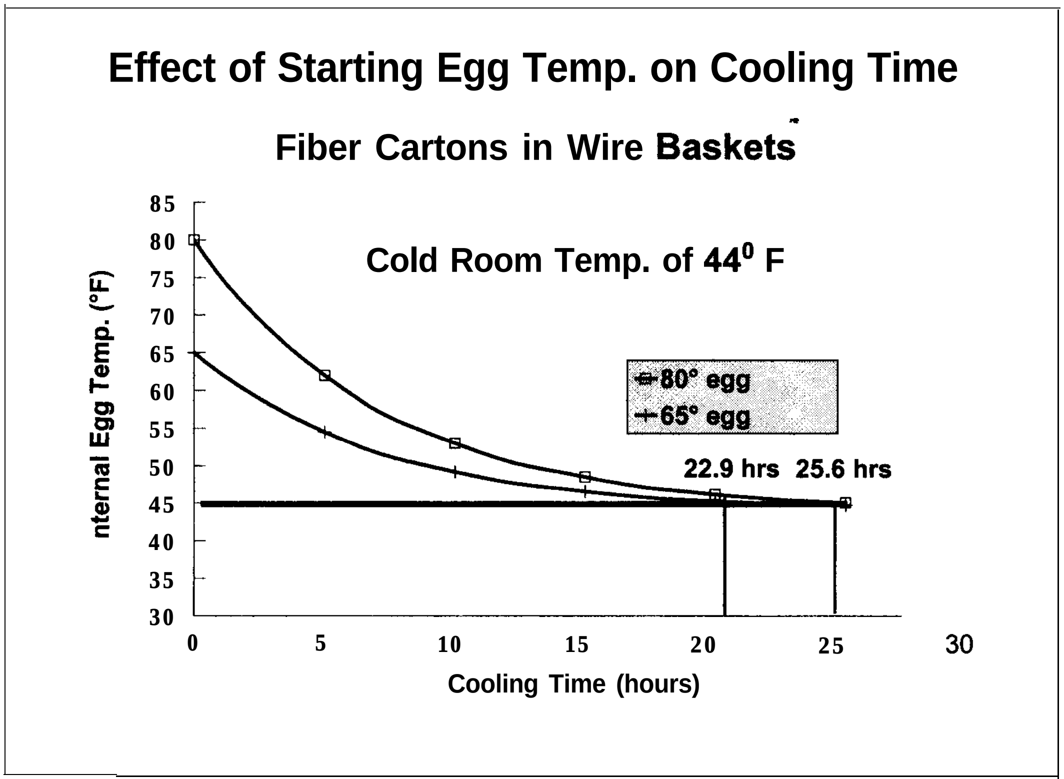
Cooling Curves are Generated from Times to Cool Eggs to:

1/2 Cooling
7/8 Cooling
15/16 Cooling
31/32 Cooling

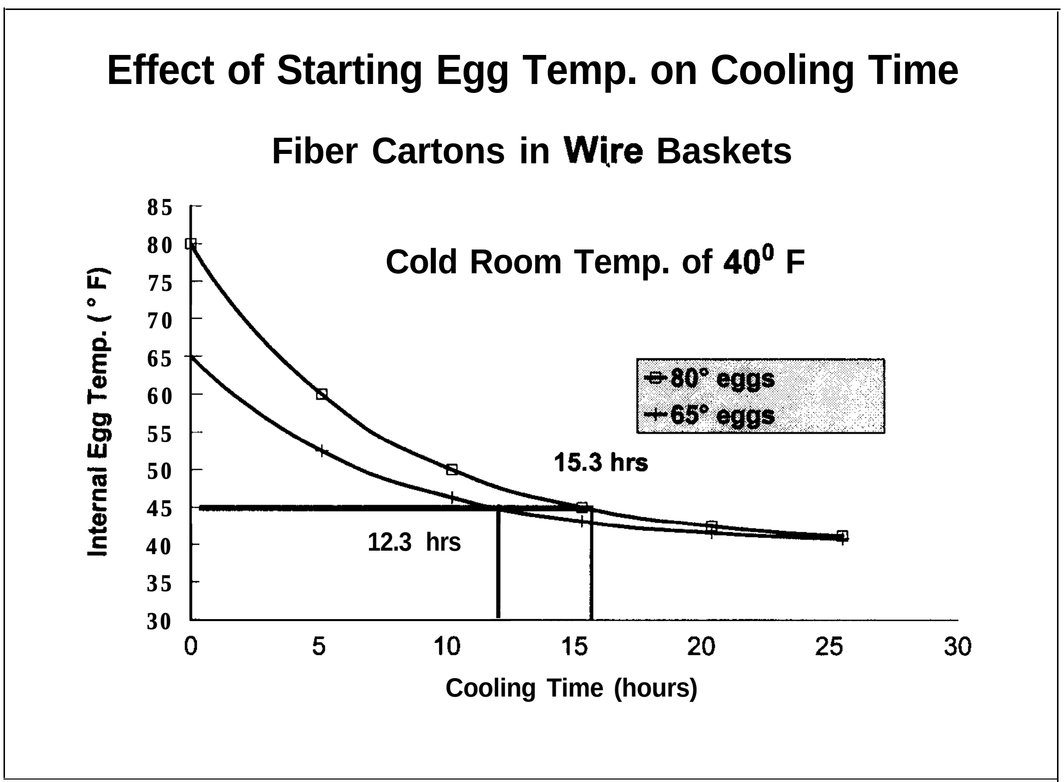
In Room Cooling, Fiber and Foam Cartons Cooled at the Same Rate

Only Data for Fiber Cartons Will be Discussed Here

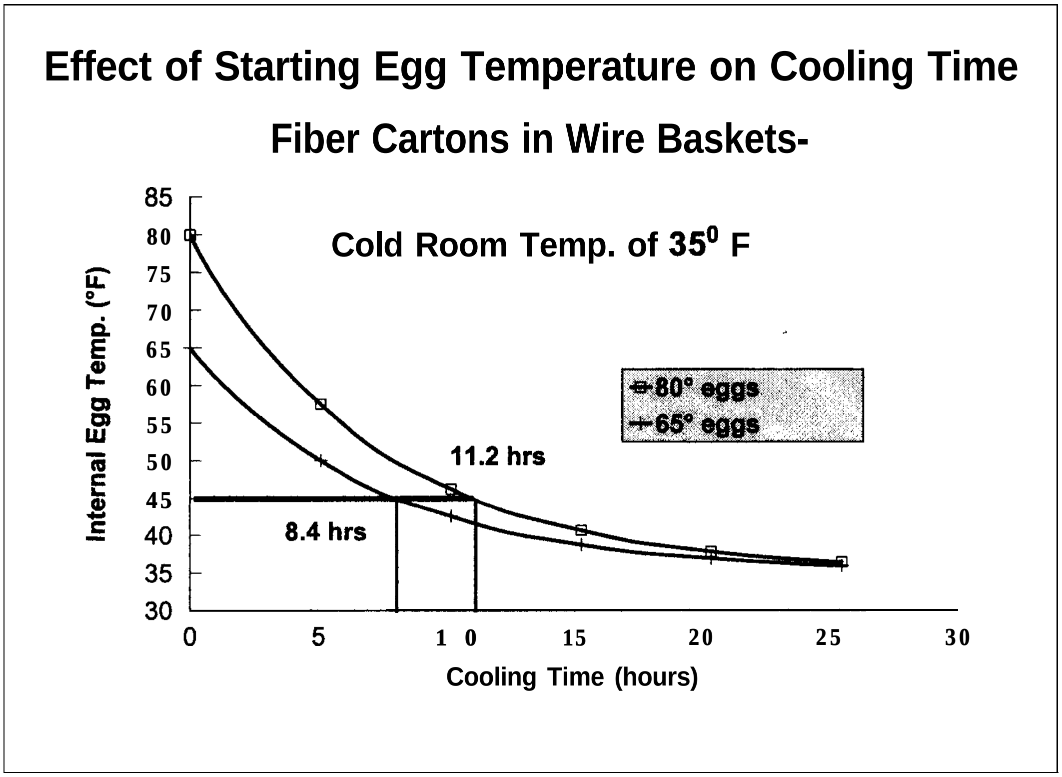


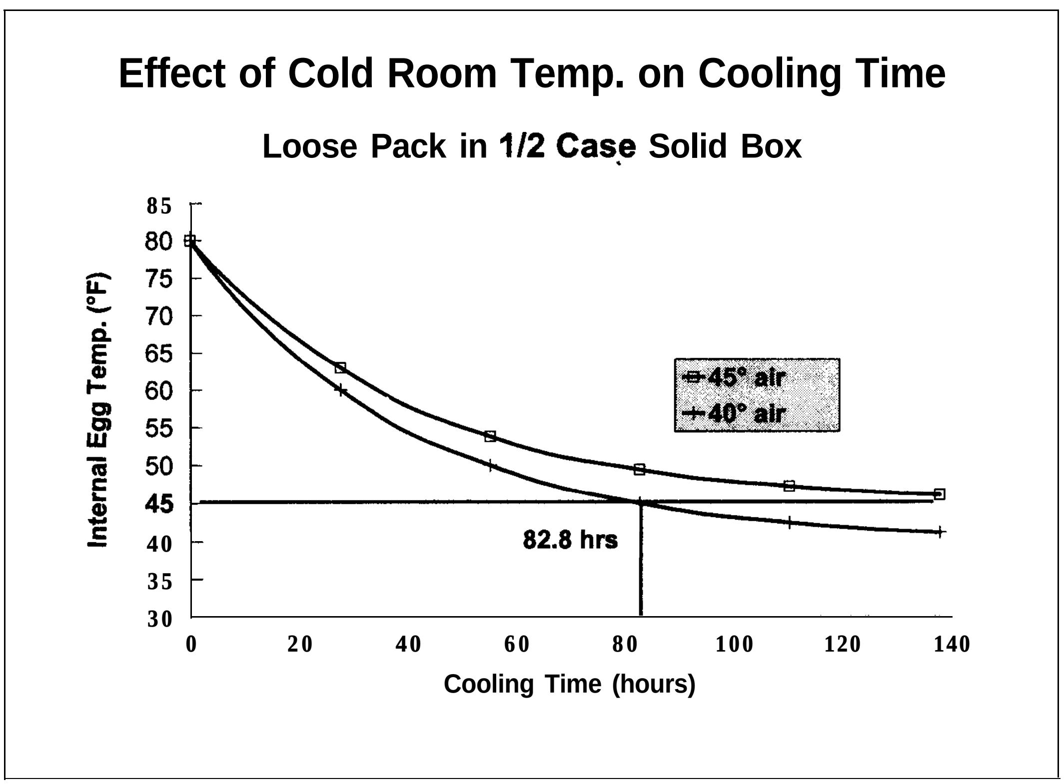


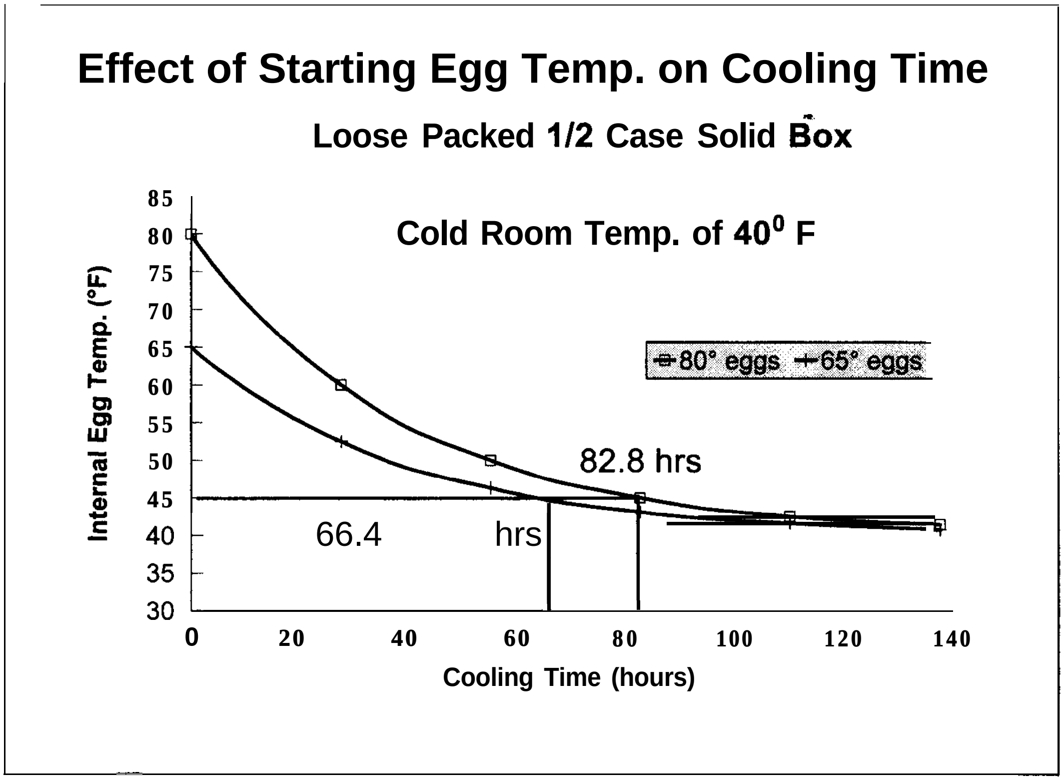
Effect of Starting Egg Temp. on Cooling Time
Fiber Cartons in Wire Baskets
Cold Room Temp. of 44⁰ F
80° egg
65° egg
22.9 hrs
25.6 hrs
Internal Egg Temp. (°F)
Cooling Time (hours)

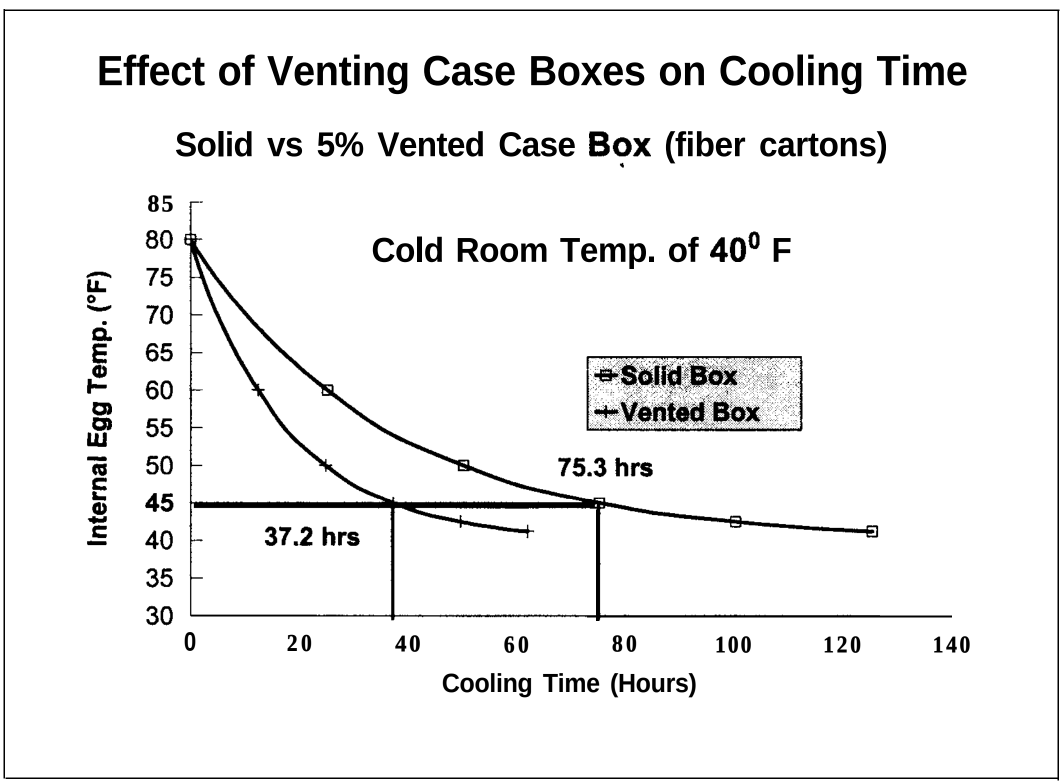


Effect of Starting Egg Temp. on Cooling Time
Fiber Cartons in Wire Baskets
Cold Room Temp. of 40⁰ F
80° eggs
65° eggs
15.3 hrs
12.3 hrs
Internal Egg Temp. (° F)
Cooling Time (hours)


Effect of Starting Egg Temperature on Cooling Time
Fiber Cartons in Wire Baskets-
Cold Room Temp. of 35° F
80° eggs
65° eggs
11.2 hrs
8.4 hrs
Internal Egg Temp. (°F)
Cooling Time (hours)
85
80
75
70
65
60
55
50
45
40
35
30
0
5
10
15
20
25
30


Effect of Cold Room Temp. on Cooling Time
Loose Pack in 1/2 Case Solid Box
45° air
40° air
82.8 hrs
Internal Egg Temp. (°F)
Cooling Time (hours)
85
80
75
70
65
60
55
50
45
40
35
30
0
20
40
60
80
100
120
140


Effect of Starting Egg Temp. on Cooling Time
Loose Packed 1/2 Case Solid Box
Cold Room Temp. of 40⁰ F
80° eggs
65° eggs
82.8 hrs
66.4
hrs
Internal Egg Temp. (°F)
85
80
75
70
65
60
55
50
45
40
35
30
0
20
40
60
80
100
120
140
Cooling Time (hours)


Effect of Venting Case Boxes on Cooling Time
Solid vs 5% Vented Case Box (fiber cartons)
Cold Room Temp. of 40⁰ F
Solid Box
Vented Box
75.3 hrs
37.2 hrs
Internal Egg Temp. (°F)
85
80
75
70
65
60
55
50
45
40
35
30
0
20
40
60
80
100
120
140
Cooling Time (Hours)

Effect of Cold Room & Starting Egg Temperature on Time to 45^0 F

(Fiber Cartons in Wire Baskets)

Starting Egg Temp.	Ambient Cold Room Temp. 45” F	44” F	40” F	35” F
	(Hours)			
80” F	>26	25.6	15.3	11.2
65” F	>26	**22.9**	12.3	8.4

Summary

- ✓ To cool eggs to 45^0 F, coolers must be below that temp.
- ✓ Higher starting egg temp. increases cooling time
- ✓ The lower the cold room temperature, the faster eggs cool
- ✓ Eggs packed in case boxes cool the slowest
- ✓ 5% venting of case boxes significantly reduces time to cool

Conclusions

- Eggs can be cooled to 45^0 F, but at a cost--refrigeration, space & time
- Rapid cooling and shipping of eggs improves quality and reduces egg weight loss

Maintaining 45°F in Egg Cold Rooms

November 1999

James F. Thompson
Biological and Agricultural Engineering Dept, UC Davis
530-752-6167

Adeauate Refrigeration

Engineering estimates and the experience of several operations in the state indicate that a cold room receiving mostly eggs from an in-line operation needs 25 to 30 tons of refrigeration per 1000 cases of eggs packed per day. Off-line facilities, receiving eggs at about 60°F, need only 8 to 12 tons of refrigeration per 1000 cases. Refrigeration capacities below these ranges will allow cold room temperatures to rise above 45°F on days with large pack outs or warm summer outside conditions.

Thermostat temperature

Even with adequate refrigeration capacity there will be some variation in air temperature during the day. Temperatures may be high near pallets of uncooled eggs, near exterior walls, near loading docks or in areas of the cold room with poor air flow. The thermostat must be set to about 40°F to insure maximums do not exceed 45°F. However, reducing the thermostat is not a solution for inadequate refrigeration capacity. Air holds little refrigeration effect and heat transfer to already cooled product is too slow to get any significant amount of stored refrigeration capacity. There is little or no 'flywheel' refrigeration capacity in a cold room.

Reduce heat sources

Areas of high temperature can also be minimized by reducing heat sources in the cold room. Trucks should be cooled to operating temperature before they back up to the loading dock. Dock openings should have seals to prevent hot air from entering during loading. Doorway to the packing room should have a fast acting door or plastic flaps to reduce warm air infiltration.

Air distribution

Cold air from evaporators should be well distributed in the cold room to prevent hot regions. A high ceiling height allows volume for cold air from evaporators to mix with room air before reaching eggs, causing more uniform air temperature. (High ceilings also allow the use of racked storage for future expansion.) The cold room should have a fan capacity of 100 cfm per ton of product to promote good air mixing. If evaporator fans do not provide adequate air flow, add propeller-type fans. The added fans should reinforce the air movement caused by the evaporator fans. Spread pallets of recently packed eggs so that their heat is not concentrated in one area.

UC Poultry Symposium and Egg Processing Workshop
November 9 & 10, 1999

RETAIL EGG SAFETY:
CALIFORNIA REGULATORY GUIDANCE FOR SAFE EGG HANDLING

Department of Health Services, Food and Drug Branch

California Uniform Retail Food Facilities Law

Standard statewide approach to retail food facility operation and equipment which is enforced by the local jurisdictions.

Potentially Hazardous Food 113845.

"Potentially hazardous food" means food that is in a form capable of supporting rapid and progressive growth of infectious or toxigenic microorganisms that may cause food infections or food intoxications.

Cooking Temperatures 113996

- All ready-to-eat foods prepared at the food facility from raw or incompletely cooked animal tissues shall be thoroughly cooked prior to serving. Eggs and foods containing raw eggs shall be heated to a minimum internal temperature of 63 degrees Celsius (145 degrees Fahrenheit).
- When microwaving heat to a minimum internal temperature of 14 degrees Celsius (25 degrees Fahrenheit) higher. The food shall be completely enclosed in a container and periodically stirred or rotated to assure even heat distribution Upon completion of microwaving, the enclosed food shall be left standing for a minimum of two minutes to assure temperature equilibrium.
- A ready-to-eat salad dressing or sauce containing a raw or less-than-thoroughly cooked egg as an ingredient, and other ready-to-eat foods made from or containing eggs, comminuted meat, or single pieces of meat (including beef, veal, lamb, pork, poultry, fish, and seafood) that are raw or have not been thoroughly cooked as provided in subdivision (a) may be served if either of the following requirements are met:
  - (1) The consumer specifically orders that the food be individually prepared less than thoroughly cooked.
  - (2) The food facility notifies the consumer, orally or in writing, at the time of ordering, that the food is raw or less than thoroughly cooked.

Holding of Raw Shell Eggs 113997

Store raw shell eggs ambient temperature of 7 degrees Celsius (45 degrees Fahrenheit) or below. Raw shell eggs may be stored and displayed unrefrigerated if all of the following conditions are met:

- (1) Not more than four days have elapsed from the date of pack.
- (2) The eggs were not previously refrigerated.
- (3) The eggs are not stored or displayed at an ambient temperature above 32 degrees Celsius (90 degrees Fahrenheit).

- (4) Retail egg containers are prominently labeled "REFRIGERATE AFTER PURCHASE"" or a conspicuous sign is posted advising consumers that these eggs are to be refrigerated as soon as practical after purchase.
- (5) Retail egg containers are conspicuously identified with the date of the pack.
- (6) Any eggs that are unsold after four days from the date of the pack shall be stored and displayed pursuant to subdivision (a), diverted to pasteurization, or destroyed in a manner approved by the enforcement agency.

Diligent Preparation 113995 (c)
For purposes of this subdivision, preparation shall be deemed to be "diligent" with respect to raw shell eggs held for the preparation of egg-containing foods that are prepared to the specific order of the customer as long as the total ambient-temperature holding of these eggs does not exceed a total time of four hours.

***"Pooling" of eggs**
While not strictly forbidden by California Law, the combining of eggs prior to use is highly discouraged. Several foodborne illness outbreaks have been traced to this practice. One infected egg or poor quality egg will affect the entire batch. For this reason the practice is prohibited in the Federal Model Food Code and is discouraged by egg boards, commissions and health agencies.

Inspection Upon Receipt 114003
Inspect food as soon as practicable upon receipt and prior to any use, storage, or resale. Food must be prepared by and received from approved sources. It should be received in a wholesome condition in containers that are not contaminated or damaged in a manner as to permit contamination of food. Shell eggs shall be clean and unbroken upon receipt

Special Situations
Produce stands and Certified Farmers' Markets

ADDITIONAL RESOURCES

www.foodsafety.gov/~fsg/eggs.html
www.dhs.ca.gov/fdb
www.dhs.ca.gov/fdb/Food/Fsn9808.htm Food Safety News regarding cooking temperatures
www.cdfa.ca.gov/foodsafety/assurance pquality; html
www.dhs.ca.gov/ps/dcdc/calmorb.htm California Morbidity article *"Salmonella serotype Enteritidis in California: Current Status and Containment Efforts*"
www.aeb.org
www.enc-online.org/
www.eggcom.com/

Jeff Lineberry, Retail Food Program Specialist, (916) 327-6905, jlineberry@dhs.ca.gov
Bruce Morden, Retail Food Program Specialist, (805) 654-4887, bmorden@dhs.ca.gov

Egg Handling & Care Guide - Courtesy of the California Egg Commission

- 1 .Accept only clean, sound, odor-free eggs.
- 2.Purchase eggs according to grade and size desired and only in the quantities needed for 2 weeks.
- 3.Accept only eggs packed in clean, snug fitting fiberboard boxes which reduce breakage.
- 4.Accept only eggs delivered under refrigeration.
- 5.Check the grade of eggs delivered to you to be sure that they meet your specification.
- 6.To ensure constant turnover, institute a first-in and first-out policy of rotating your egg stock.
- 7.To avoid odor transfer, store eggs in their original boxes away from foods with particularly strong odors.
- 8.Do not "pool" eggs. Although it might seem efficient to pool eggs in large batches, a safe and better quality product results from smaller batches.
- 9.Do not leave egg-containing dishes at room temperature for more than one hour including preparation and service.
- 10. Use clean, sanitized utensils and equipment for food preparation.
- 11 .Wash hands before and after handling eggs.
- 12.Cook eggs and egg-containing dishes thoroughly. Eggs must reach a temp-erature of 140" F. for three minutes or 160" F. in order to be considered safe.
- 13. Beware of "hidden" uncooked egg in recipes such as Caesar salad dressing, mousses and ice cream bases. Cooked versions of these recipes are available from the California Egg Commission.
- 14.Hot egg dishes must be kept at 140" F. or above, cold egg dishes below 40" F. Do not add freshly prepared eggs to a batch of cooked egg on the steamtable. Discard eggs after an hour on the steamtable.