

# California Poultry Letter

MAY 1997

## FIRST AND SECOND CYCLE EGG PRODUCTION RELATIONSHIPS

A study of 1231 first **cycle** and 887 second cycle table egg flocks (by Bell and Adams) in the early 1980's in California revealed a series of very important relationships. These relationships are essential to the decision of whether or not flocks should be molted and if so, when? If molting is to pay, the second cycle of production must yield high performance compared to a one cycle option. The closer the two cycles of performance, the greater the justification for molting.

In this review of flock performance, it was discovered that first cycle peaks averaged 89.1% compared to second cycle peaks of 80.0%. Molting allowed the flock to recover approximately 50% of the first cycle decline in production back to the rate of a 46 **week-old** flock. Weekly loss of production during the, first cycle averaged 565% per week up to 50 weeks of age and slightly more, **.596%**, per week for the 50 to 60 week period. Comparable losses during the second cycle averaged **.634%** per week to 30 weeks beyond the molt and **.815%** per week from 30 to 40 weeks beyond the molt. This indicates a significantly steeper egg production curve during the last 10 weeks of each cycle and a steeper curve in the second cycle compared to the first. For the entire period from the peak to the end of each cycle, the first cycle averaged a loss of **.60%** per week compared to **.67%** for the second cycle.

Early attainment of peak and the peak rate of lay were both correlated to **hen-** housed egg production at 60 weeks. An

earlier peak was also associated with a higher rate of production at the peak, but a lower rate of production at the end of the cycle. Even though there was considerable variation between flocks in these relationships, they were highly significant. Higher peaks in both cycles resulted in greater weekly losses in egg production (slope of the curve).

The month of hatch had a significant effect on several egg production traits. The age at peak varied from a low of 29.6 weeks for September hatches to a high of 30.8 weeks for flocks hatched in March. This appears to reflect the effect of increasing day lengths during the Spring for **the** September hatches and the opposite effect for the flocks hatched in March. Peak egg production, on the other hand, varied from a low of 88.4% for the flocks hatched in February to a high of 89.7% for the flocks hatched in August. Flocks hatched in December produced 205.9 eggs to 60 weeks compared to 204.8 eggs for June hatched flocks.

December molted flocks peaked the latest (12.8 weeks) with an 81.1% peak (the highest) compared to the June molted flocks which peaked the earliest at 11.9 weeks with a 79.2% peak (the lowest).

First cycle flocks at 52 weeks of age during October through March had a significantly steeper slope to the end of the cycle compared to the pre-50 week period. Flocks during the remainder of the year tended to have more consistent slopes.

In the second cycle, flocks at 30 weeks of age during the Spring (April - June) and the Fall (October - December) expressed a greater loss of production to the end of the cycle than during the pre-30 week period. Flocks during the remainder of the year performed similarly through the entire cycle.

The average age at molt was 66 weeks with a range between flocks from 48 to 87 weeks. The oldest molted flocks reached peak egg production earlier and experienced lower peaks. Egg production rates at 30 and 40 weeks were markedly lower in the older molted flocks. Egg production curve slopes to 30 weeks were also steeper in the older molted flocks. (see table 1).

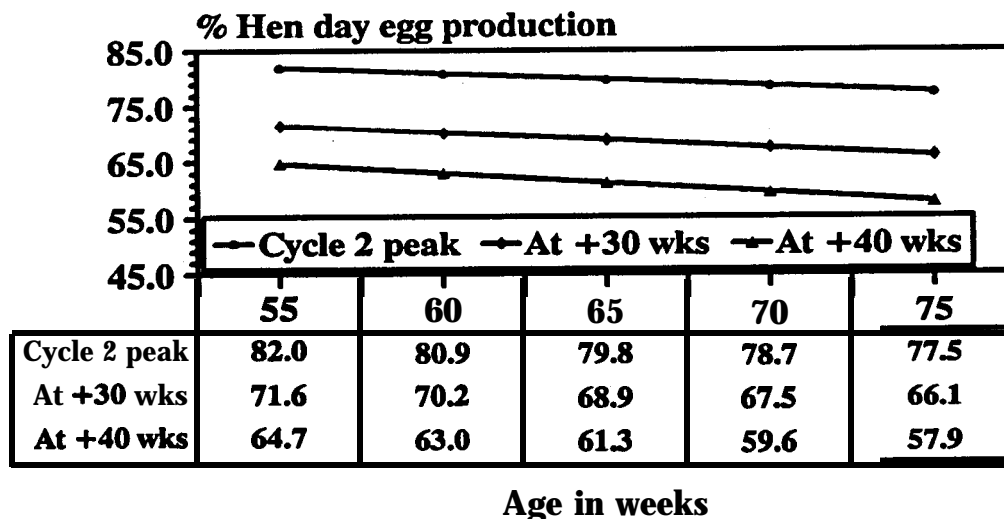
The second cycle egg production peak was significantly associated to the first cycle peak. The higher the first cycle, the higher the second cycle. Even though this was a highly significant relationship, the first cycle peak only accounted for 16.3% of the variation in the second cycle

peak - obviously there are many other factors affecting this measurement.

The results from this study indicated that the simple straight-line approach in defining the egg production curve does not reflect the observed flock performance especially during certain periods of the year. The more abrupt decline after week 50 in the first cycle and after week 30 in the **second cycle** might justify a curvilinear representation for the curve. A higher degree of controlled environment conditions, though, may allow the continuation of the straight-line approach.

To be most accurate, models need to reflect the seasonal effects of hatch and molt dates in deriving their peak ages, peak rates of lay, and curve slopes. Although the present study did not include economic considerations, practical management decisions must include both the biological responses in this analysis and important factors that may also be associated with the season.

**Table 1: The Effect of Age at Molt on Subsequent Egg Production (%)**



Source: Bell & Adams, Poultry Science, 1992.

## GET THE WATER OUT

Chicken manure has long been used by crop farmers as a fertilizer. It's an excellent source of both organic matter and various needed plant nutrients. In most major poultry areas, manure is available through-out the year in large quantities. In many areas of California it can be spread in most any month. In other parts of the U.S. its use is restricted due to cropping. patterns and climatic restrictions.

One of the principle complaints against the use of manure is the uncertainty the farmer has about the actual nutrient levels in individual deliveries. Manures may vary considerably from load to load, and it is next to impossible for the farmer to fertilize scientifically when this is so.

One of the major reasons for this variation is the difference in water content. Fresh manure will generally contain between 70 and 80% water. As the manure dries, the nutrients are not only concentrated on a weight basis, but also on a volume basis due to structural changes in the manure.

The quality of manure produced by a farm is highly dependent upon the rate of water removal from the piles. The faster this is accomplished, the higher the nutrient levels - especially nitrogen. The manure is simply more concentrated. Rapid water removal is also essential to the efficient transport of the product.

For example, relatively dry manure (less than 35% water) would typically contain 65 pounds of nitrogen per ton, while moist manure (35 to 55% water) would contain about 44 pounds and wet manure (over 55% water) would contain only 27 pounds of nitrogen. A farmer who needs 65 pounds of nitrogen would have to purchase 2.4 tons of wet manure (vs 1 ton of dry manure) for the same effect

The mathematics of water removal from manure is an important concept to understand. When fresh manure dries from 80% water to **70%**, a ton is reduced to 1333 pounds and to 72% of its original volume. If it is taken to 20% water, it will be down to 25% of its original weight and 44% of its original volume. Table 1 illustrates these relationships.

**Table 1. The Loss of Weight As One Ton of Manure Dries**

Percent moisture	80	70	60	50	40	30	20	10
Lbs. of dry matter	400	400	400	400	400	400	400	400
Lbs. of water	1600	933	600	400	267	171	100	44
-Total weight (lbs)	2000	1333	1000	800	667	571	500	444
% of original weight	100	67	50	40	33	29	25	22
Total wt. loss (lbs)	0	667	1000	1200	1333	1429	1500	1556
% water removed	0	42	63	75	83	89	94	97
Est. Weight/cu. ft.	51.9	48.2	44.5	40.8	37.1	33.4	29.7	26.0
Est. Cubic ft.	38.5	27.7	22.5	19.6	18.0	17.1	16.8	17.1
% of orig. volume	100	72	58	51	47	44	44	44

## **INFECTIOUS BRONCHITIS AND ITS EFFECT ON EGG QUALITY**

**Dr. Darrell W. Trampel** Extension Veterinarian at Iowa State University recently gave an excellent summary of the egg quality effects resulting from exposure to the Infectious Bronchitis Virus (**IBV**). In his introductory remarks he commented "IBV is found in nearly all commercial laying flocks. After initial infection of the respiratory system, IBV moves through the blood stream and replicates in the reproductive and urinary systems. Infection of adult laying hens or young chicks by IBV may cause injury to the oviduct which results in impaired external and internal egg quality."

"Infectious bronchitis is a highly contagious viral disease of chickens that initially infects the respiratory system and enters the bloodstream 1-2 days later. IBV can be found within the ovaries and oviduct between 5 and 11 days after exposure. The virus infects all regions of the oviduct, including the infundibulum."

### **Reproductive Symptoms**

"**Egg** production drops by 10 to 50% or more beginning 5-7 days after respiratory tract infection. Production may start to increase after 2-3 weeks, but may never return to normal levels. The average time out of lay is about 35 days."

"**Egg** weight declines following an IBV infection. Average **egg** weight may be 1.5 ounces per dozen below normal at 7 weeks after infection. Loss of weight is due primarily to reduction in total albumen."

"Malformed egg shells become apparent by 4 weeks after infection. Chickens consistently lay eggs with the same egg shell defects in the same location and

egg shell quality may be permanently impaired. In one study, misshapen eggs were produced by 17% of IBV-infected hens from 5 to 50% of the time. **Soft**-shelled eggs were laid consistently by 25% of the hens and 6% laid them intermittently. Calcium deposits were present on eggs from 10% of the chickens. Thin-shelled eggs may be produced by 12% of hens 7 weeks after infection. Both shell thickness and egg specific gravity are reduced."

"Albumen quality declines in infected flocks. Watery albumen with the almost complete disappearance of thick albumen is commonly associated with IBV infection. Marked reduction in ovomucin in both the thick and thin albumen probably accounts for the watery appearance. Average Haugh unit measurements may decline 3-5 units with wide variation."

"Internal laying in **IBV-infected** flocks is usually associated with the production of soft-shelled or fully formed eggs in the abdominal cavity. Yolks progress through the oviduct to a certain point and then reverse peristalsis pushes the egg back into the body cavity."

### **Chick Infections**

When chicks were exposed to IBV at one day of age, 14% of eggs laid after sexual maturity had calcium deposits on the shell, 14% had ridges, and 2% had a faulty shape. Less than **.5%** of the eggs from normal chickens have these defects. **If** female chicks with no or low maternal antibodies are exposed to IBV at 1 day of age, up to 25% of adult hens may develop into "false layers" (normal appearing layers with only internal or **non**-laying).

## **RELATIONSHIP OF EGG COLLECTION METHOD AND EGG SIZE TO EGG BREAKAGE IN COMMERCIAL FARMS**

Research by **Dr. Carlyle D Bennett** of the Department of Animal and Poultry Science at the University of Saskatchewan (Canada) studied the effects of hand packing eggs into plastic filler flats vs the use of mechanical packers in 24 commercial egg production facilities. The weights of cracked and intact eggs were compared at different ages - 52 to 58 (55 wk. av.), and 65 to 70 (67 wk. av.) weeks of age.

When eggs from the pallets in the egg coolers were candled, the role played by egg weight in egg shell damage depended on whether or not the eggs had been packed into trays mechanically or by hand and the age of the flocks represented. In general, the egg breakage from the 55 week old flocks showed no relationship to either the method of packing or to the size classification (medium to jumbo sizes). On the other hand, with the 67 week old flocks, both method of packing and egg size played significant roles in affecting the amount of breakage.

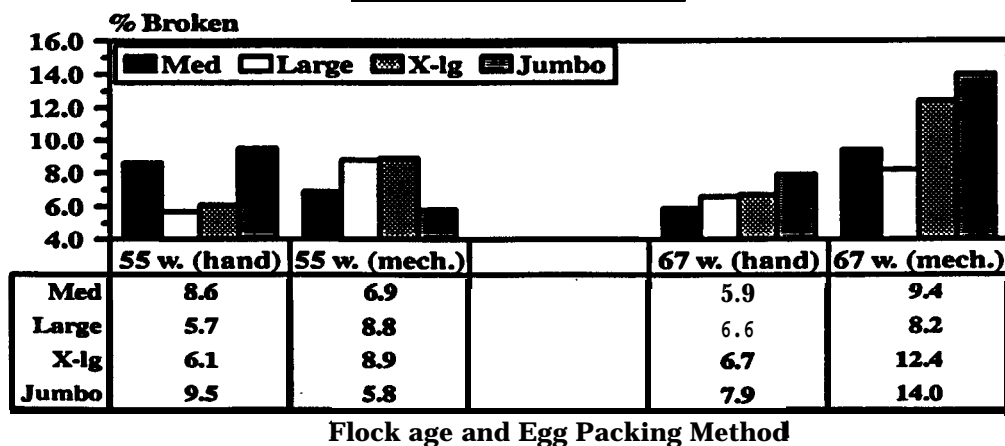
Breakage (hand candled) in the 55 week- old flocks ranged between 5.7 and 9.5% while the breakage in the 67 week-old flock ranged between 5.9 and 14.0%.

The highest breakage, 12.4 & 14.0%, occurred in the mechanically packed eggs in the “extra-large” and “jumbo” categories respectively. (See figure 1).

The author summarized his observations: “The propensity of mechanical packers to crack the shells of larger eggs can result in severe damage if egg size is not controlled in older flocks. In this study, the single flock with the largest eggs had 71.5% of its eggs in the extra large plus jumbo category while the flock with the smallest eggs had only 25.5% of its eggs in these categories. If it is assumed that mechanical packing will increase cracks in the larger size categories by **4.8%**, the flock with the largest eggs would have 3.4% more cracks if its eggs were packed mechanically instead of by hand. In contrast, egg breakage in the flock with the smallest eggs would increase only 1.2% if a mechanical packer was used, and cracks would be 2.2% less than in the flock with the largest eggs. Overall grade-out can be altered significantly if mechanical packers are used on farms where egg size is above normal.”

(Editor’s comment: In the U.S. 1% egg breakage is usually estimated to cost the producer 5 cents per hen per year.)

**Figure 1: Egg Breakage as Affected by Flock Age and Packing Method**



Source: CD. Bennett, Journal of Applied Poultry Research, 1992

## **INDEXING AND PERFORMANCE STANDARDS IN POULTRY**

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In the poultry industry, we have many terms that are used to express a quantitative evaluation of different performance traits such as body weight, body weight gain, feed intake, feed conversion, feed efficiency, mortality (**%**), hen-day egg production (**%**), hen-housed egg production, egg weight, egg mass, and the list goes on. Several of these **are** indices of one type or another, such as “feed conversion” which relates feed consumption to product yield. When dollars are added, an economic index is the result - feed cost per pound(kilo) or per dozen.

Standard measures of biological performance are very important in emphasizing areas of strength or weakness, but they need to be taken one step further so that they are considered **together** with other important factors which contribute to the economic success of the enterprise. Too often the interpreter of flock performance places his or her own emphasis upon the importance of one trait over another. An index using a standardized price relationship expresses results in a manner more relevant to commercial applications.

The word “index” has many definitions, but the one that applies to this topic is: “a ratio or other number derived from a series of observations and used as an indicator or measure”. In other words, a single number is used to represent a **series** of observations.

The principal objective for being in the poultry business is associated with economic gain. For this reason, it's essential that the measures of performance that are used are related to economics. High body weights are not, in themselves, always the most economic. This is obvious when one compares the poorer feed conversion

associated with attempts to obtain higher body weights. Other measures of performance may be adversely affected when striving for the highest rates of egg production. Egg size and value may be sacrificed to the point where total income suffers.

Why do we measure flock performance in the first place? The usual answer is that “it tells us where we are relative to our potential”. It helps us to evaluate the quality of our management. It helps us to know whether our many management decisions are up to the standards of the industry as a whole. A two pound feed conversion is nothing to brag about if everyone else is getting a 1.75 pound conversion. It wouldn't even be competitive. But it would be exceptional if the industry standard was 2.25.

Obviously, in order to know where we are, we must first record accurate data from our own flocks and then have access to equally accurate data from our competition. No one benefits from living in a vacuum relative to the need for comparison data. Comparison **data** is readily available from the breeders and various consulting firms, but care must be taken to recognize conditions which may or may not allow for their meaningful use. Your flock is real and exists during a specific **time** period under a distinct set of environmental conditions. Standards are generally nothing but **averages** for all conditions and are usually quoted on the high side. They usually do not take into account a wide range of conditions which can affect their usefulness. Standards that quote feed consumption rarely consider temperature variation. Egg size standards are not adjusted to the season. Standards associated with a specific age are subject to more error than standards associated with an entire flock. For example, an egg weight taken in July would usually fall far short of an average weight stated for that same age. On

the other hand, an average weight representing the entire cycle of production with multiple sampling would usually be more comparable to that expected.

An important objective of the economic evaluation of performance is to analyze the economic benefits associated with change. New birds, feeding programs, beak trimming procedures, replacement programs, etc. may have readily visible attributes, but they require a major analysis of **all factors** which may result from their adoption. Too often we look only at one or two obvious traits such as body weight at **six** weeks or hen-day egg production % at the peak. Without considering all aspects of production over "normal" life spans and relating this to costs, income, and investment, the change may result in lowered profits rather than the improved profits expected.

### Egg Production

Current economic indices were first suggested for use in the U.S. table egg industry about 5 years ago and have gained wide-spread acceptance during the past several years. The key factors included in the indices are weekly egg production rates (%), mortality rates (%), feed consumption, egg weights and standardized feed and egg values. An essential element of the equation to calculate an egg economic index is the formula which converts egg weight to a standardized value per dozen.

Weekly or monthly input of, all data is required because of the changing egg values associated with age. A simple average price does not estimate income properly.

We use the economic index in conjunction with various research projects and it allows us to apply **our** research results to the commercial industry in a more meaningful manner. In typical published research, economics are rarely applied.

The egg indexing model utilizes calculations already available on most egg production farms and, in a sense, recreates the original totals. Most egg producers already collect most of the data required with the common exception of egg weight. Results are in dollars and reflect egg income minus feed costs per hen housed. Indexes have been applied to U.S. flocks hatched since 1986 and values have ranged from less than 4.75 to as high as 6.25 to 60 weeks of age. Our ongoing average for 200 flocks **averages** 5.26. In general, a flock with an index of **6.0+** would be considered an exceptional flock. Egg numbers would be high, mortality and feed consumption would both be low.

### Poultry Meat Production

In general, in the U.S., performance indices are usually limited to feed conversion. In the European Community, a performance index is used which recognizes livability and final weight as well as feed conversion.

$$\text{Europe Broiler Index} = \frac{[(10) \times (BW/D)] \times (L)}{FC}$$

The index is calculated by multiplying by 10 the final body weight in grams (**BW**) divided by the number of days at sale (D). This answer is then multiplied by a livability factor (L) (example, 96% = **.96**). This number is then divided by feed conversion (FC) (total feed used/total body weight). If BW = 1970, D = 42, L = **.96**, and FC = **2.0.**, an index of 225 would be obtained.

**A copy of a more descriptive article on this subject is available from the author (Don Bell).**

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