Breeding for broiler efficiency - a long term commitment

In 1981, Cobb began deriving data on reliable individual bird performance from a large number of birds, to focus on efficiency.

Efficient growth rate became the selection driver and feed conversion ratio (FCR) became the trait of greatest importance. Feed conversion showed moderate to high heritabilities and was predicted to respond to genetic selection year on year. Approval of a test facility with controlled environment encompassing temperature, airflow, light intensity and several other factors influential on feed conversion, afforded accurate control of the environment and enabled the birds to truly compete against each other and expose individual bird's differences due to genetics, instead of environment.

Full testing in the pedigree program resulted in measureable improvement in the field where the reduction in feed conversion was recognized by customers and led to full commercialization of the Cobb 500 in the early 1990's.

Testing identified individual birds with exceptional feed efficiency and muscle deposition. Appetite remained relatively unchanged and feed conversion improved as a function of bird efficiency. The focus was on a bird that did the most with the feed it consumed. By holding feed intake and environmental factors constant, individual bird growth rate and yield differences were identified. Fine tuning created the important advantage of producing the breed with the lowest cost per kilogram or pound of live weight produced - a sustainable advantage for customers.

The computer supported testing program enables multiple traits to be monitored along with the genetic performance of full siblings, half siblings, cousins, aunts, uncles, and parents to provide better predictability of performance. This support enhances the accuracy of bird selection, maximizes the rate of gain from the program and allows welfare traits to be incorporated. Breeding values derived from the testing have allowed better predictive values for the next 5 to 10 years.

Continued refinements offer better compatibility with new technology like Marker Assisted Breeding derived from use of biotechnology methods relating identifiable gene sequences, which can improve speed and accuracy in bird performance improvements and the potential gains from the program.

Today's products have all benefited and provide the greatest efficiency and lowest cost in the conversion of feed to live weight, delivering excellent customer value in the current climate of continuing high grain prices.

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Rearing male broiler breeders for reproductive efficiency

Hatchability is the ultimate measure of reproductive efficiency. Anyone who has candled eggs in the hatchery from a flock with infertile eggs soon realizes the enormous waste of eggs and energy this represents.

Success in achieving reproductive efficiency begins in the rearing house. In particular, the male feeding and management program should enable the male reproductive system to develop correctly while controlling the tremendous growth potential and capacity to deposit breast muscle.

This balance is best achieved by growing the males on a "sigmoid" (S-shaped) weight profile as opposed to a linear growth pattern. This allows relatively rapid growth and skeletal development up to 8 weeks of age, controlled growth from 8 to 16 weeks, and accelerated growth again from 16 weeks to sexual maturity.

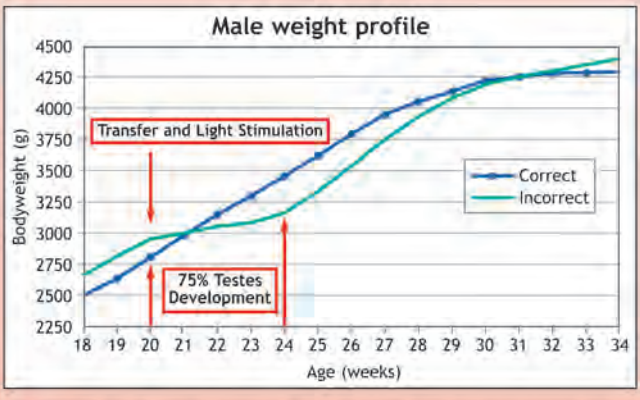
A good start in rearing is crucial for weight uniformity, organ and skeleton development. Excess bodyweight at 4-6 weeks of age is undesirable but a fairly common problem. Heavy males will develop big frames and will then require more bodyweight during production to maintain proper fleshing condition. These males will also show more body composition and skeletal issues as they are usually restricted too severely during the weeks 8 to 16 to return to target weight.

The keys to good uniformity are low stocking densities, sufficient feeding space, proper brooding and a good grading program to accommodate the smallest 20% of the males.

At sexual maturity and thereafter, the shape of the breast on the males is a good indication of the body condition. For example, a V-shaped breast is much better than either a thin, emaciated breast or a wide, almost "double-breasted" male.

Transferring the males from the rearing to production:

- Achieve a ratio of 9-10 males per 100 females
- Cull underweight and overweight males
- Match heavier groups of males with heavier females
- Cull poorly conditioned males regularly
- Ensure good, positive growth in the first weeks after light stimulation (refer to graph below).



Arrival at 30 weeks with a uniform population of males at the target bodyweight and preferred composition, normally means the most difficult task has been completed and the management should then be much easier.

Preparing breeder pullets for lay

Good egg production from today's meat-type breeder hens demands close attention to every phase of the pullet rearing.

Normally, the rearing is divided into three distinct phases: Starting phase from 0 to 28 days; maintenance phase from 4 to 16 weeks, and then preparation for lay to point of light stimulation. This last phase is where the producer can make a great impact on performance.

It is essential that the female parent achieves sufficient bodyweight gain between 16 and 20 weeks of age to maximize peak egg production and maintain post-peak efficiency.

The female's body composition at lighting is as important as the actual bodyweight of the bird. This means that the hen must have adequate fat reserves and fleshing at this point. Birds normally lay down fleshing quite easily between 16 and 20 weeks of age, but this is not the case with building fat reserve.

To build an adequate amount of fat deposition, the female must achieve sufficient weight gains in this critical phase. A good management tool is to have a 33 to 35 per cent weight increase in female bodyweight during the period from 16 weeks (112 days) of age to 20 weeks (140 days). It is also possible to calculate as a guide the bodyweight increase from 16 weeks to first light stimulation, if the flock is stimulated later than 140 days. For example, this increase should be around 45% for birds stimulated at 147 days. The beginning of fat deposition can be felt under the skin of the bird at the end and outside of the pelvic bones (see below).

Adequate fat reserve

Inadequate fat reserve

It is evident in meat-type breeders that the ideal point of the first light stimulation is not age but body composition dependent.

Uniformity of both bodyweight and body composition largely determines the sexual response of the flock and hence the peak performance, as well as persistency over 80% and 70% production. If either the average bodyweight or uniformity is below the breed specific recommendations, consider a delay in initial light stimulation.

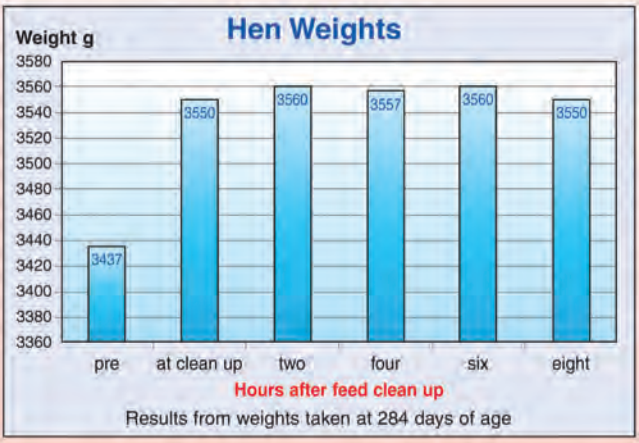
Accurate weighing of breeder hens

The proper sampling and accurate weighing of breeder hens during their production cycle is both important and necessary. Knowing the hen flock's status on weight and body composition gives the producers and technical service personnel the information necessary to make the proper decisions for long term performance.

This information is vital at any stage during production, as a management decision concerning feeding based on incomplete or inaccurate weights could easily cause the flock to become underweight or overweight. This compromises the ideal body composition, and in either case could result in a 10 to 15 egg per hen decrease in life-of-flock production, as the affected hens reduce their production in the latest weeks of the lay cycle.

The weighing of hens is sometimes compromised by the fact that the hen has a certain amount of feed remaining in her system after consuming her daily ration. Accurate weights have been generally considered to be "empty" weights, in order to get the true weight of the hen without the added complication of guessing how much to adjust the weight because of feed in her system.

Contrary to this belief, recent research at the University of Arkansas (USA) shows that hen weights tend to remain constant all through the day at any time beginning at two hours after feed cleanup. This would indicate that the technician gathering the flock data does not really need to wait until after mid day to do the weighing, and the results would still be just as accurate.



Results from weights taken at 284 days of age

The above weights were taken by weighing all birds of the same pen during each weighing, so no sample error would enter into the data. These hens were being fed 139 grams per bird (30.55 lb/100) on an every-day basis. The weight patterns are typical of any age for hens in production, and are consistent and repeatable over a wide range of hen ages and weights, even including onset of lay.

This research points concludes that hens can be weighed at any time after 2 hours post cleanup with no change in the accuracy of the hen weights. This could help the technician make more productive use of the complete workday if there are several flocks to be weighed in a day's time.

Minimizing floor eggs - a review

A significant problem facing egg producers is getting the hens to use the nest provided rather than laying eggs on the floor. Producers and hatcheries want hatching eggs that are clean, free from bacteria, and untouched by moisture. Less labor is required to gather nest eggs and more clean eggs are produced. Nested eggs have less surface contamination, producing a higher hatch and healthier chicks for the broiler producer.

Areas of consideration:

Rearing house

Lighting needs to be uniform within the rearing house and reduced in intensity from the lay house. Mechanisms must be implemented that do not discourage the young hen from jumping onto the slats. A producer can use training perches in rearing with same design and materials that the birds will see in lay.

Production House

Differences from recommended weight ratios of males and females can affect nesting behavior. If males pursue the females too aggressively, the females may become frightened and this interferes with selection of a correct nesting site.

Artificial lighting should be placed to supply the correct intensity and eliminate shadows.

Ventilation should be designed to provide airflow patterns that keeps the environment as uniform as possible to reduce bird migration from less comfortable areas in the house.

Feeding and watering equipment should not restrict passage to and from the nest sites. Feeders should be raised immediately after feed cleanup to discourage nesting under the equipment.

Nests should be readily available, clean, properly ventilated and maintained for the best hen comfort. Enough nest boxes should be supplied to accommodate the number of hens in the house. Nests and equipment must be checked regularly for stray electrical voltage which may interfere with nesting.

Slats should be low enough to allow the hen's easy access, or have ramps or steps to facilitate entry to the nests. An angle of more than 10 degrees on slats is uncomfortable for the hens and may lead to more floor eggs.

Sick birds are less active and less able to move between the scratch area and the slats to find a nesting site.

Training hens to use the nests is extremely important. From around 23 weeks through peak production, it is best to walk the hens in a slow, consistent pattern which encourages the hens to move towards the nests. Block off attractive sites like corners or under feed hoppers.

There is no easy answer to floor eggs other than good hen house management which minimizes the number laid.

Grading breeders in rearing for maximum performance

Flock uniformity, both of males and females, has become recognized as the most important factor contributing to the success of a breeder flock. Keeping the birds uniform, both in body weight and body composition, offers several important advantages:

- The flock can be fed more precisely during rearing
- The flock will have a more uniform and consistent response to light stimulation
- Peak performance will be enhanced
- Persistency of lay is better
- Hatchability is better and persists longer
- Life of flock mortality is normally less.

Grading can be a fairly basic process, or very elaborate. The intensity of the grading program would depend on how uneven the flock has become. Grading too often can create stress and uniformity improvements can be lessened. Under good management conditions, minimum grading would be sufficient. Under poor management conditions, grading will only temporarily increase uniformity.

The first grading should be done by weight at 21 days of age for females and 28 days of age for males. Sample weights from three areas of the house should be taken to determine the actual average weight of the flock. Weight limits for each division can then be calculated. For example, there could be an 'average' weight group, a 'light' group that is more than 1 CV below the average, and a 'heavy' group that would be more than 1 CV above the average. Further divisions could be necessary if the flock is extremely uneven due to disease or other challenges.

The entire flock then needs to be weighed individually and segregated into divisions. The flock could be re-graded at 7-8 weeks of age if still uneven. At 15-16 weeks of age another grading could be done based not on weight, but on body composition. These techniques would apply to males and females both.

Flocks also become uneven due to differing individual levels of aggressiveness when feeding. Aggressive birds will crowd out the more timid birds, and this is intensified when feeder space is at a premium. For this reason, the smaller birds should not be returned to the main flock after recovery, as they will in most instances become underweight or under fleshed again. Due to lower levels of competition after grading, smaller birds in a division with like birds tend to have better weight gain even if no additional feed is given.

Grading is an excellent tool to help flock performance when the grading crew is experienced and the technique is perfected.

Effect of breeder hen diets on broiler performance

Significant research has been completed on hen diets and the effect on egg production, hen body weights and the number and quality of eggs produced. Numerous trials, studies and examinations of field data concerning broiler diets and the impact on performance are also available. However, much less research has been conducted comparing the effect of the parent hen diet on the subsequent performance of her broiler progeny.

PROTOCOL

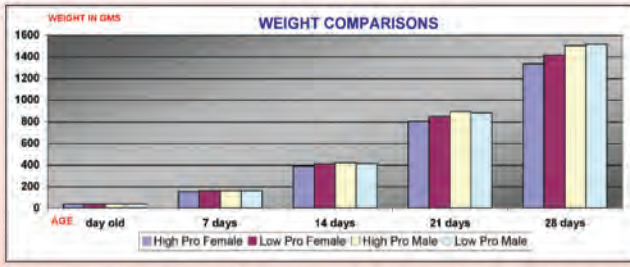
A recent trial was performed by Cobb-Vantress, Inc. at their research facility in the United States to measure these effects. Two groups of broilers from identical hen lines were hatched and placed in grow-out pens. Group One was from hens fed a standard protein diet (SP) with 16% crude protein and Group Two was from hens fed a low protein diet (LP) with 14% crude protein. The broilers were sexed, individually weighed for a comparison of chick weight and uniformity, then placed randomly in sex-separate pens with an equal number of chicks per pen. Each chick was fed 568 grams (1.25 pounds) of broiler starter diet and then placed on a broiler grower diet for the remainder of the trial, which concluded at 28 days of age.

RESULTS

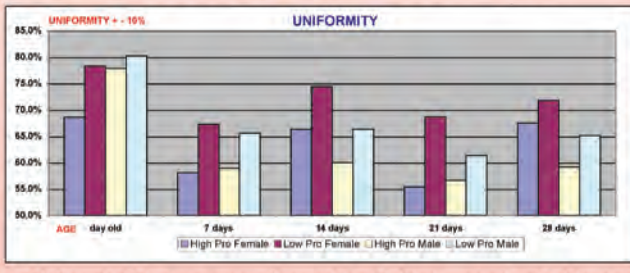
Hatchability from the LP group was 5% higher than the SP group. This hatchability difference between different groups has also been confirmed in trials by Dr. Craig Coon at the University of Arkansas.

Overall broiler mortality at 28 days was 2.12% in the LP group compared to 3.95% in the SP group, with males showing the most benefit. Female mortality was similar in both groups.

Although similar over 21 days, the broiler weights of the LP group were greater in both males and females by 28 days of age.



The most striking difference was in the uniformity of the two groups. In both males and females at each age the uniformity (+/-10% from the average) was better in the LP group.



Although this was a small number of birds, conducted in pen trials, these findings have also been reported in the field in both the U.S. and Europe. Further research and larger trials, carrying the broilers to full market age, need to be completed to determine if this is repeatable commercially. Confirmation could allow the integrator to fine tune the hen rations to the most economical diet and be assured that this is beneficial to the performance of the broilers.

On-farm egg storage:
Avoid pre-incubation

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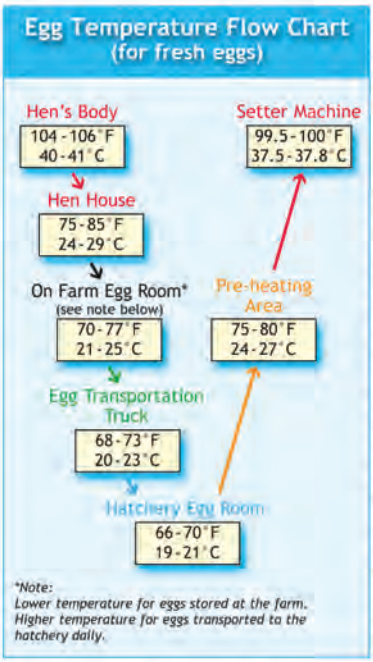
Broiler breeder hatching eggs are commonly held in storage facilities at the breeder farm anywhere from one to four days and again at the hatchery until placed in the setters. One purpose of egg storage is to accumulate eggs to meet the demand for chicks and to best utilize hatchery facilities, but ultimately the goal is to arrest further embryonic development while maintaining embryo viability. In the poultry industry, some pre-incubation of hatching eggs following lay and during storage is inevitable, yet efforts should be made to reduce this occurrence.

It is well known that most hatchability problems are a result of poor fertility. However, how we care for hatching eggs can have a tremendous effect on overall hatchability. While an egg storage temperature of 68°F (20°C) is the most common industry recommendation, the actual on-farm egg storage temperatures often range from a low of 60°F (15.6°C) up to 75°F (23.9°C). This range is due to different management programs or as a result of poor egg storage facilities that are unable to maintain a proper and constant storage temperature.



Each time the internal temperature of the egg is elevated to near 75°F (23.9°C), metabolic activity is again initiated and embryo development ensues, only to be slowed again during additional egg cooling. While cooling of hatching eggs is necessary, starting and stopping embryo development weakens the embryo and reduces its viability. The ideal situation is for hatching eggs to undergo only two temperature direction changes; one from the hen to the lowest temperature point at the commercial hatchery egg storage facility and the second temperature direction as eggs are moved to preheating and then into the hatchery setter machines (see chart).

Research completed at the University of Arkansas (USA) indicates that variations in on-farm egg storage temperatures of as little as 2°F (1.1°C) can reduce hatchability by as much as 3.5%. Field observations of on-farm egg rooms indicate that the actual temperature variations often exceed these limits. Therefore, regardless of the equipment in the breeder house and the hatchery facilities, hatchability is routinely lost in commercial hatcheries due to neglect of the on-farm egg storage facilities.

Extra care and attention therefore needs to be given to all areas of possible temperature variations. Location and capability of the on-farm egg room machinery, proper temperature control during all phases of egg transport (particularly during times of the hottest or coldest weather), hatchery egg room storage and correct pre-warming procedures are all critical to attaining the hatch potential of the flock. Close monitoring of all of these parameters will enhance the resulting hatch.