

# Improved Egg Size

## high heritability of egg weight gives rapid response to selective breeding

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**Breeding for egg size** differs in several important respects from other problems of poultry breeders.

In the improvement of egg number, livability, hatchability and many other economically important characters, the breeder always selects in one direction. His goal is to have the birds in his flock lay the largest possible number of eggs, live as long as possible, at least until he is ready to dispose of them, and produce fertile eggs all of which would hatch when incubated.

Egg size is a trait where the most profitable type is not the extreme one: eggs can be too small to be of great economic value, and they can be too large for maximum net returns to occur.

The most desirable egg size is an intermediate one; the most profitable range of egg weights being 24 to 26 ounces to the dozen.

Although substandard egg sizes are more frequent than overly large ones, especially in flocks of high egg production, there are instances where breeders have had to reverse the direction of selection.

A breeder may have started with a flock characterized by too small eggs. After several generations of selection for larger size, he may have found that too many of his birds were laying jumbo-sized eggs.

Under such circumstances the breeder would be forced to reverse his standards of selection for egg size.

The fact that the optimum condition is the intermediate one is only one of the reasons why such reversals of selection goals can occur. Another reason that is no less important is that of all economic traits in poultry, egg weight probably responds to selection most rapidly—the trait of egg weight shows extremely high heritability.

### Heritability

Heritability measures the degree of accuracy with which the genetic constitution of an individual may be estimated from the individual's own appearance or performance with respect to the trait in question. Thus the heritability of the hen-housed average egg production is in the neighborhood of 5%, and that of livability under 10%. The heritability of egg weight in contrast to these figures has

been recently established as being about 60%.

The definition of heritability should itself make it clear why selection on the basis of the individual's own record—mass selection—is relatively ineffective for characters of low heritability. Since the correlation between performance and hereditary make-up is low in such cases, the breeder will make many mistakes of judgment in attempting to select genetically superior individuals. In characters with high heritability, good performance of an individual is a much better guarantee that such a bird does indeed possess a superior genetic endowment which it in part transmits to its offspring. As a result of this difference, the improvement of characters with low heritability has to be based primarily on methods of selection involving family averages—sister or progeny testing—while that of characters with high heritability is best pursued by the use of mass selection.

While the other characters cited—egg production, livability, hatchability—fall in the first category, egg size belongs to the second.

In selective breeding for egg size family averages need not be paid too much attention—except in the case of selection of males—the individual performance of the bird being the most reliable guide for selection.

### Disassortative Mating

It is the property of high heritability which permits the breeder to apply successfully the principle of disassortative mating—the mating together of unlike birds. The breeder may constantly use this type of mating system to obtain birds possessing the desirably intermediate genetic constitution for egg size instead of changing the direction of selection over a period of years.

Under this plan, females laying large eggs would be placed in pens headed by sires from small-egg families, and females laying small eggs would be mated to males from large-egg families.

With characters of low heritability the assurance that the progeny would be possessed of the desired intermediate properties is much less than it is with traits of high heritability.

In general, the efficiency of any breed-

ing program is determined by the balance between the genetic gains achieved and the cost of obtaining them.

Just as some breeders keep insufficiently complete records, so others expend a considerable amount of effort in amassing data which may contribute so little to the success of a breeding program as to fail to pay for the cost of collecting them. Egg size is a character of economic importance which illustrates this point particularly well, since most breeders as a rule make much more elaborate measurements for this trait than seems to be warranted by the latest information on its inheritance.

### Egg Weights

Probably the basic reason for this lies in the fact that egg size does not remain constant throughout the laying year. Hence the breeder reasons that measurements should be made at several different times. This leads to the common practice of weighing several eggs from a given bird in each month of her first year of production. To reduce the information gathered in this fashion to a single figure, the monthly weights are usually averaged for the whole year. Subsequent selection is then based on the annual mean egg weight.

There are many modifications of this method but they all involve the weighing of many more eggs than is really needed to arrive at a judgment regarding the merits of any particular bird with respect to egg weight.

Although the weight of eggs produced by a pullet will vary throughout the year, a sufficiently high correlation between the weights in different seasons exists to permit the selection of birds on the basis of measurements taken in one season only. More specifically, recent studies indicate that the average weight of eggs produced in the course of five days during November provides an adequate estimate of the genetic value of a bird for egg size.

The advantage of such limited measurement lies not only in the cutting down of the cost of record keeping but also in the fact that this procedure enables evaluation of a pullet's worth before she is a year old, and thus speeds up the breeding program.

It is conceivable that in some flocks there are significant differences in the patterns of seasonal egg size increase. In such instances additional spring measurements may be needed. There is no available information to indicate that this situation is of frequent occurrence.

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