Breeding chickens to meet egg quality needs

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 Worldwide, egg customers have much in common, generally preferring eggs which have a sound shell, uniform shell colour, freedom from obvious blood and meat spots and a reasonably upright egg white. However, there are also regional preferences that can strongly influence the choice of genetic type for particular markets.

**Differences in market needs**

- **Shell colour.**
  The most obvious trait affecting breed choice is eggshell colour, with the brown egg type dominating the markets of most of Europe, Southeast Asia, Australia, New Zealand, much of Africa and some countries in South America. However, there are differences in shell colour preference from country to country within Europe.

- **Albumen height.**
  Although all consumers prefer that the albumen in a broken-out egg be reasonably thick, the relative importance of this trait varies from one market to another. In the USA, standards are set for the minimum acceptable Haugh unit level. Haugh unit values are a measure of the height of the thick white in a freshly broken egg. The Haugh unit calculation takes into account egg size, since it is correlated with the thickness of the egg white.

- **Blood spots.**
  Blood spots in the egg weight than the Hy-Line variety Brown.

- **Egg size.**
  In general, egg size averages 60-61g across the world; however, there are regional preferences for egg sizes that can influence the choice of genetic strain toward varieties that produce eggs that are larger or smaller than this average.

- **Blood spots.**
  Blood spots in the egg are generally unacceptable, but very small spots will pass unnoticed in most markets. However, for those adhering to the Kosher dietary laws, any blood in the egg is unacceptable. Islamic dietary laws prohibit the eating or drinking of blood, so blood spots are also unacceptable in predominantly Muslim markets.

- **Colour.**
  The Hy-Line variety Brown and other white tailed Red varieties provide most of the world’s supply of brown eggs.

- **Blood spots.**
  Blood spots in the egg are generally
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In both Israel and Spain, those genetic varieties with a larger size have an edge over strains with smaller sizes. In addition, birds are managed in a way to get more eggs of the larger grades.

- Percent solids.

Historically, most eggs have been sold in the shell, but the proportion being marketed as liquid, dried or further processed product is increasing.

In the USA, approximately 30% of all eggs produced are now broken out for further processing. A similar market split, between the shell egg and broken out eggs, also occurs in Italy.

The US Department of Agriculture has set minimum standards for percentage solids in egg product. For liquid egg mix resulting from the combination of yolk and white, the minimum is 24.2% solids.

For whole egg resulting from the direct breakout of the egg, with no separation of white and yolk, buyers are commonly asking for at least 23.6% solids. Egg product that falls below these standards is commonly ‘docked’

Table 1. The heritability for some key traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>White egg lines</th>
<th>Brown egg lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg weight</td>
<td>0.53</td>
<td>0.55</td>
</tr>
<tr>
<td>Shell strength</td>
<td>0.27</td>
<td>0.40</td>
</tr>
<tr>
<td>Albumen height</td>
<td>0.37</td>
<td>0.44</td>
</tr>
<tr>
<td>Shell colour</td>
<td>0.43</td>
<td>0.55</td>
</tr>
<tr>
<td>Blood spots</td>
<td>0.03</td>
<td>0.10</td>
</tr>
</tbody>
</table>

In price, with the producer receiving less than the market rate. Percent solids in the egg vary with age, but it is also influenced by strain of bird, so there is pressure on breeding organisations to develop hens that produce higher proportions of solids.

Since the yolk is much higher in solids content than the white, varieties with a lower proportion of albumen are favoured for this market.

In Italy much of the egg product is used for the manufacture of pasta and the emphasis is on percentage lipids. The Italian industry has set a standard of 10.5% lipids in liquid yolk.

Breeding to meet market needs

Breeders of egg type chickens are improving all of the key egg quality traits. This improvement takes the form of selection within the pure lines making up each commercial cross. This within line improvement is translated into a slow but steady improvement of the commercial product.

The proportion of the total observed variation for each trait that is genetically determined influences the amount of genetic change that a breeder can make. This proportion is referred to as ‘heritability’.

The heritability for some key traits is listed in Table 1.

From Table 1, it is clear that it is much easier to modify some traits than others. Egg weight has a relatively high heritability and responds rapidly to selection. Blood spots on the other hand have been bred to very low levels, particularly in white egg stocks. Further reduction in blood shell strength, after which the egg is broken onto a mirrored glass, allowing observation of the egg from all angles.

Blood and meat spots are recorded, as are any other abnormalities in the egg. Albumen height is measured.

Finally, the yolk is separated and weighed.

In addition to the eggs brought in from the pure lines, we also bring in samples from our field trials, where each family is on test. These eggs are sent in at three ages before the moult, and once post moult.

As an illustration of the process of evaluation, the procedures for evaluation of two traits will be described in more detail.

Albumen height measurement

As each egg is broken out, a tripod is placed over the egg, with a probe centred midway between the edge of the thick white and the yolk.

This probe is lowered down into the white, and at the instant at which it comes into contact with the white, a signal indicating the height off the glass plate is transmitted to the computer. This is the albumen height, which is measured in millimetres.

Since the egg weight has already been measured, we can calculate the Haugh units.

Shell colour measurement

Shell colour for each egg is evaluated using a device manufactured by the Minolta Corporation.

The aperture of the device is centred on the top of the shell, and when the trigger is depressed, a flash of light is projected onto the egg’s surface.

From the reflected light is determined its lightness (L) and its hue, expressed on a red-green scale (a) and a yellow-blue (b) scale. We convert L, a, and b into an index, calculated so that a high value indicates a dark brown shell and a low value a pure white shell, on a scale over an approximate range of 1 to 100.

Hy-Line brown eggs are being selected for a darker shell, with a genetic improvement of about one unit per generation. Among our white egg lines, any hens with tinting in their shell are removed, to ensure that the commercial continues to have a pure white shell.

In conclusion, breeders have to recognise the unique egg quality needs of each of their worldwide markets. To some extent this is accomplished through the development of special varieties for certain niche markets.

In general, the principal genetic varieties are sold throughout most of the world, with management adjustments to provide eggs for customer requirements that vary from the norm.