TECHNICAL NOTE

LowInputBreeds

Breeding of Laying Hens

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About

This note describes how breeding of laying hens developed worldwide and if and how breeding programs should be adapted for free range and organic systems. Discussions with farmers in France, Switzerland and The Netherlands with free range or organic laying hens at the onset of the Low Input Breeds project on what the ideal hen is for such systems was used as input.

History of poultry breeding

The domestication of chickens started over 4000 years ago. Since then, they have been bred selectively, either for their appearance or their performance. At first, chickens were used for religious and cultural purposes; with their feathers and bones used for rituals, as decoration or for tools. Soon afterwards entertainment became of importance as well; for instance cock fighting. Nowadays the chicken plays an important role in our food chain, but this just started a few centuries ago. In the 19th century there was a sharp increase in breeding 'fancy fowl', and the upper class spent large sums of money to breed poultry just for their appearance, and they kept them in special poultry parks. An enormous variety of breeds were created and poultry shows for exhibiting their creations were held all over the world. Specialized breeding for egg production or meat was not manifested until the 20th century. Ordinary chickens were kept as scavengers and only occasionally eggs or chickens were eaten.

However, around 1900 a reliable trap nest was invented (making it possible to register which egg belongs to which hen). Besides, the Mendelian principles of hereditary were recognised; poultry were a major species to test these principles – in this way it became possible to breed for production! Early in the 20th century, over all continents existing breeds were selected for egg and/or meat production. Around 1940 it was detected in the USA that the crossing of breeds offered an advantage concerning production traits.

Initially most production breeds were 'dual purpose'. The hens were kept for their eggs and in the end, the spent chickens were used for making chicken soup, while the cockerels were reared for their meat. Famous dual purpose breeds were Plymouth Rock, Rhode Island Red and the Australorp.

A Japanese invention was the start of further specialization: around 1930 the skill to sex newly hatched chickens was developed, thereby removing the need to raise all chicks to about 8 weeks before males and females could be distinguished from each other. In fact, sexing of day-old chicks, the invention of vaccines and medication to prevent coccidiosis (leading to a significant reduction of mortality among young chickens) were the start of the industrialization of poultry production.

Leenstra and Sambeek (2014): Poultry Breeding.
LowInputBreeds technical note. Download at www.lowinputbreeds.org

Breeding for industrialized poultry production

Worldwide all commercial poultry are being produced by breeding companies. When the industrialization of poultry production started, every country had numerous small breeding companies, but a huge consolidation took place with the increasing global importance of poultry production.

Currently two (family owned) companies dominate the world market for breeding layers, although a number of smaller local companies operate as well, but mostly for niche markets. Breeding for poultry meat production is concentrated in three breeding companies (one of which is related to one of the layer breeding companies; one is family owned, and one is a subsidiary of a stock listed company).

This note focuses on laying hen selection, although in all cases commercial poultry breeding follows the same system: within the company a large number of pure lines are selected for a variety of traits. These lines are crossed in specific combinations to deliver the parents of commercial laying hens or commercial broilers. A commercial hen or broiler is thus a so-called 4-way cross. Due to the crossing scheme different capabilities can be combined. And there is a clear, positive effect of heterosis, e.g. the fact that a hybrid or cross is superior to both parental lines. Although there is no public or recent information on the comparison of pure line versus cross line birds performance available, from the theory and the experimental comparisons of over 50 years ago it still can be assumed that cross line hens perform 10 to 40 percent better than pure line hens. The biggest improvements can be seen in the low heritable traits, like liveability and reproductive traits.

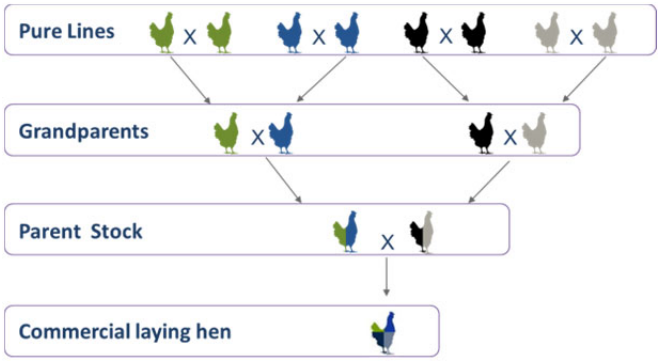

Figure 1: Cross breeding or hybridisation scheme of commercial laying hens

Worldwide most commercial hens are kept in small groups in cages, although in some parts of the world there is the trend that more and more laying hens are being housed in large groups and some of them even with outdoor access. This type of housing implies new requirements for the hens. Social behaviour is of much higher importance, as is good nesting behaviour and a temperament that prevents smothering and pecking each other. For laying hens, egg production per hen, feed conversion and shell quality are also important economic traits. To measure the genetic potential of hens, data on individual egg production are required, which is quite easy when hens are kept in (individual) cages, but much more complicated for hens kept in groups. In this case the trap nest is a prerequisite and can also asses nesting behaviour (to eliminate floor eggs). Trap nesting might be carried out mechanically although subsequent electronic tracking and tracing of eggs is still in its infancy and requires a high investment to reduce labour necessary to check the nests. Accuracy of recording is the key in successful breeding programs. Currently, breeding companies are mainly making use of group selection; the so-called Recurrent Testing and Reciprocal Recurrent Testing (select the pure lines on the performance of their cross bred progeny), to select the modern breeds for liveability, less pecking and social interaction in the field.

Picture 1: Free range laying hens. (Photo: WUR-Livestock Research)

Random sample testing

In the old days, when there were still many breeding companies, the so-called random sample layer tests were used in many countries. Random samples of hatching eggs of commercial crosses were sent to the testing stations and their performances were compared under identical conditions. In Europe the results of different testing stations were summarized until about 1990. By that time the number of breeding companies and the interest in random sample testing decreased significantly and most testing stations closed down during the last decades of the 20th century. Today, only three testing places are left: Ustracise Czech Republic, Kitzingen Germany and North Carolina USA. Hens are tested in cages as well as in a floor housing system although without outside access.

'Rustic breeds'

In organic production there is some demand for so-called rustic breeds that should be more robust compared to those reared for cage production. During discussions with farmers organised in LowInputBreeds, it was indicated that organic and free range production have more unpredictable condi-

tions that might be stressful for hens. In addition, with organic production the dietary requirements (for instance no synthetic amino acids) make it difficult to formulate adequate diets, which might also imply stress. A more robust bird, with a relatively high eating capacity, might be more capable to deal with such circumstances. For LowInputBreeds in Switzerland, France and The Netherlands a total of 260 farmers with free range hens were interviewed. The interviews showed that a large variety of commercial genotypes is used (Leenstra et al. 2012).

Performance of rustic breeds

To date there is no suggestion that rustic breeds outperform commercial crosses when kept for commercial egg production. Egg production from rustic breeds can be 200 to 250 eggs per hen per year. But this is below the output of commercial crosses held in the same situation, where 280 to 300 eggs are possible, often with lower feed consumption (feed costs).

In some countries, there is a market for small scale dual purpose production, often on mixed farms, where a small number of chicken is kept on crop by-products and/or kitchen waste. In such situations, when feed costs are very low, a rustic breed can be an option. More so, if the farm is open to the public and sells eggs and chicken meat directly. Then an 'alternative' bird is an extra asset and marketing tool.

Eating quality and sensory properties of rustic breeds

More rustic breeds are available for meat than for egg production. A major reason is that meat from rustic breeds differs significantly in taste and texture from standard poultry meat due to older slaughter age of the former giving a more pronounced chicken flavour and firmer meat. There is a small but significant market for this high cuisine poultry meat. Rustic breeds are heavier than current layer genotypes, but much lighter and slower growing than commercial broiler stock.

With eggs it is hardly possible to distinguish eating quality and even less so in taste from standard eggs. Only with carefully designed diets it is possible to modify fatty acid composition, the pigments that produce yolk colour, or the content of some minerals. No differences in taste due to breed or housing have been found for eggs in blind-tests.

There is, however, a minority market for specialty eggs, often based on shell color or egg size. For instance the Marans breed from France derives its value from the outstanding dark brown shell color and in Asia small eggs with a creamy color (so-called tinted eggs) from local breeds sometimes get a premium price as 'kampong eggs'.

Variation in shell quality and colour is clearly related to genetics. For the large breeding companies strong egg shells and a uniform specific shell colour (shining, pure white, or deep brown, etc.) are an important selection criterion.

Breed your own layers?

Organic farmers, in particular, have a preference to breed their own animals, whatever the species. In principle this is possible with laying hens, but on a commercial scale, in practice maybe not, for a number of reasons:

First, advantages in performance and biosecurity that commercial companies guarantee with their intensive selection programmes and crossing schemes are difficult to match by small scale breeders.

Second, even organic commercial egg production flocks are rather large, which implies investments in incubation equipment and skills to hatch the next generation chickens. Laying hens can produce for more than 365 days, and if the incubator is only for own use, such periodic occupation is unlikely to give acceptable costs or success in the process. On the other hand, if chicks, hens or eggs are traded, regulations on food safety and animal health maybe challenging for free ranging flocks. Also tests have to be carried out to prove that the breeding animals and the hatchery are disease free.

Taken together, the chances for success of a small scale breeding program for commercial egg production are limited.

Picture 2: Research in a floor housing breeding project. Selection of young pullets. (Photo: ISA, France)

Further reading

Cobb, S.P., 2011. The spread of pathogens through trade in poultry hatching eggs: overview and recent developments. Rev. sci. tech. Off. int. Epiz., 2011, 30 (1), 165-175. www.oie.int/doc/ged/D10758.PDF

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OIE, Terrestrial Animal Health Code, Chapter 6.4. Hygiene and disease security procedures in poultry breeding flocks and hatcheries. http://web.oie.int/eng/normes/mcode/en_chapitre_1.6.4.pdf

Tixier-Boichard, M.; Leenstra, F.R.; Flock, D.; Hocking, A.D.; Weigend, S., 2012. A century of poultry genetics. Worlds Poultry Science Journal, vol. 68, nr. 2, p. 307-321.

Weblinks

General information on breeding for commercial and back yard purposes:

www.poultryhub.org/production/industry-structure-and-organisations/poultry-breeding/

An (American) overview of a number of original breeds and their characteristics:

www.ithaca.edu/staff/jhenderson/chooks/chooks.html

The large breeding companies that provide laying hens (in alphabetical order):

www.isapoultry.com

www.ltz.de/index.php

www.novogen-layer.com

www.syndicat-poules-marans.fr/marans.htm

Imprint

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