What are the egg layer traits that further sustainable production?

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Genetics companies sit at the apex of a pyramid of livestock and are constantly improving the genetic potential of the next generation of animals in agricultural production. Therefore genetic companies must weight seriously the current demands of the marketplace and predict future demands of the consumer.

Genetic improvement relies on measurements of phenotypic traits in pureline and cross bred progeny of pureline animals to evaluate the genetic potential of these animals under commercially relevant environments. The best animals are selected on the basis of these evaluations to reproduce the next generation and to multiply out these genetic improvements to the livestock industries they serve.

In the egg layer industry we select on a large group of traits, divided into five trait groups, namely production, egg quality, efficiency, animal well being and reproduction.

Many of the individual traits within these trait groups have a direct impact on the sustainability of production of eggs as food.

Egg layers are among the elite of animal agriculture production systems in terms of their sustainability, with their low carbon footprint, high reproductive rate and, most importantly, their high yield relative to low input costs.

Groups	Individual trait measured and selected
Production traits	Sexual maturity, peak egg laying rate, persistency of production, post moult production.
Animal well being	Livability of pullets and adults, specific disease resistance (Marek's disease), feather cover, social behaviour, reducing fear, nesting behaviour.
Quality traits	Shell strength, shell colour, freedom from cracks, albumen quality, egg size, yolk weight, % solid yield, freedom from blood or meat inclusions.
Efficiency	Residual feed intake, group performances, low feed intakes, dry manure, body size, maintenance costs.
Reproduction	Fertility, male mating ability, hatchability, sperm count, sperm mobility.

Table 1. Traits under selection.

Selection structure

Pedigreed populations, both pureline and crossbred progeny are evaluated for over 30 different traits in individual animals and in group environments, each and every generation.

Only a quite small percentage of the very best animals with the highest genetic value will be multiplied to produce future production stocks and to perpetuate the pureline themselves.

Such a rigorous system needs very high throughput evaluation systems with high accuracy and repeatability of each measurement taken.

Today the phenotype evaluation is accompanied by more and more genotype information from DNA markers such as microsatellite and single nucleotide polymorphism which have been validated to show an association with differences in a traits performance.

So, selection decisions are now made based on a triangulation of data from pureline, crossbred and DNA marker data points. This use of multiple data sources and complex pedigrees over multiple generations requires very large computing power.

Today, egg layers are evaluated in breeding programs where crossbred birds are measured under commercial conditions. This allows very good group performance data evaluation for behaviour traits.

These traits are very important from a sustainable perspective, avoiding feed and water wastage, feather cover of the hens, low social stress and livability related traits along with efficiency traits directly impact sustainability.

The trait groups are production traits which include sexual maturity, peak rate of lay, persistency of egg production and post moult rate of lay.

The animal well being trait group includes livability of pullets and adult

Continued on page 17

Fig. 1. Improving FCR of the Hy-Line W-36 commercial.

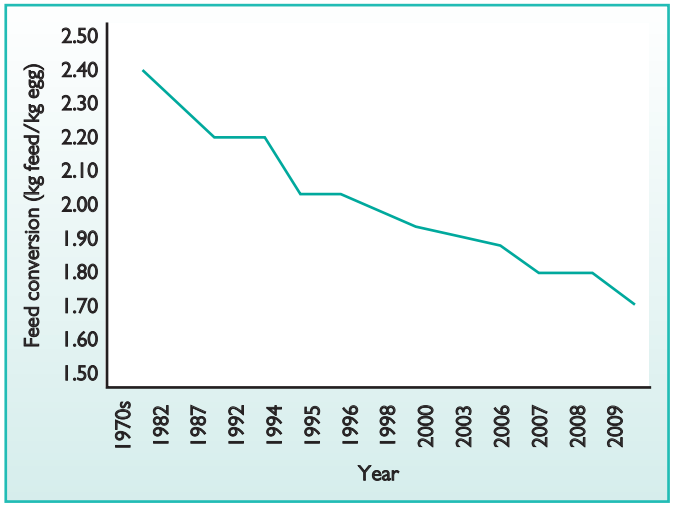
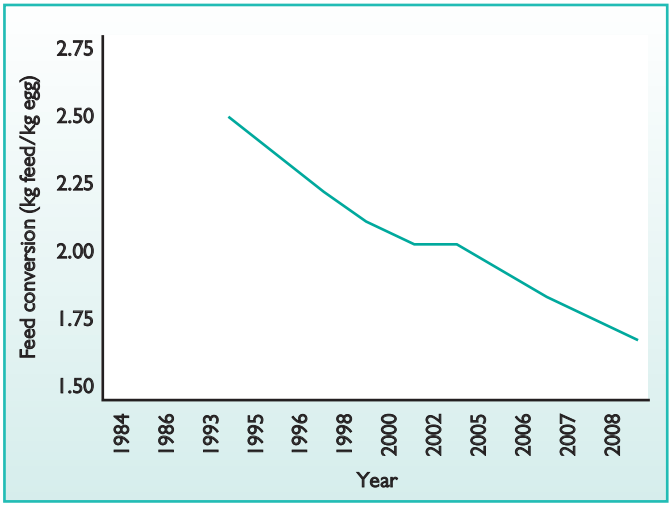
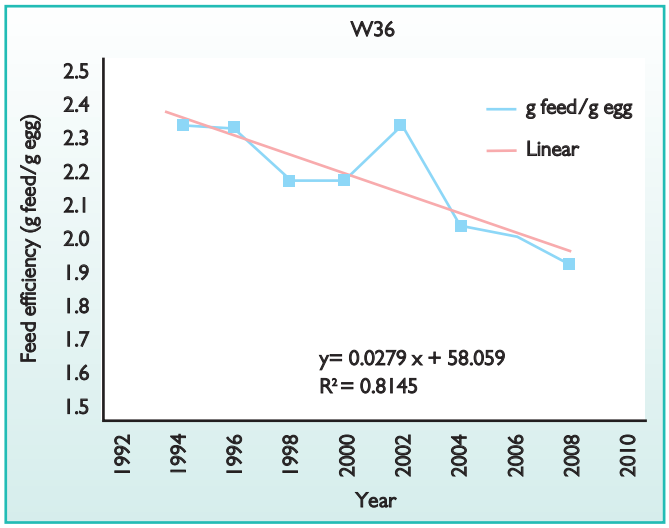


Fig. 2. Improving FCR of the Hy-Line Brown commercial.





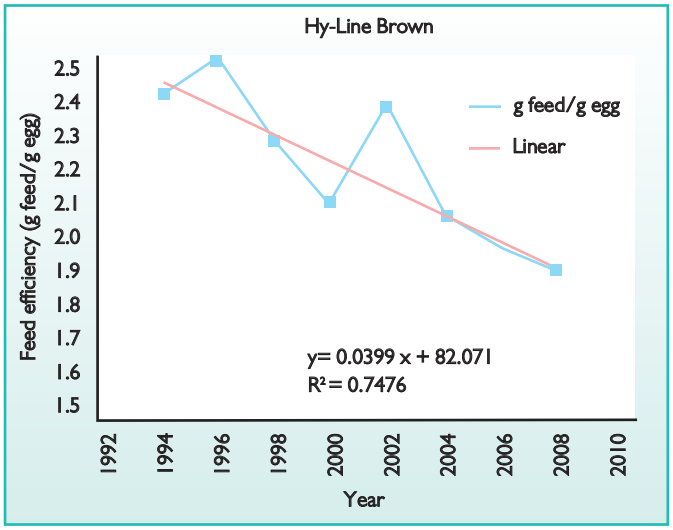


Fig. 3. Feed efficiency – annual genetic progress of two main commercial lines over 14 years.

Continued from page 15

layers, specific disease resistance such as Marek's disease, feather cover, social behaviour, reducing fear and nesting behaviour.

The quality trait group includes, shell strength, freedom from cracks, shell colour, albumen quality, egg size, yolk weight, percent solids in eggs and freedom from blood or meat spots.

The efficiency trait group includes residual feed intake, group bird performance, low feed wastage, dry manure, and low maintenance body cost.

The reproductive trait group includes, fertility, natural mating ability of males, hatchability, sperm count and sperm mobility.

Sustainable traits

Productivity, number of eggs laid and that they be salable quality is a key factor in sustainable egg production.

Livability is a sustainable trait as pullet capital costs must be spread out over long lived viable productive animals. Nutrition of the egg is a factor in sustainable egg production as egg quality and especially the percent yield of egg solids and albumen quality play a key role here.

The kilo of feed needed to produce a kilo of eggs is obvious as a sustainable trait, however low feed and water wastage as well as complete feather cover all have roles in this trait.

The social behaviour of the animals with low dominance drive, low cannibalism and wastage due to social stress are all necessary to factor in along with the use of nests by the birds.

Productivity	Egg numbers and salable quality.
Livability	Spreading pullet capital costs out over long lived viable productive animals.
Nutrition	Egg quality especially % yield of egg solids and albumen quality.
kg feed/kg eggs	Feed efficiency, low feed and water intakes, low feed wastage, complete feather cover.
Animal well being	Social behaviour, low cannibalism, reducing social pressures, stress behaviour, laying within nests.

Table 2. Sustainable traits.

Measuring genetic progress

The figures in this article show continued year on year improvement in genetic stocks of egg layers, Hy-Line Brown representing brown egg stocks and the Hy-Line W36 representing progress in white egg stocks.

From data on public tests, such as the North Carolina layer tests, long term progress can clearly be seen for feed efficiency and eggs per hen housed.

When we look at animal protein prices to the consumer we see eggs are the most affordable, followed by poultry meat and other meats.

Clearly the genetic trends show no sign of loss of progress over time. ■

Table 3. Annual genetic progress.

One pure line over 36 years	
Egg number to 60 weeks	+2.1
Liveability	+0.17%
FCR (g)	-0.014
Selection is intense for overall 'objective'	
Many phenotypic traits	
De novo variation	

Fig. 4. Eggs per hen housed – annual genetic progress of two main commercial lines over 14 years.