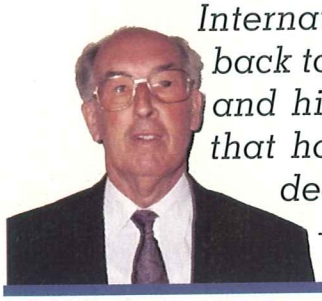
Half a century of egg production – the industry's development from 1962 to 2012



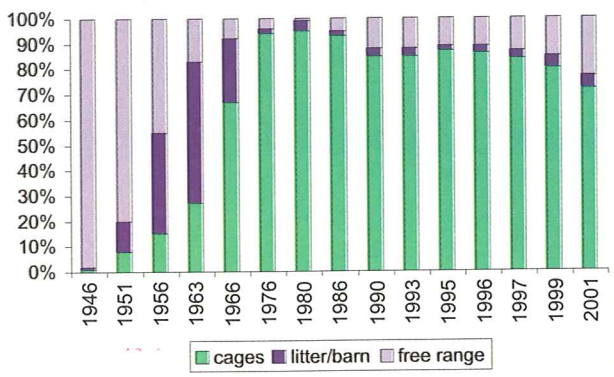
Continuing our series of special features for Poultry International's 40th birthday, Arnold Elson takes us back to the start of his career in the poultry industry and highlights some of the tremendous advances that have taken place since the 1960s. In another decade, will we be back where we began?

— Arnold Elson

Celebrating 40 Years of Serving the Poultry Industry
1962-2002 POULTRY INTERNATIONAL

Egg production has a long history but it is easier to look back forty years than to look forward ten! Early last century, egg production was based on small flocks of hens kept outdoors on mixed farms alongside other livestock and crop enterprises. As farming became more specialised, average flock size increased and the hens were kept indoors, often on littered or part-littered floors, sometimes with access to an outdoor enclosure. The first commercial cages were developed in the USA during the late 1920s and early 1930s; early versions were for single hens and were constructed of wood and wire mesh. Their use soon spread to Europe. Several other intensive systems were tried, such as deep litter and wire-floor systems but they gradually gave way to multi-bird cages - generally known as battery cages because they are arranged in rows and tiers. Today it is estimated that about 90% of the world's commercial egg production is derived from caged laying hens.

Figure 1: Changes in UK egg production systems, 1946-2001 (% of eggs)



Adapted from data of MAFF and DEFRA and the Museum of the British Poultry Industry

1962

When we enter the scene - about the time the first edition of Poultry International was published - many rapid changes were taking place in the egg industry. This is illustrated by the move from extensive and deep litter systems into cages (see Figure 1). In 1963, 27% of eggs were produced in cages and 56% on deep litter. Just three years later in 1966, the figures were reversed - 67% of eggs coming from cages and only 25% from deep litter. Ten years later, cages dominated the scene at 94% and reached their peak of about 95% in 1980.

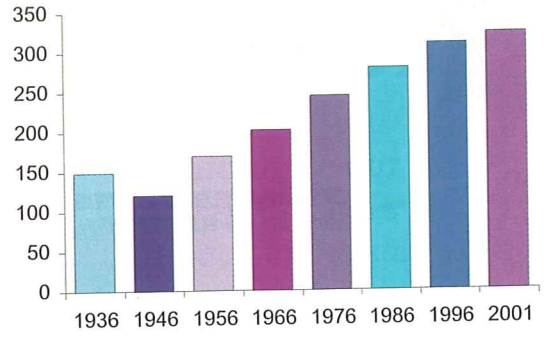
Most of the eggs produced in many countries were white-shelled, although breeds laying brown- and tinted-shells were available. The vast majority of eggs produced were sold 'in shell', i.e. apart from a small amount of dried egg, there was little egg processing.

The rapid move into cages produced marked improvements in egg production, feed conversion and liveability but it was by no means the only factor. Other important advances included:

- improved nutrition, especially better knowledge of essential amino acid requirements
- progress in genetics, including hybridisation
- reduction in mortality especially that caused by parasitic infestations and cannibalism
- better control of environment in intensive housing including wind- and light-proofing and insulation

Half a century of egg production

Figure 2: Improvement in egg production in the UK, 1936-2001 (eggs/bird housed/year)



Compiled from data from various sources

- the application of well researched light patterns
- simplified management achieved by better housing and equipment design.

These factors all contributed to remarkable progress in egg output per bird. The bar chart of UK improvements in performance (Figure 2) illustrates this point well; with feed rationing and other constraints, egg output was held back during the time of World War II but rapidly recovered thereafter. In the ten years between 1956 and 1966, output per hen rose by an average of 3.2 eggs per annum and in the following ten years (1966-76), it reached a remarkable 4.3 eggs per annum. Considerable momentum was also maintained in the following years.

During the 1960s, poultry welfare became an issue in Europe, especially for laying hens in cages. A common practice to control feather-pecking and cannibalism was de-beaking which entailed cutting and cauterisation to remove one third to a half of the upper beak and much less of the lower one. De-beaking was carried out on growing and sometimes point-of-lay pullets. This continued in several European countries but, due to welfare pressure in the UK, it was succeeded by beak trimming carried out before ten days of age with the removal of no more than one-third of the upper beak. Done at this age, it is thought to be less painful both at the time of the operation and subsequently. It is required more for pullets destined for alternative systems than cages.

1976

By this time, 94% of the eggs produced in the UK were from hens in cages (Figure 1) and in the USA, the proportion was even higher. As illustrated in Figure 2, egg output had reached about 245 eggs per annum, about double what it had been thirty years before, with an average annual increase of over four eggs per bird per year during the previous ten years - a remarkable achievement by any standard!

During the 1970s, several design improvements were applied to European laying cages. These occurred to a lesser extent in North America and the cage models in the two continents grew apart and have remained different. The design changes in Europe were mainly due to the need for improved feed conversion efficiency - feed energy costs quadrupled in Europe during the mid-1970s, but increased much less in the USA - and to poultry welfare requirements which were also higher in Europe.

Both housing and cage design improved during the 1970s and early 1980s. Better wind-proofing, insulation and ventilation control led to lower feed intake in winter without loss of egg output. Feeding systems greatly improved to allow a smaller amount of feed to be dispensed several times a day, usually by mechanised conveyors, or for the feed to be protected by grids from heaping or flicking by the hens. In both cases, feed waste and over-consumption were reduced without significant loss of egg output. This resulted in the desired improvement in feed conversion efficiency.

Welfare requirements affected cage design in particular. Areas of wirework that could trap and/or injure birds were designed out. Also, cage gates gradually changed from closely spaced vertical bars to wider spaced horizontal ones that improved plumage condition. Cage height increased and anti-egg-eating baffle plates became continuous along cage rows to prevent hens being trapped between them and side partitions. Floor slopes began to decrease and claw shorteners were tested. The purpose of the latter was to avoid long claws being trapped in the narrow gaps between cage components and sometimes breaking off.

1986/7

The next ten years saw further growth in productivity and improved efficiency. Average egg output continued to increase at the rate of just under four eggs per bird per annum. Breeders had evidently selected for lower body weight, especially in brown hybrid strains which were becoming more popular, particularly in some European countries. The lower body weight led to greater feed conversion efficiency.

Further processing of eggs 'out of shell' was developing especially in the USA and Italy. Although per capita consumption of shell eggs was declining, total consumption was maintained in those countries that developed and sold processed egg products.

The popularity of cages had peaked in some countries, e.g. the UK and Denmark, and modern free-range production was beginning to emerge (see

Figure 1). This trend was to gain momentum in some countries in subsequent years. Aviary and perchery barn systems were researched and developed particularly in Britain, the Netherlands, Germany and Switzerland and some came into use commercially.

In 1987, POULTRY INTERNATIONAL ran a series of special articles to celebrate its 25th anniversary. Don Bell, the well-known poultry specialist from California who had also contributed to the first edition in 1962, wrote an interesting article entitled, "Your place in tomorrow's egg industry". It provides an interesting commentary on the progress made by the egg industry and how he saw the future. Part of it reads:

> Since the beginning of Poultry International in 1962, the world's egg industry has gone through an amazing evolutionary process. Traditional centres of egg production have rapidly adopted new technologies, while less developed countries have completely by-passed older systems. Today's rapid communication techniques assure a minimum time between the formulation of an original concept and its adoption by alert egg producers everywhere.
>
> The world's egg industry has numerous similarities which allow broad application of many basic principles. Poultry breeding is international in scope with less than two dozen breeding companies of any significance. The science of nutrition is universally understood with most practitioners having essentially the same background. The veterinary profession is well integrated with numerous international conferences and journals for scientific exchange. Finally, the engineering community has developed all types of equipment and housing concepts with broad application possibilities throughout the world.
>
> Even though we will have fewer separate ownerships in most major countries in the future, those who innovate and excel will always be rewarded with higher returns. The ultimate company will be the one that recognises the value of details, consistently selects the optimum technology for the time, responds to his flock's needs and effectively markets his product at value and not at cost.

1996

By the end of the 20th century, egg output had reached 310 eggs per bird per annum but the average yearly increase was down to just over three eggs per bird. The egg output data presented in this article and illustrated in Figure 2 are hen-housed egg production figures. These are a useful measure since they include the effects of mortality. It is interesting to note that improved liveability has contributed to increased hen-housed egg production. The data in Table 1 show that mean mortality reduced from over 15% to about 5% in the 30 years or so leading up to the early 1990s.

Table 1 Summary of mean results from the Netherlands random sample tests (per year)

Period	Mortality (%)	Eggs per hen housed	Feed conversion ratio
1956-1960	15.5	225	3.4
1971-1976	11.4	273	2.8
1988-1993	5.1	306	2.2

In the early 1990s, Switzerland banned virtually all laying cages although imported cage eggs were still consumed there. However, Switzerland was a small, affluent country with only about three million laying hens. The Netherlands had planned to outlaw cages in 1994 and in preparation for this, financed R&D on the tiered wire floor aviary system. The Dutch government granted financial support to several poultry farms to encourage the industry to take up the system but only a few units were developed. When 1994 came, the Dutch government recommended to the European Commission that cages should be banned as soon as possible throughout the European Union but allowed them to continue in use in the Netherlands meanwhile.

Although by 1996 caged hens still accounted for well over 95% of the eggs produced in places like the USA and Spain, free range and other alternative systems were providing 14-15% of the eggs produced in some other countries, e.g. the UK. Also, organic free-range egg production was just beginning to emerge in Europe.

The unthinkable had happened: the trend toward ever increasing economies of scale in very large labour-saving, automated, multi-tiered cage houses linked in with egg packing and grading facilities had begun to be reversed. The reason? Welfare pressures and a proportion of consumers demanded premium products that they perceive to be better for the person and to enhance the wellbeing of the hen! The question therefore was, how great would that demand become and how much further would the trend back to free range and organic systems proceed?

In 1995, a European Council Directive for the protection of laying hens came into force for all laying cages in Member States, requiring an increased minimum cage area to at least 450 cm2 per hen and imposed several other conditions aimed at improving bird welfare. Meanwhile, also during the early 1990s, research on enriched or furnished laying cages got

Figure 3: The author inspecting recently installed furnished laying cages at the ADAS Gleadthorpe Poultry Research Centre.

underway at several poultry research centres in Europe - see Figure 3. Work in Sweden resulted in the development of a commercially available furnished cage that was subsequently approved by the Swedish Board of Agriculture.

2002

Almost inevitably, the rate of improvement in egg production has slowed a little to a mean of about 2.6 eggs per hen per annum over the past few years. This may be due partly to the selection pressure that breeders are putting on other traits like reducing injurious pecking. Sweden banned beak mutilation some years ago and several other countries would like to follow suit if breeders could solve the problem of cannibalism or some other acceptable management technique could be found to avoid it.

Egg breaking-out and processing has now reached significant levels. Eggs sold 'out of shell' amount to over 20% in Europe, with Italy being well above that figure. In the USA, 31% of eggs are further processed and this proportion is increasing at a rate of 3% per annum. Originally, it was mainly second-quality eggs that were used but now many eggs are produced specifically for breaking out. Further processing of liquid egg into a variety of products is also increasing.

Regarding egg production systems, the trend has continued away from cages in those countries that have gone down that route. In some, production in alternative systems has reached almost 30% including barn, free range and organic systems. However, there are signs that it may have reached a plateau. In Europe, Council Directive 1999/74/EC has to be implemented in all Member States in 2002 and it will result in lower stocking densities in both cages and alternative systems. It will, of course, increase production costs. Some countries may go further than the Directive requires. The German government has already decided to phase out all laying cages by the end of 2005. Furnished cages are now being well researched, current studies in the UK concentrating on finding a scientific basis for stocking density and minimum cage height in order to inform the review of the Directive in 2005.

In the USA, stocking density in laying cages has begun to reduce under pressure from fast food outlet egg buyers who have themselves been targeted by welfarists. The high densities practised in the past are now moving towards the European levels of the recent decade. Beak trimming and induced moulting are also practices now under increasing pressure.

Towards 2012

Egg production efficiency is now at an all-time high but the trend for year-on-year performance to increase more slowly is likely to continue. One factor influencing this is that the nearer egg output gets to an egg a day, the harder it is to approach this barrier; another is the apparent negative correlation between increasing fecundity and injurious pecking. Liveability is also at a high level in caged hens and 3-4 % mortality over a laying year is not uncommon. Mortality is about double this in alternative systems if the chicks have been beak-trimmed and can be much higher if not. We may see some genetic improvement here but this cannot be expected in the short term.

Half a century

The proportion of broken-out eggs has been rising rapidly and this will continue. It has been predicted that fifty per cent of eggs will be consumed out-of-shell within ten years and well before that in the USA. Eggs from hens in alternative systems are now being broken out for special markets in the UK and this will probably increase.

It is uncertain how far the trend towards reduced stocking density in cages and alternatives will go. There are clear milestones in the European Union and other countries may well follow. In new alternative system houses from 2002, the maximum is 9 hen/m^2 usable area and this may lead to increased use of systems with several levels of perforated platforms to increase density on the ground surface area, like the recently developed Dutch portal aviaries (Figure 4). In 2003, the minimum area per hen in conventional cages will increase from 450 to 550 cm^2 and a suitable claw shortener will have to be fitted. 2012 will mark the end of conventional cages and only enriched ones will be permitted, the standards for which will be reviewed in 2005 but it is evident that more space will be required than in conventional cages.

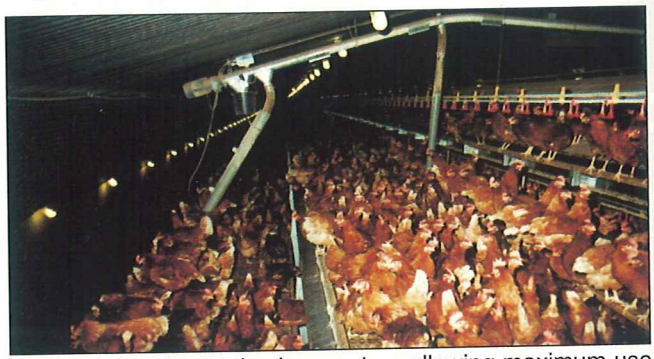


Figure 4: Dutch portal aviary system allowing maximum use of house space.

Against this, egg production units are rapidly being installed in many countries and bird numbers are increasing - in intensive systems in developing countries like India and China. Perhaps production capacity will shift from one part of the world to another and cage eggs will be exported to countries where cages are banned. A possible example is the Netherlands which has long been an egg-exporting nation. If as seems probable, they follow Germany in banning the use of all cages over the next few years, the Dutch could become an egg importer.

There are challenging times ahead for egg producers worldwide!

— Arnold Elson, international consultant on poultry systems, Agricultural Development and Advisory Service (ADAS), Nuthall, Nottinghamshire, UK.

Figure 4 photograph courtesy of Vencomatic bv, the Netherlands