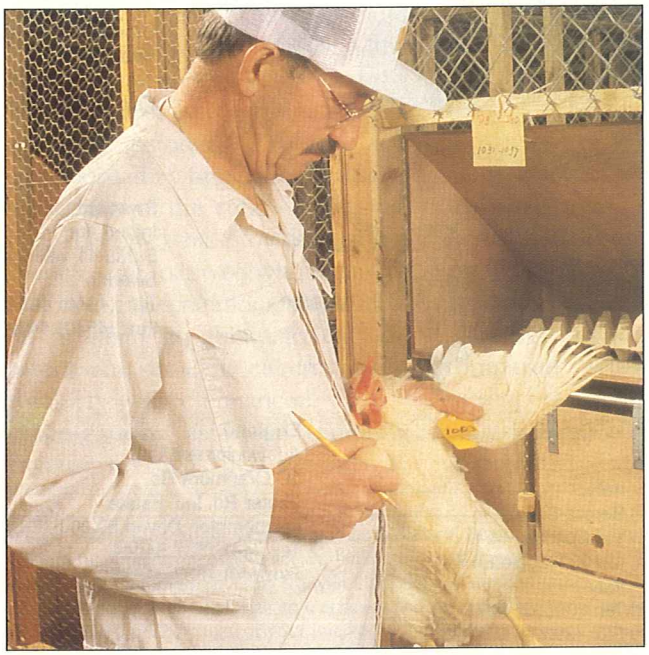
New Genetics Approach To Breeding Layers

The ranking of family groups for egg production characteristics will change markedly when they are measured in multiple-bird instead of single-bird cages.

It's not often we hear of a potential breakthrough in breeding for egg production, but that's how we could describe Dr Bill Muir's presentations at the 1995 meeting of the Poultry Science Association, held at the University of Alberta, Edmonton, Canada.

Muir, one of the few population geneticists active in academic research on poultry breeding, is based at Purdue University, West Lafayette, India, USA. He is a former student of the late Professor Ben Bohren, and has clearly inherited from this mentor an ability to identify an exciting research field. He has also called into question some long-held beliefs which form the foundation of many commercial breeding programmes for egg production.



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The problem Muir's work addresses is how to breed layers which are better adapted to multiple bird cages. He points out that in several European countries, the practice of beak-trimming is prohibited and thus many strains are virtually eliminated from those markets. This point was made by Muir in a presentation to the First North American Symposium on Animal Welfare, held prior to the Poultry Science meeting.

It is well documented that selection programmes should be conducted in an environment similar to the one to which commercial generations will be exposed. Thus, when most producers began to keep commercial layers in cages, this was a signal for breeders to use them for measuring egg production. In addition, cages were an ideal replacement for the labour intensive and error-prone technique of trapnesting, so breeders changed rapidly to them in the 1960's.

However, most selection programmes used single cages to replace the trapnest, thus denying hens the opportunity of interacting with cage mates. The assumption here is that records obtained from individually caged hens will accurately predict those which would be obtained from hens housed in multiple bird cages. In other words, there must be no interaction between genotypes and the one bird versus multiple bird environments.

The use of individual records is important when estimating breeding value of both female and male candidates for selection purposes. The so-called 'Osborne index', published in the 1950's may be used to combine individual, full-sib, and half-sib records into an index which optimises selection accuracy. It is especially valuable where heritability is low, as it is for many egg-related traits, and where the desired characteristics are expressed in only one sex. Either the Osborne index, or modifications of it, have been widely used in layer breeding. It is this aspect of the traditional methods which Muir has called into question.

He stated that the ranking of families for egg production will change markedly when they are measured in multiple bird cages versus single bird cages.

Beginning in 1981, Muir began a selection experiment to determine whether genetic progress could be made by selection based on the records of whole families housed together, in nine-bird cages, with beak-trimming. After two generations, colony size was increased to 12/cage in a slightly larger cage. Floor space was 413 cm2(64 sq in)/bird in generations of one and two, and 362 cm2(56 sq in)/bird thereafter. Light

intensity was set higher than in commercial practice.

The selection criterion varied in detail but was basically aimed at extending survival and increasing egg production. Females were selected based on family performance, while males were selected based on their full- and half-sibs performance.

An unselected line was maintained as a control, held in single bird cages. Results were dramatic. In generation two, mortality in the selected line kept in multiple bird cages was 65% at the end of the first laying cycle: in generation six, this had fallen to 8%, even with the higher colony size and stocking density and without beak-trimming. Eggs/hen housed had increased to 250, but egg weight had fallen about 2.0g. The selected lines after six generations laid as well in their environment as the control line kept one bird/cage.

In generation seven, the selected and control lines were compared with a commercial strain of layers, both in multiple cages without break trimming and in single bird cages. Mortality data were as follows:

Commercial strain	**12/cage 89%**	**One/cage 0**
Control strain	**12/cage 54%**	**One/cage 0**
Selected strain	**12/cage 20%**	**One/cage 0**

In this comparison, birds which died were replaced with others of the same strain to maintain cage populations. Eggs laid/cage of 12 birds was as follows:

Commercial strain	**Colony (12/cage) 193**	**Single (1/cage) 295**
Control strain	**Colony (12/cage) 198**	**Single (1/cage) 251**
Selected strain	**Colony (12/cage) 217**	**Single (1/cage) 266**

In the 1/cage environment, the commercial strain was clearly superior, while in the 'commercial environment' the Muir-selected line showed a major advantage. The reduction in mortality is evidence of much improved well-being, since so many more birds survived.

In an associated report by Dr Jim Craig of Kansas State University, the mortality in this comparison was studied in detail. In the cages occupied by commercial strain hens, 287 hens died and were replaced, and 91% of this mortality was basically due to cannibalistic and pecking injuries. Variation in feathering was much greater in the hens kept at 12/cage and the median feather score was significantly better in the hens kept 1/cage.

In addition to measuring the direct results of selection in terms of mortality and egg production, the physiological responses to the environmental stresses are also of considerable interest. Dr P.Y Hester, a colleague of Muir's at Purdue, measured several indicators of stress and found differences between the commercial and selected lines when kept in 1-bird and 12-bird cages. When exposed to 72 hours at 0oC, the selected strain performed much better than the commercial, especially in the 12/cage environment. In the control environment, the activity of bleeding the birds for analysis caused much less disruption to the selected strain than the controls.

In another trial using high temperature stress, the selected line was again superior in terms of productivity and especially survival, notably in the 12/cage environment.

Hester also reported on studies of the hens' immune response during the high- and low-temperature stress. While the cage density and environmental treatments caused differences in immune response, there were no measurable differences between strains.

How will these results affect commercial breeding? In discussing them with some of the breeders, Muir reports guarded interest. It is clear that, for various reasons, breeders cannot adopt this methodology overnight. Nevertheless, the work addresses an area of real concern, and one in which interest may intensify in the future. A few countries now prohibit beak-trimming. Strains adapted to multiple bird cages without trimming will enjoy a natural advantage in those markets. Even where beak-trimming is routinely practices, its avoidance, if unnecessary, would yield economic benefits. Not only would the cost of the operation be avoided, but so would the damage suffered by some birds even when beak-trimmed by expert crews.

This most recent example of the power of selection has the potential to secure more genetic progress for the egg industry. — *Dr Peter Hunton, Ontario Egg Producers' Marketing Board.* PI