Current Concepts in Poultry Breeding*

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IN THE course of the last twenty years the production capacity of poultry was greatly improved. The remarkable progress is due to breeding, feeding and management.

Poultry breeding became the "training field" of population genetics. The application of modern and effective breeding methods is facilitated by the great reproduction rate of hens, leading to large sib- and progeny groups and allowing a high selection intensity, and by the short generation interval of generally one year only.

The fact that culled hens can also be used in production makes it economically possible to realise high selection intensity. On the other hand, genetic progress in poultry breeding is restrained by the low heritability of most of the important production traits and by negative genetic correlations between them.

A very important source of recent progress is heterosis, due to non-additive effects of genes. Nevertheless the base of practically all breeding work is selection. Its aim is the increase of favorable gene effects, especially additive ones. Within a selection program the main problem is the estimation of the breeding value of a single bird. Individual records give valuable information in working with highly heritable traits only.

Generally the estimation of the breeding value is based on a combination of individual records and the records of full- and half-sib families. In traits of low heritability e.g. the accuracy of the average of a seven-full-sister-family is about the same as that of a single individual record. Considering the problem created by age-differences within families the optimum family-size in a selection program may be 8 to 12 female birds. If non-additive gene effects have to be considered, progeny testing gives the only suitable information. Records of ancestors are rarely used in poultry breeding.

The different information available can be combined in a selection

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index. Selection indices are of great help especially if several characters are involved.

Example: Production-trait A and B
individual record R
family average OR

Index $I = aR_A + bOR_A + cR_B + dOR_B$

It is a purely statistical problem to calculate the accurate values of a, b, c and d. They are a function of the heritability of character A and B, the genetic and phenotypic correlations between them and their economic weight.

Compared with mass-selection the genetic gain with independent culling levels can theoretically be improved by 30—50 per cent using an adequate selection index. The weakness of selection indices is the inaccuracy of the genetic parameters used for their construction.

A few years ago blood group testing was thought to become a great help in poultry breeding. It has, however, not yet been possible to demonstrate clear-cut correlations between blood group types and economic production characters which could be useful in selecting breeding birds.

In actual poultry breeding selection generally is the first part of the whole procedure only. It can be combined with inbreeding and it leads to the creation of special breeding or parental strains. These strains are finally mated to produce the commercial end-product. Two-, three- and four-way crosses are used.

The very important point completing the selection work therefore is the combining ability of the parental strains which at least is partly due to heterosis. Positive heterosis effects are mainly to be expected in characters with low heritability. But the hybrid vigour should not be overestimated. In producing an egg-type hybrid e.g., heterosis seems to be responsible for not more than 5—16 per cent of the number of eggs produced.

The favourable combinations between parental strains must be found out by testing numerous crosses between different strains. It is not the parental strain itself which can be judged directly, but only its crossbred progeny. Theoretically probably the most effective way in breeding for combining ability is the recurrent and the reciprocal recurrent selection. It is the adequate method in developing crossbreds if their superior quality is due to specific combining ability.

The disadvantage is the doubling of the generation interval, and it is doubtful if the specific combining ability developed by reciprocal recurrent selection will be important enough to compensate for this disadvantage.

In breeding for egg production the most important characters are:

Production Character	Average Production Level	Heritability
First year production	220—240 eggs	20—35%
Egg weight	56—60 g	45—60%
Sexual maturity	160—170 days	20—40%
Body weight	1,800—2,200 g	45—60%
Rearing mortality	5%	} 5—15%
Laying house mortality (150—500 days)	10—15%	
Fertility	90—95%	very low
Hatchability	85—90%	10—15%

In addition, the food consumption per day and hen, and especially per egg, are of great economic importance. Also egg qualities, first of all shell strength and the interior qualities of the egg (albumen, yolk etc.) have to be considered by the breeder.

Producing meat-type birds the breed aim can be characterised by

rearing and fattening period	7—9 weeks
body weight at 7—9 weeks	1,400—1,700 g.
food consumption	2·2—2·4 kg/kg body weight
rearing mortality	1—3 per cent

Female parental stocks should produce 120—140 hatching eggs per hen during the first eight to ten months of production.

Breeding for broiler production is facilitated by the high heritability of body weight and growth rate and the positive correlation between growth rate and food conversion. On the other hand difficulties arise by the negative correlation between body weight and reproduction ability (egg production, fertility, hatchability). In breeding for broiler production, therefore, a compromise is found in the creation of clearly differentiated parental strains, "female" strains, combining growth rate and egg production in a reasonable proportion and "male" strains with extremely high growth rate.

There is no doubt that further progress in poultry breeding will be achieved in future. What we need is more specific information about the physiological background of production characters and genetics.

Dr. F. B. Hutt Received Honorary Degree

THE UNIVERSITY of Agriculture, Brno, Czechoslovakia, Awarded the degree of Doctor of Science (*honoris causa*) to Dr. F. B. Hutt during the Mendel Memorial Symposia held in Brno and Prague on August 7, 1965.

Dr. F. B. Hutt has been an active member of the W.P.S.A. for many years. This honorary degree was given in recognition of his many excellent contributions to the science of genetics.

Four others were given honorary degrees at the Mendel Memorial Symposium, they were: Academician Nicolay Vasilyevich C, USSR; Prof. Dr. Arthur Horn, Hungary; Prof. Dr. Arne Müntzing, Sweden, and Prof. Edward Sørensen, Denmark.