SELECTION CRITERIA AND BREEDING OBJECTIVES IN POULTRY EGG PRODUCTION: SOME EXPERIMENTAL RESULTS

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A selection plateau may arise for several reasons in a selection program and inhibit or delay the achievement of the breeding objective, say maximum production of eggs of acceptable size in the pullet year. It has been recognized for over 20 years that the physiological influence of the diurnal light-dark rhythm may provide an ultimate barrier to reaching the above objective, by preventing the expression and detection of genotypes capable of oviposition more frequently than an average of once every 25-26 hours. For this reason, several research workers have modified the above general objective to the more specific one of breaking through this threshold. Different workers have used different selection criteria. The most successful approaches have involved selecting for reduced interval between eggs, usually under a modified lighting environment. We have used this selection criterion in an environment of continuous light.

Selection over 12 generations in a White Leghorn line and 15 generations in an Australorp line has led to a reduction of 3-4 hours in mean interval between eggs within clutches in continuous light. In a normal environment of 14-15 hours light : 9-10 hours dark, both selection lines also show a significant reduction in interval between eggs, and the Australorp line has a 12-15% higher pullet-year egg production than its control line. As average interval between eggs within clutches, at 30-34 weeks of age, is now about 23.5 hours in continuous light and 24.3 hours in a normal environment in the Australorp line, significant progress seems to have been made towards achieving the modified breeding objective by this selection criterion.

The two selection lines and their control lines, four Leghorn x Australorp (L x A) crosses between them, and three leading Australian commercial strains have recently been compared for interval between eggs and related variables in continuous light and normal environments, and for total egg production, egg weight, egg quality and feed consumption during the pullet year. A summary of these results will be presented. They show:

1. The average interval between eggs in the crosses having at least one selection line as parent is also reduced, but with a complex inheritance pattern and no heterosis for interval between eggs. However, the cross between the two unselected control lines does show heterosis for interval between eggs.

2. The crosses having at least one selection line as parent have in general a lower interval than the two commercial crosses of L x A type. They also have a lower interval than the third commercial strain, which is a White Leghorn strain cross, in continuous light, but not in the normal environment except for the cross between both selection lines. These results suggest that industry lines with lowest interval may be at a stage requiring a change in selection criterion, i.e. from simply egg production to direct selection for reduced interval, probably in a modified lighting environment.

3. The cross between both selected lines has higher egg production, rate of lay, total egg mass and feed efficiency than the two industry L x A crosses, but, due to its lower egg weight, is better than the industry Leghorn strain cross only in egg production and rate of lay.

4. The cross between both control lines is higher in egg production than, and similar in total egg mass and feed efficiency to, the industry L x A crosses, indicating that little or no genetic improvement has been made in these characters in some commercial breeding flocks in the past 10 years. This aspect of the above experiment in particular needs to be confirmed. If true, it will indicate an urgent need for industry to review and change selection criteria.

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SELECTION FOR EFFICIENCY OF PRODUCTION IN AUSTRALORP HENS

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In a preliminary study in 1973, the heritability of liver fat in crossbred layers was found to be 0.37. Based on this estimate and the correlation between liver fat and total body fat, three selection treatments were established in 1974 from an Australorp population of wide genetic base. These treatments involved selection for low liver fat, high liver fat and an unselected control. Two replicate lines of each treatment were established with 112 birds housed at 16 weeks of age in all replicates.

Data are presented for the low and high fat lines after four generations of selection. It has not been possible to this stage to measure the control birds, due to practical limitations. Trends have been similar for the two replicates, so for conciseness of presentation the results have been pooled over the two replicates.

There has been a significant reduction in liver fat in the low line as compared to the high line (10.3% V 17.7%), in carcass fat (35.3% V 41.8%) and in body weight at 40 weeks of age (2.31 kg V 2.46 kg). Growth rate to first egg was also reduced (13.7 gm/day V 14.1 gm/day) as was growth rate after first egg (0.8 gm/day V 1.8 gm/day). All these differences were significant at the 1% level except for growth to first egg which was significant at the 5% level.

There was a non-significant delay in age at first egg (166.1 days V 162.9 days) in the low fat line and a slightly higher mean specific gravity of eggs laid to 40 weeks of age (1.091 V 1.089).

Egg production to 40 weeks of age was not statistically different for the two lines (86.1 eggs for the low fat V 87.2 eggs for the high fat) and the total egg mass was also not different (4.235 kg V 4.272 kg).