A NOTE ON DEVELOPMENT OF WHITE EGG LAYER BREEDING STOCK FROM COMMERCIAL DAY OLD CHICKS.

By

N.I. DIM

*Department of Animal Science
Ahmadu Bello University
Zaria, Nigeria.*

(Received 12 June 1984; accepted for publication 14 January 1985).

ABSTRACT

An attempt has been made to show that white egg layer can be developed from commercial day old chicks. This is a comfortable way to have a gene pool and pure lines. At this stage of Nigeria's development, we should not be bothered about the luxury of producing brown eggs. This is because white eggs are more economical to produce. Brown egg layers consume more feed per egg produced, while in most cases, white egg layers lay more eggs. Furthermore, the development of the brown egg layer will involve more expenses than the white egg layer. This is so because the starting point for such a development will be the brown egg layer grandparent stock, which is more expensive than the commercial white egg layer.

Key words: Breeding of White egg layer.

Nigeria is a developing country. And so, there are many projects that are competing for the scarce resource. The production of animal protein happens to be one of the few areas given priority. The government so far has been trying to increase animal protein consumption, through importation of both live, chilled or frozen meat. This is a temporary measure and will not be enough to satisfy dietary demand. The animal protein consumption in this country is low and ought to be increased.

The reasons for the development of a national commercial egg laying strain are

obvious. In the first place, it will reduce the risk of disease importation. This will increase the production of animal protein, since egg is the next cheapest source of animal protein after milk. It will reduce the dependence on foreign countries or the drain on the Nation's foreign reserve. This will also reduce the monopoly of the few poultry breeding companies that exist in the country. It will enable the breeding programme to be tailored to the needs of the country. This will mean developing a breed of poultry that will produce on low protein or industrial by-products. The breed so

produced will depend on the crops that can be produced in this country and also adapt to our environment with regard to heat stress etc. This will also enable us to have a gene pool that can always be used by both the present or future generations, if the need arises to change the breeding objectives.

According to FOS (1979) Nigeria imported 14,532,827 day old chicks and 16,535 hatchable eggs. This number of day old chicks, when converted to grand parent stock, will be roughly equivalent to 6,000 grand parent. The number has been increasing since 1979. A rough estimate of the parent stock demand for the country, based on the few available data, is about 300,000. This estimate excludes chilled or frozen chicken, which if added, will increase the demand a great deal. This only takes care of the present level of demand. But if the desirable level of optimal protein consumption is used, then the present figure for grand parent stock must be increased many fold. According to Ikpi and Akinwumi (1979), there is an estimated 124 million local chicken. If breeding work is undertaken to the exclusion of the local chicken, it means that the local chicken will eventually be replaced by the improved breed. This exclusion will not be considered in this discussion. Rather, attention will be focused on the development of poultry strains, based on the available white commercial strains. The reason for choosing white egg laying strain is because it is easier to work with. This is the strain that can be used for breeding, using commercially available strains or breeds. Another reason for using white egg laying strain is because it costs more to produce brown than white egg. And, as a developing country with scarce resource, it is better to concentrate on

developing what is cheap for the country. Furthermore, there is no difference between white egg and brown egg except the shell, which is not normally eaten. Besides, white local chicken and guinea fowl produce white eggs and consumers, to a large extent, are used to white eggs.

The breeding plan was based on the purchase of a few white commercial egg production strains. The different commercial strains were randomly mated for four generations to allow for recombination and crossing over and allow the genes to be in equilibrium. If, for the sake of this illustration, we take 4 different commercial strains namely A, B, C, and D. The crossing for the production of the first generation (F_1) will be the followings

	A	B	C	D
A		AB	AC	AD
B	BA		BC	BD
C	CA	CB		CD
D	DA	DB	DC	

The crosses A A, B B, C C and D D will not be included because the chicks are brothers and sisters. And to avoid inbreeding, this crossing is omitted. But in practice it will be better to use as many good white egg strains as possible, so as to widen the basic population by including as many genes as possible. If polyallele crossing system is used, then the number of crosses will be the square of the number of strains used.

In the mixing of the strains for the

production of F_2 , the mating system will be as follows:

	DCAB	DDAC	CBAD
ABDC		BACD	CADB
ACDB	ADCB		DABC
CDBA	DBCA	BCDA	

This means that the same 12 sub-lines as in F_1 , will be obtained in the F_2 . In the F_1 each combination will produce males and females. The males of one combination is mated to the females of another combination, so that in F_2 each offspring will have genes from the four strains e.g. DCAB. The first two letters, e.g. DC, represent the male and the second two letters e.g. AB represent the female in the cross. In the production of F_3 , the F_2 offspring can be mated randomly since each has genes from the four strains. This mating can be made for one or two more generations before starting selection for the different traits. Alternatively for the production of F_3 , this system of mating can be followed.

The offspring will be for example ABDCDCAB. The letters show where the genes in this offspring are derived from. In this ABDCDCAB offspring, the first four letters e.g. ABDC will be for the male and the next four letters DCAB will be for the female. The same 12 sub-lines are still retained as in the F_1 . As from this F_3 , random mating within F_3 can be carried out for the production of F_4 . And as from the F_4 , the creation of the different lines for selection purpose can commence. This will mean that the F_5 offspring will be the result of the first round of selection for the different traits of interest.

It is also possible to use artificial insemination. In this case as from F_1 offspring, the sperm from the different combinations will be collected, mixed and used in insemination. Chance will be the only factor that determines which sperm fertilizes the egg. If artificial insemination is used, the period needed for the thorough mixing of the different strains will be reduced.

Since the aim is to produce a good number of eggs, one line will be selected for egg number. Another line will be selected for egg weight. The reason for concentrating on one trait in each line is because the two traits are negatively

	ABDCDCAB	ACDBDBAC	ADCBCBAD
DCABABDC		CDBABACD	DBCACADB
DBACACDB	CBADADCB		BCDADABC
BACDCDBA	CADBDBCA	DABCBDA	

out genetically correlated. Furthermore, there may be change during selection. By the crossing of the lines for the production of commercial chickens, the two or more antagonistic traits, that each has been improved in one line only, will be combined. Though this method, it will be possible to avoid the negative genetic correlation effect and at the same time make greater progress in each line. And, through the crossing, the progress made through selection in each line will be transferred to the commercial chick. This method will also help in making use of the heterosis effect for livability and reproductive ability that is expected. There is no doubt that this heterosis effect will be increased as selection progress, since different lines will differentiate in their genes.

Because of this negative genetic correlation, which is to be avoided and in order to avoid selecting for the negatively correlated traits in the same line, the well mixed basic population will be divided into a number of lines. The different lines will be hatched from the same basic population. It is the selection that is applied that will eventually distinguish the lines. In the case of three lines, which is the basic minimum for two negatively but genetically correlated traits, where one trait is to be selected in each line. One line will be selected for the number of eggs (NE) laid and a second line for the egg weight (EW) and the third line will be a continuation of the random mating of the basic population. This randomly mated basic population will serve as a control that will monitor the genetic progress, that will be made, during the course of selection. If a fourth line is added, then, that will be the selection index line (1_1) in which NE and EW (NW) will be combined in an index. The reciprocal cross

will be EE. If a fifth line is to be added, that could be another index line (1_2) or a replicate of the first index line. This separation into the lines could take place as from the 4th generation — chicks. The progress made in the selection will be evaluated through the crossing, which will be in the form of the male of NE line crossed with the female of NW line (NE x EW) and vice-versa. With this method of crossing, the best evaluation of the cross will be through taking half the sum of the two reciprocal crosses and comparing with the control population such as $(\delta \text{ NE} \times \varphi \text{ NW} + \delta \text{ NW} \times \varphi \text{ NE})/2 - B$, where B is the basic population serving as the control. Of these crosses the best cross will be $\delta \text{ NW} \times \varphi \text{ NE}$. The number of lines that can be created from the basic population is dependent on the available resources. It is possible to create a line for early maturity and another line for shell thickness and yet another line for egg weight — body weight relationship and yet another line for resistance to specific diseases, another line can be selected for production under high environmental temperature, and another line for egg quality, etc.

If selection index is to be used, then it will be the conventional selection index type. This means that the hen will be selected on her egg production capacity plus the average production capacities of her full and half sisters. The cock will be selected on the basis of the average egg production capacities of his full and half sisters. The economic weighting factor depends on the current relative income to be realised for any increase in egg number, compared to income from an increase in egg size. Since our eggs are not graded or sold by weight, as of now, it means that once an acceptable egg size is achieved, greater emphasis should be on egg number.

The selection intensity will be such that the inbreeding coefficient should not exceed 1%. This will mean that $(NM + Nf)/(8Nm) \approx 0.01$ where Nm is the number of males and Nf is the number of females. If we are to assume that 200 males and 1000 females are available for selection and the inbreeding coefficient should be less than or equal to one percent; then 30 males and 150 females will be selected to be the parents of the next generation. This method may likely delay the negative genetic correlation between other traits.

The generation interval will be one year, which connote that the selection will be based on egg production up to 42 weeks of age. The remaining 10 weeks in the year will be used for the calculation of production results, selection and reproduction of the selected males and Females. The interval from hatching to 20 weeks will be for raising, while 20–42 weeks will be for production. The period 41–46 will be for calculation and selections, 46–49 weeks for mating and 49–52 weeks for hatching the next generation.

It is possible to compare the expected genetic progress with the actual progress. This can be done with the help of the formula $\Delta T = r(I) i(I) T$. The ΔT represents genetic progress, $r(TI)$ represents the genetic correlation between the breeding value and the index, (I) represents the intensity of selection of the index and T represents the additive genetic variance. Such a calculation may show that greater

progress will be made in line, where only one trait is selected for whereas the index line will be best in improving all the traits simultaneously.

Costs and Returns Over Years:

It has been shown by Hill (1971) with an example from cattle that the breakeven point is arrived at earlier, if heavy investment is made at the beginning and small investment made in the subsequent years. This was compared with a situation, where a relatively small investment was made at the beginning and increased in the second year and kept constant at that level in subsequent years. The nature of the breakeven point and profit in the calculation, may apply if there is no government assistance, in which case, at or after the 7th year, the products can be marketed commercially. Whereas if there is government assistance in imposing restriction on imports, the products can be marketed earlier or as from second generation of selection.

References:

- HILL, W.G. (1971) Investment appraisal for national breeding programmes. *Animal Prod.* 13, 37–50.
- IKPI, A. and AKINWUNMI, A. (1979) The future of poultry industry in Nigeria. In National Poultry Seminar, A.B.U., Zaria., 1979.
- FOS (1979) Federal Office of Statistics -- Nigerian Trade Summary, Lagos.