Egyptian J. Anim. Prod., 33, Suppl. Issue, Nov. (1996): 567-576

IMPROVING INDIGENOUS CHICKEN BREEDS: EXPERIENCE FROM EGYPT, NORWAY AND TANZANIA

F.H. Abdou

Poultry Production Department, Faculty of Agriculture, Menofyia University, shebin El-Kom.

INTRODUCTION

In Egypt a lot of efforts has been done to improve indigenous chickens. Figure 1 illustrates most of these efforts and it is clear that Fayoumi chickens have been involved in most of the developed breeds. An early trial in 1940's was done by M.F. El-Kishin through crossing Fayoumi with W. Leghorn chickens. Another trial was also done at Faculty of Agriculture, Cairo University with the aim of developing White and Red Baladi through selection within indigenous chickens. However, these developed breeds were not commercially produced on large scale.

Some other trials are still going on to improve Fayoumi breed at Fayoumi station (El-Hosari, 1996). In upper Egypt efforts are done to improve Dandrawi chickens which are characterized with high tolerance to heat stress (Al-Hamady, 1996). Sinai chickens (Bedouin) existed in Sinai Desert have attracted attention of poultry researchers for their adaptation to high ambient temperature. One of these trials started in 1985 and is still going on now through the project of improving Bedouin fowl; Sinai, (Soltan, 1996). More details existed in the final report of the project (Grant FRCU 851002, Soltan, 1987).

Concerning the objectives of the poultry breeders in the three countries, in Egypt breeders agree, in general to develop specialized lines for commercial production and dual purpose for the farmers and small flock holders. In Norway the main objective was to develop specialized lines for commercial production. Efforts were also done to improve local Norwegian chickens "Jaer" as a breed of egg laying for its genetic variation of interest for future poultry breeding in Norway (Kolstad, 1978). Tanzania, as many developing countries, still relies on the traditional sector for over 80% of her supply of poultry products, (Katule, 1989). Therefore, the main objective was to explore the possibilities for developing high performing dual-purpose strains of chickens adapted to low input production in Tanzania conditions.

Concerning the procedures applied and results achievements in the three countries, in Egypt most of the developed breeds came through crossing with exotic breeds, except of those of improving Fayoumi, Dandrawi and Sinai. It may be useful to illustrate the procedure of the most recent trial applied to improve indigenous chickens; Norfa, (Figure 2).

A base population of Norfa chickens was formed through crossing of two indigenous breeds of chickens (i.e. Fayoumi and W. Baladi, the latter was developed at Cairo University) with two exotic strains of W. Leghorn imported from Norway in 1980 (L_2;

strain of high egg number and L_7 ; strain of high egg size). The mating and selection scheme on Norfa project can be summarized as follows:
Selected individuals (with 1 σ selection intensity) consisted of the upper nucleus of the triangle of the population (1,4 and 7, Figure 3).

To renew the flock for next generation the selected dams are supposed to give at least all the layers for the next upper nucleus and all cocks needed for the new generation. Individuals proved to be superior in performance are moved to the upper nucleus. Random mating is applied in the control flock. The selection indices applied in Norfa layers were as follows:
General indices, subindices and reduced indices. (Enab, 1991; Enab *et al* ., 1992a; and Enab *et al*., 1995)
Two-stage indices (Enab *et al*., 1992a; Abdou and Enab, 1994a and Sherif *et al*., 1996)
Restricted indices (Enab *et al*., 1992b; Abdou and Enab, 1994b and El-Wardany *et al*., 1996).
Six selection indices were used for the upper nucleus for the generation 1996/1997. Four of them for females,

$I_1 = b_1 EN_i + b_2 EW_i + b_3 BW_i$
$I_2 = b_1 EN_i + b_2 EW_i + b_3 BW_i + b_4 EN_f + b_5 EW_f$
$I_3 = b_1 I_1 + b_4 EN_f + b_5 EW_f$
$I_4 = b_1 I_1 + b_4 EN_f + b_5 EW_f$

and two of them for males:

$I_f = b_1 SM_f + b_2 EN_f + b_3 EW_f + b_4 BW_f$
$I_h = b_1 SM_h + b_2 EN_h + b_3 EW_h + b_4 BW_f$ (Enab, 1996)

where i=individual performance, f = full-sib performance,
h= half-sib performance, EN = Egg number,
EW=Egg weight, BW=Body weight and SM=Sexual maturity

Table 1 shows the performance of the base and selected dams of the last three generations.

A common research project (NKJ 19) was started in Summer, 1969 for poultry breeding in Scandinavian countries (*i.e* Sweden, Norway, Denmark and Finland). The aim of the project was to develop selected lines of laying hens independent of the international hybrids available on the world market (Liljedahl *et al*., 1979). The project was composed of various sub-projects contributed by the four countries. An establishment of a gene pool was founded in Sweden which was used as a common base and control populations for developing the selected lines. It was formed by polyallele crossing of commercial hybrids from various origins (*i.e* seven international commercial hybrids).Figure 4 illustrates the idealized system for selection and crossing among the four developed strains (N,E,I_1 and I_2) plus the control population (C).
In 1971 replicates of the F_2 generation were distributed to Norway, Denmark and Finland. In Norway, it may be useful to illustrate the general outline of the selection experiment applied in this F_2 generation for laying hens. The base population was divided into four main lines: N; high egg number, E; high egg weight, NxE and ExN. In addition to a random bred control a fifth line was also established and the selection criterion in this line was the proportion of egg weight to body weight. The aim of this

particular line was to obtain more information about the relationship between the two traits; egg and body weights and what genetic gains would be achieved on the traits by selection on the basis of this ratio (Kolstad, 1980). The general outline of the selection indices used to evaluate the candidates was as follows:

$Index_F$ (Female index) = $\sum_{i=1}^{t} [b_{i1} (P_{Ii}-P) + b_{i2}(P_{Fi}-P_t)]$

$Index_M$ (Males index)= $\sum_{i=1}^{t} [b_{i2} (P_{fi} -P_t) + b_{i3} (P_{Hi}-P_t)]$

where t = number of traits

P_{Ii} = individual performance for i^{th} traits

P_{fi} = full sib mean for i^{th} trait

P_{Hi} = half sib mean for i^{th} trait

p_t = population mean for i^{th} trait

It was clear that selecting an individual depended mainly on its superiority over the population mean. The traits involved in these indices were, age at sexual maturity, number of eggs till 42 weeks of age, pecent egg production, mature egg weight, egg mass, mature body weight, egg weight, body weight, shell quality, albumen height, fertility, hatchability and mortality rate (from 20 to 42 weeks of age, Kolstad, 1980). Since the 1970 the following genetic gains wee achieved in the Norwegian breeding program for layers (Kolstad, 1984; Nordvoll, 1990 and Katle, 1991).

Year	Number of eggs for 467 days	Egg weight at 38 weeks	Body weight at 38 weeks	Sexual maturity
1970	210	56.9 g	1760 g	194 d
1990	288	64.1 g	1950 g	138 d

In the same time the National Random Sample Test Station was established in 1960 in Norway. The main objective of these test stations was to estimate genetic progress. Figure 5 illustrates the connection between the breeding stations where the selection was carried out, the Random Sample Test Station and the Control population.

Analyzing the results of the selection program after five generations of selection showed that the average of total genetic gains due to selection for three strains (H, M, and N) were + 14.5 eggs to 510 days of age, + 1 g in egg weight, + 80 g in 20 weeks body weight and - 14.2 days in age at sexual maturity (kolstad, 1979).

In Tanzania exotic meat type, egg type imported from England and local chickens were crossed in the first generation followed by backcrosses and three-breed crosses in the following generation to from the base population. From the base population a selection program was started for high productivity under the sub-optimum environmental conditions. Katule(1989) stated that "it seems more sensible to transfer the technology of breed improvement than to transplant non-adapted breeds to developing countries".

The performance of some egg production traits in the Tanzanian experiment was shown by Katule (1989) as follows:

	Egg rate% at 32 weeks	Mean egg rate up to 32 weeks	Egg size at 32 weeks
Local hens	42.7	26.1	41.7 g
3-way crosses	57.3	43.1	50.0 g

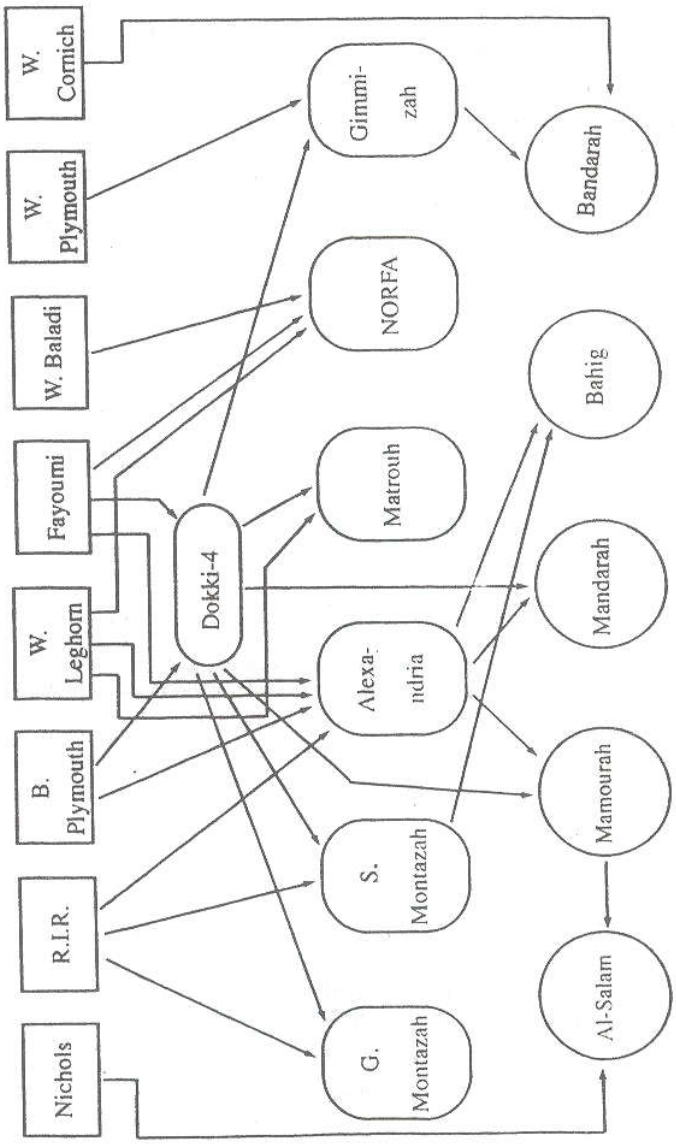

Figure 1: Some trials of improving indigenous chickens in Egypt.

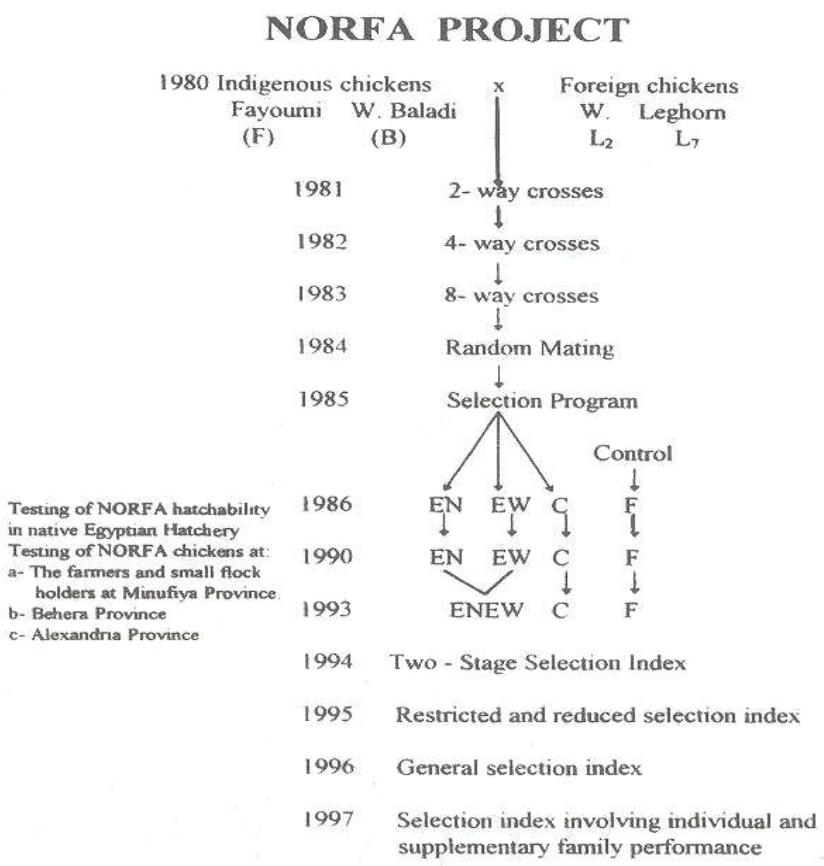

Figure 2: Breeding and selection scheme of NORFA chickens.

Table 1:Some results of the selection experiment of NORFA chickens.

Trait	1994-1995		1995-1996		1996-1997	
	B.p*	S.I**	B.p*	S.I**	B.P*	S.I**
	1+2+3	1	4+5+6	4	7+8+9	7
Sexual maturity,d	165.2	150.6	155.9	156.3	159.3	157.9
Egg number (90d)	47.71	65.8	50.7	55.5	46.7	59.2
Egg weight,g.	41.9	47.6	43.9	44.5	50.6	50.7
Body weight,g.	1280	1353	1300	1263	1420	1359

* B.P Base population
** S.I Selected individuals

Figure 3:Selection scheme of NORFA chickens

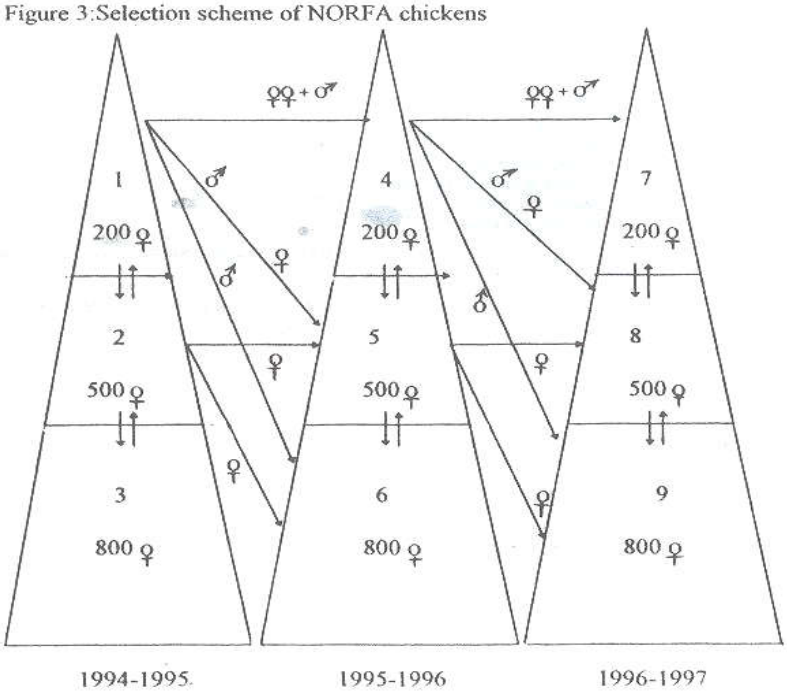

Figure 4: Selection scheme in Sweden showing the idealized system for selection and crossing applied in the base population (F4 generation) to develop four selection lines (N, E, I, and I2) and a control , (cited after , Liljedahl et al., 1979).

Gen No	Specialized selection			Overall performance selection			Random mating
	Line N Number of eggs	Cross N × E E × N	Line E Egg weight	Line I_1 $b_1N + b_2E$	Cross $I_1 \times I_2$ $I_2 \times I_1$	Line I_2 $b_1N + b_2E$	Line C Control
1	N 115 ♂♂ 500 ♀♀		E 115 ♂♂ 500 ♀♀	I_1 115 ♂♂ 500 ♀♀		I_2 115 ♂♂ 500 ♀♀	C 115 ♂♂ 400 ♀♀
	Selection 15 ♂♂ 100 ♀♀		Selection 15 ♂♂ 100 ♀♀	Selection 15 ♂♂ 100 ♀♀		Selection 15 ♂♂ 100 ♀♀	Random mating
2	N 115 ♂♂ 500 ♀♀	N × E E × N	E 115 ♂♂ 500 ♀♀	I_1 115 ♂♂ 500 ♀♀	$I_1 \times I_2$ $I_2 \times I_1$	I_2 115 ♂♂ 500 ♀♀	C 115 ♂♂ 400 ♀♀
	Selection 15 ♂♂ 100 ♀♀		Selection 15 ♂♂ 100 ♀♀	Selection 15 ♂♂ 100 ♀♀		Selection 15 ♂♂ 100 ♀♀	Random mating
•	•	N × E E × N	•	•	$I_1 \times I_2$ $I_2 \times I_1$	•	•
•	•		•	•		•	•
•	•		•	•		•	•

N = Line selected for number of eggs.
E = Line selected for egg weight.
I1 = Line selected for both N and E.
I2 = Replicate of I1
C = Control line reproduced by random mating

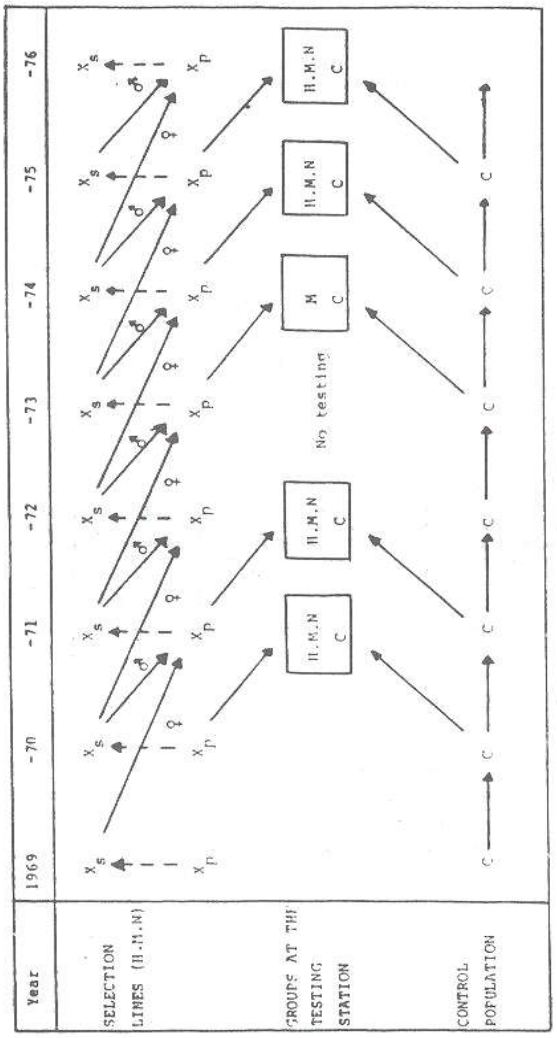

Figure 5. Selection scheme of Norway showing the connection between the Breeding stations (x_s = selected lines and x_p = Base populations), Random sample Test Station (T) and the Control population (C), cited after Kolstad. (1979 b).

It would be valuable to illustrate the following comments of some poultry breeders who contribute in developing some Egyptian breeds of chickens:

El-Ibiary (1996) stated that "The future of genetic improvement of economically important characters in Egyptian strains of chickens seems to rest on one of two procedures, or both: (1) selection for these characters as to their combinability among different strains or inbred lines, and (2) genetic engineering"

El- Hosari (1996) pointed out that local chickens should be given the priority to form base population from which grand parents should be developed. Genetic pool preservation for local breeds of chickens should be done through keeping local flocks in sufficient numbers in different places. Crossing within local breeds of chickens and also with exotic breeds is considered an efficient way to improve the productivity of local chickens. Registeration of some local breeds of chickens has already been done.

Elham Abd El-Gawad (1996) emphasized the importance of genetic engineering since "we should try to use the new biotechnology to develop strains of chickens instead of the traditional methods specially some results of genetic engineering in chickens are promising". Efficient facilities and high speed of computers should be also utilized in analyzing the experimental data.

Mahmoud, T.H. (1996) gave a proposal for "improving the performance of local strains of chickens, as egg- type lines". The improvement program includes:

-Genetic improvement (*i.e* selection for egg-type lines and strain crossing).
-Physiological aspects and immune genetics.
-Nutritional aspects.
- Flock management.
- Technological aspects.

REFERENCES

Abdou, F.H. and A.A. Enab, 1994a. 5*th* World Congress on Genetic applied to Livestock Production Guelph Ontario, Canada, Augst 7-12,1994.

Abdou, F.H. and A.A. Enab, 1994b. The second scientific conference on poultry, Kafr El-Sheik, 12-13 Sept., 1994.

Al-Hamady, 1996. Personal communication.

El-Ham Abd El-Gawad, 1996. Personal communication.

El-Hosari, 1996. Personal communication.

El-Ibiary, H,M., 1996. Personal communication.

El-Wardany, A.M, B.T.Sherif, and F.H. Abdou, 1996. The 9*th* Conference of The Egyptian Society of Animal Prod., Shebin El-Kom, Menofyia, Nov., 1996.

Enab, A.A, 1991. Ph.D. Thesis, Menofyia Univ.

Enab, A.A., M. Soltan, F.H. Abdou, and M. El-Sayed, 1992a. Menofyia J. Agric. Res.

Enab, A.A., M. Soltan, F.H. Abdou, and G.Gebriel, 1992b. Menofyia J. Agric. Res.

Enab, A.A., B.T.Sherif, A.M, El-Wardany, and F.H. Abdou, 1995. first Egyptian Hungerian poultry Conference, Alexandria Egypt, 17-19 Sept., 1995.

Enab, A.A., 1996. Egypt. Poult. Sci.

Katle, J., 1991. Dr. Agric. Thesis, Agric. Univ. of Norway.

Katule, 1989. Ph.D. Thesis, Sokoine Univ. of Agric. Morogoro, Tanzania.

Kolstad, N., 1978. Meldinger No. 42.

Kolstad, N., 1984. Utviklingen av fjorfeholdet. Edit:Eskilt, A. and Valland, D. Chapt.III, pp 200-228.
Liljedahl, L., N. Kolsted, P. Sorensen and K. Maijala, 1979. Acta Agric. Scand.29:273-286.
Mahmoud, T.H., 1996. Personal communication.
Nordvoll, 1990. Fjorfe, 9:412-419.
Sherif, B.T. A.M, El-Wardany, and F.H., Abdou, 1996. The 9*th* conference of the Egyptian Society of Animal Prod., Shebin El-Kom, Menofyia, Nov., 1996.
Soltan, M.E., 1987. Final report othe project (Grant FRCU 85 1002).
Soltan, M.E., 1996. Personal communication.