SUITABLE METHODS FOR THE IMPROVEMENT AND CONSERVATION OF LOCAL CHICKENS IN THE DEVELOPING COUNTRIES

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SUMMARY

The techniques employed in the cryogenic storage of germplasm and molecular engineering are based on advanced technology. They are therefore considered unsuitable for adoption for the improvement and conservation of poultry genetic resources of the poorer, developing countries. The poor living standards, low levels of technological development and the worsening economic conditions of the countries call for the use of simpler, low-tech conventional methods which they can afford. Evidence from published reports on the use of selection, crossbreeding and modern management systems to conserve and genetically improve the local chickens of Nigeria indicates considerable success. However, if well adopted to combine the three methods and then co-ordinated on regional basis the improvement and conservation programme can achieve best results at minimum costs to individual third world countries.

INTRODUCTION

The population of the native chicken of Nigeria is estimated at over 123 million and when compared with the exotic stock population of nearly 10 million, the local fowl out-numbers the latter 13 times, and represents over 90 per cent of the entire domestic chicken population in Nigeria (FLD, 1979).

Merits of the local chicken

The local chicken in Nigeria deserves conservation because it can show appreciable heterosis and "nicking" ability in body weight when crossed with exotic breeds (Asuquo, 1984; Omeje and Nwosu, 1984). It responds quickly to genetic improvement for egg production (Nwosu and Omeje, 1984) and has good dressing and meat qualities (Nwosu *et al*, 1985).

Methods best suited for developing countries

Methods for the improvement and conservation of animal genetic resources include (a) the fastly developing high-tech cryogenic storage of germplasm, genetic engineering and associated techniques, and (b) the conventional breeding and management systems. Genetic resources conservation and improvement in the third world should involve methods that take care of the prevailing poverty and low technological handicap of those nations. It is the aim of this paper to assess and discuss such methods vis-a-vis those that are based on advanced technological know-how.

CRYOBIOLOGICAL AND MOLECULAR ENGINEERING TECHNIQUES

These techniques are broadly grouped into the reproductive and genetic intervention types.

Reproductive Techniques

They comprise artificial insemination, *in vitro* fertilization, embryo harvest and transfer, and germplasm storage, the details of which have been discussed by Fitzhugh (1984) and Maijala (1984). According to Seidel and Seidel (1981) these methods, especially embryo harvest and transfer, are each made possible by combinations of discrete technologies. By the reproductive techniques man has made major break-throughs in being able to determine which gametes (and not population) to preserve.

Genetic Interventions

Much more fascinating is the new series of techniques by which man can now directly intervene in the genetic determination of individuals. By the new technology - molecular or genetic engineering - genetic interventions such as micro-manipulation of gametes and embryos (Schuman and Shoffner, 1982), gene isolation and synthesis, and the addition, deletion, repair or transfer of DNA segments (Sinha and Sinha, 1980) have been made possible and can alter the genotypic constitutions of individuals among breeding populations.

CONVENTIONAL BREEDING TECHNIQUES

Evidence of Improvement and Conservation Through Selection

Body Weight: Selection for body weight among the indigenous chickens in Nigeria was first reported by Oluyemi (1979) who, after 7½ years of work covering seven generations of selection on the local chicken, obtained a considerable improvement in the 12 week body weight of the fowl (Table 1). Among the selected populations, the males improved by 296.3g while the females by 284.5g.

Table 1: Response of the Local Chicken to selection for body weight at 12 weeks of age (Oluyemi, 1979)

Generation	MALE				FEMALE			
	Control		Selected		Control		Selected	
	Mean (g)	CV (%)	Mean (g)	CV (%)	Mean (g)	CV (%)	Mean (g)	CV (%)
0	463.7	21.9	463.7	23.4	391.0	23.1	391.0	22.5
1	459.6	22.3	492.0	22.3	395.0	22.8	422.4	20.3
2	466.0	22.6	522.0	20.0	389.0	22.1	432.5	24.9
3	463.7	23.1	546.7	17.5	395.2	23.2	457.7	22.2
4	501.5	23.4	631.1	13.3	439.0	21.0	556.7	17.9
5	507.2	22.4	686.6	10.8	440.1	22.2	608.4	14.7
6	499.0	22.9	736.4	8.7	450.3	22.5	651.6	12.5
7	510.0	23.1	760.0	8.3	441.0	22.7	675.5	11.7

Egg Production: Instances of artificial selection as having improved egg production of the Nigerian native fowl are quite scanty. The only reported attempt was by Akinokun and Dettmers (1977) who increased the 260 day production of the local pullet from 104 to 106 eggs after two generations of selection. Owing to the few number of generations involved, this evidence cannot be regarded as conclusive. However, in India, Iyer (1950) who had conducted selection in a non-descript flock of desi fowl, reported an increase in annual egg production from 116 to 140 eggs per hen and in egg weight from 43.4g to 49.3g through six generations (Table 2).

Table 2: Performance of a strain of indigenous chicken during successive generations of selection (Iyer, 1950)

Generation	Mean Egg No. per hen	Mean Egg Wt. (g)
0	116.1	43.4
1	131.9	44.5
2	136.4	41.4
3	140.5	42.5
4	131.1	46.5
5	138.9	47.3
6	135.4	49.3

Evidence from Crossbreeding:

Body Weight: The fastest improvement response so far has come from crossing the local chicken with imported strains. In body weight, the heterosis generated by cross-mating the indigenous fowl reciprocally with White Rock and Rhode Island Red breeds respectively ranged from 4 to 12.4% at 12 weeks of age (Oluyemi, 1979). On crossing with Gold-link, the local-exotic cross yileded considerable heterosis in body size from 4 to 20 weeks of age (Omeje and Nwosu, 1984). It was shown by the authors that up to the point-of-lay the crossbreds and the exotic chicks did not differ significantly (Table 3) in the same trait.

Table 3: Heterosis in body weight of F_1 crossbred (CB) progeny chicks from local (LC) by Gold-Link (GL) chicken mating (Omeje and Nwosu, 1984)

	Mean Body Weight (g)			Mean Crossbred
	LC	GL	CB	Heterosis (%)
Wk 4	88.36^a	108.73^b	107.49^b	9.07
Wk 12	530.00^a	660.00^b	651.70^b	9.53
Wk 20	851.67^a	1195.42^b	1175.88^b	14.89

Note: For all row results, $a < b < c$ ($p < .05$)

Egg Production: Similar results of the genetic improvement of the native chicken through crossbreeding have been obtained in egg production. Nwosu and Omeje (1984) obtained a significant increase in the egg production of the local chicken from 146 to 213.34.eggs/hen/annum through crossing with the Gold-Link chicken strain. In the same study, the authors showed the crossbred pullet eggs to be about 80% in size and mass of those laid by exotic pullets (Table 4). By undertaking a three-breed (Yaffa x Gold-Link x Local) cross, Omeje and Nwosu (1985) increased the egg size of the local from 40.36g to 52.07 (about 30%) in the crossbred progeny whose eggs attained over 97% the size of those produced by an all-exotic (Yaffa x Gold-Link) cross at 52 weeks of age.

Table 4: Improved annual egg production from Nigerian local chicken (LC) by gold-link (GL) F_1 cross progeny

Trait	LC	GL	F_1 superiority over the LC(%) GLxLC	LCxGL	F_1 improvement as % of Exotic GLxLC	LCxGL
SEN, mean	146.00	226.80	46.12	29.49	94.07	83.36
EW,g mean	38.63	53.44	23.58	21.72	89.33	87.99
TEM,kg mean	5.64	12.12	80.50	57.62	83.99	73.35

Note: SEN, survivor egg no.-; EW, egg weight ; TEM, total egg mass (Nwosu and Omeje, 1984).

Evidence from Improved Management Systems.

Under primitive, traditional system of poultry husbandry in rural Nigeria the egg production of the local fowl averages 50 eggs per annum having been characterized by long pauses and marked broody periods with short laying intervals. With the introduction of modern, intensive systems of management that include improved dietary regimes, the indigenous fowl has been shown to improve greatly in her production capacity. Using battery cage housing and compounded ration techniques, Hill and Modebe (1961), and Nwosu and Omeje (1984) obtained annual productions of 124 and 146 eggs per hen respectively from local chicken populations. In the deep-litter system under improved diets the Nigerian chicken laid an average of 128 eggs per annum (Nwosu et al, 1979).

GENERAL DISCUSSION

Tests conducted on laboratory and farm animals using techniques that involved germplasm and embryo storage, micromanipulation of zygotes and genetic modification at the molecular level have yielded fascinating results. It has also been observed that these methods have the potential for making great impact on livestock productivity and conservation (Schuman and Shoffner, 1982; Fitzhugh, 1984 and Parez, 1984). However, their use to achieve improvement and preservation of poultry genetic resources in the developing countries could be ridiculed by a number of factors. The overall

cost of hiring experts, erection of structures and laboratories, the procurement and installation of the various sophisticated equipment and materials, including drugs and chemicals will go far beyond those already listed (Seidel and Seidel, 1981 and Parez, 1984). Considering the present low level of technological development and the deteriorating economic conditions of third world countries, whose foreign debts keep piling, it is most doubtful if any of the countries can afford to adopt the new bio-technology. Where attempts could be made to embark on the programme, the problem of providing continuous electric power supply to keep the project running, and of steadily replacing worn-out parts or broken-down machines, poses a great threat to the success envisaged. Frequent power cuts and unavailability of spare-parts for the machines and even for stand-by generators, have contributed largely in crippling many hitherto viable projects Nigeria had established in the past.

The response of the local chicken to the conventional methods of breeding and management appears quite appreciable. In spite of the criticism that crossbreeding could, if uncontrolled, result in dilution or loss of indigenous breeds (Adeniji, 1984), this method is useful as a living gene bank possible for all endangered species since the genes of interest are still conserved in the crossbred animals and can be "re-cycled" or synthesized in subsequent generations of crossing and back-crossing (Bhat, 1984). Moreover, crossing, as well as selection and improved management, is of the advantage that instead of storing the local germplasm in dormant cryo-gene banks, the genes conserved in live chickens of short generations will be of productive utility to the starving countries, and will at the same time undergo all necessary evolutionary and adaptational changes that accompany dynamic populations.

CONCLUSIONS

No doubt, the more suitable option for the improvement and conservation of local chicken in the developing countries is the continued use of conventional breeding and improved management methods, rather than those that are based on advanced technology. However, the use of both crossbreeding and selection together will achieve better results as it will entail crossbreeding among local breeds and/or with exotic strains, and then reciprocally back-crossing the progenies to selected indigenous and exotic strains. The resulting populations should undergo reciprocal recurrent selection not only to exploit heterosis but to obtain indigenous strains or strain crosses that are best adapted to local environments. To still reduce costs and unnecessary duplications, the programme could be tackled on regional basis particularly in West Africa, East Africa, Central Africa or other regions where mixing of birds occurs easily or where differentiating between local breeds or strains appears difficult.

REFERENCES

ADENIJI, K. O. 1984. Recommendations for specific breeds and s species for conservation by management and preferred techniques. FAO Anim. Prod. Health Paper 44/1, 89-98.

AKINOKUN, O. and DETTMERS A. 1977. Performances of the indigenous chickens of Nigeria and the APOLLO. (1): Egg weight, rate of production and factors affecting them. Nig. J. Anim. Prod., 4(1), 67-79.

ASUQUO, BO. O. 1984. Improvement of the local chicken through crossbreeding and nutrition. Ph.D. Thesis, University of Nigeria, Nsukka.

BHAT, P. N. 1984. Breeding plans for improvement of indigenous breeds and species. FAO Anim. Prod. Health Paper 44/1, 67-79.

FITZHUGH, H. A. 1984. Genetic aspects of germplasm storage and genetic engineering. FAO Anim. Prod. Health Paper 44/2, 21-42.

FLD. 1979. Economic analysis of Nigerian poultry industry. Federal Livestock Department, Lagos.

HILL, D. H. and MODEBE, A.N.A. 1961. Poultry production at the University College, Ibadan (1950-58). University of Ibadan Fac. of Agric. Technical Bulletin No. 2.

IYER, S. G. 1950. Improved indigenous hen evolved by selective breeding. Ind. Vet. J. 26, 80-86.

MAIJALA, K. 1984. Scandinavian activities on the conservation of animal genetic resources. Animal Genetic Resources Information. FAO/UNEP, Rome, Vol. 1, 20-26.

NWOSU, C. C. and OMEJE, S. S. 1984. Improved annual egg production from Nigerian local chicken by gold-link F_1 cross progeny. Proc. 17th World Poultry Congr., Helsinki, 1 B - 3, 790-791.

NWOSU, C. C. 1979. Characterisation of the local chicken in Nigeria and its potential for egg and meat production. Proc. 1st Nat. Seminar on Poultry Prod., Zaria, 187-210.

NWOSU, C. C., IKEME, A. I. and OMEJE, S. S. 1985. Meat evaluation of the Nigerian local chickens and their crosses. (In Press) Nigerian Food J.

OLUYEMI, J. A. 1979. Potentialities of the indigenous species of poultry for meat and egg production in Nigeria. Proc. 1st Nat. Seminar on Poultry Prod., Zaria, 163-186.

OMEJE, S. S. and NWOSU, C. C. 1984. Heterosis and superiority in body weight and feed efficiency evaluation of exotic parent stock by local chicken F_1 crossbreds. Nigerian J. Genet. 5, 11-26.

OMEJE, S. S. and NWOSU, C. C. 1985. Effect of three-way crossing on the egg production of the local chicken. (In Press) East African Agric. Forestry J.

PAREZ, M. 1984. Harvesting, processing, storage and subsequent use of animal cells in developing countries, FAO Anim. Prod.Health Paper 44/2, 67-87.

SCHUMAN, R. and SHOFFNER, R. N. 1982. Potential genetic modification in the chicken, Gallus Domesticus. Proc. 2nd World Congr. Genet. Appl. Livestock Prod. MADRID. RT-C3, 157-163.

SEIDEL, G. E., JR. and SEIDEL, S. M. 1981. The embryo transfer industry. In: New Technologies in Animal Breeding. Academic Press, New York, 41-80.

SINHA, U. and SINHA, S. 1980. Cytogenetics, plant breeding and evolution (2nd Ed.), Vikas PVT Ltd., 266-278.