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* VOLUME II Contains country reports from Benin, Burkina
Faso, Cameroon, Comoros, Congo, Gambia, Ghana,
Greece, Ivory Coast, Kenya, Madagascar, Malawi,
Mali, Morocco, Nigeria, Senegal, Somalia, Sudan,
Togo, Uganda, Zaire, Zimbabwe.

* TOME II

Contient les rapports nationaux du Benin, Cameroun, Burkina Fasso, Comores, Gambie, Grèce, Côte d'Ivoire, Kenya, Madagascar, Malawi, Mali, Maroc, Nigéria, Sénégal, Somalie, Soudan, Togo, Ouganda, Zaïre, Zimbabwe.
INTRODUCTION

Smallholder rural poultry production deserves greater attention from governments and development institutions. Poultry can be found in the remotest rural areas and contributes considerably to the farm families' income, food requirements and social obligation with relatively little input from outside the farm. There is a broad base for improvement of this important sector of rural development.

During two international symposia in Germany and another conference in Nigeria, it became evident that some knowledge had accumulated in specific fields of rural poultry production. But this knowledge is dispersed, and coordinated approaches and exchange of information are absolutely essential.

In order to bridge this gap, CTA, the ACP-EEC Technical Centre for Agricultural and Rural Co-operation, organized an international seminar from 9 to 13 October 1990 at Thessaloniki, Greece. Some 60 poultry specialists from national ministries, extension services, research institutes and from international organizations were invited to:

- critically review the state of rural smallholder poultry production in African countries
- formulate guidelines for research and development of rural poultry production in Africa, and
- identify poultry research and development projects that are viable under the conditions existing in Africa.

Twelve introductory technical papers were presented. They were followed by five working groups on different sectors of poultry production. The working group results were in turn discussed by an interdisciplinary meeting of chairmen who then compiled final results of the seminar.

These proceedings appear in two separate volumes. Volume I contains the results of the seminar, reports from the working groups, as well as the technical papers, each with an abstract in English and French. The opening addresses are reproduced in the appendix.

Volume II contains the original country reports which served as a basis for some of the technical papers and for discussions of the working groups.

A list of participants and contributors is contained in each volume.

The CTA wishes to extend the most sincere appreciation to the Greek authorities who spared no effort to support this international seminar.
INTRODUCTION

La petite aviculture rurale mérite une plus grande attention de la part des gouvernements et des institutions engagées dans le développement. L'aviculture est présente dans les zones rurales les plus reculées et elle contribue largement aux revenus des familles rurales, couvrant des besoins alimentaires et assurant des fonctions sociales avec un investissement relativement faible. Il existe d'importantes possibilités d'améliorer ce secteur essentiel du développement rural.

Lors de deux symposiums internationaux tenus en Allemagne et d'une conférence organisée au Nigeria il a été constaté que des connaissances ont été acquises dans des domaines spécifiques de la production avicole rurale mais que celles-ci étant dispersées, des approches coordonnées et des échanges d'information sont absolument indispensables.

Dans le but de combler ce vide, le Centre technique de coopération agricole et rurale (CTA), a organisé un séminaire international à Salonique (Grèce) du 9 au 13 octobre 1990. Quelques 60 spécialistes en aviculture provenant des ministères nationaux, des services de vulgarisation, des instituts de recherche et des organisations internationales ont été invités pour :

- analyser de manière critique la situation de la petite aviculture rurale dans les pays africains
- formuler des orientations pour la recherche et le développement de l'aviculture rurale en Afrique, et
- identifier des projets de recherche et de développement avicoles viables dans le contexte africain.

Douze contributions techniques furent présentées suivies de cinq groupes de travail constitués autour des différents thèmes de la production avicole. Les résultats de ces groupes de recherche ont été débattus lors d'une réunion interdisciplinaire de leurs présidents qui ont ensuite mis au point les conclusions finales du séminaire.

Ces actes sont publiés en deux volumes. Le premier volume contient les résultats du séminaire, les rapports des groupes de travail et les contributions techniques dans la langue d'origine avec un résumé en français et en anglais. Les allocations d'ouverture de la rencontre figurent en annexe.

Le deuxième volume contient les rapports originaux par pays qui ont servi à certaines contributions techniques et aux discussions des groupes de travail.

Chaque volume contient une liste des participants et des contributeurs.

Le CTA tient à remercier les autorités grecques qui n'ont ménagé aucun effort pour le bon déroulement de ce séminaire international.
1. RESULTS OF THE SEMINAR

as compiled by the Interdisciplinary Chairmen’s Meeting on 12 October 1990

CHAIRMAN: Prof. Horst, Berlin, FRG

SECRETARY and RAPPORTEUR: Dr. Sonaiya, Ile-Ife, Nigeria

MEMBERS:

Dr. J.G. Bell, Rabat, Morocco
Dr. W. Bessei, Stuttgart, Germany
Dr. Ir.F. Demey, Antwerp, Belgium
Mr. Giossis, Athens, Greece
Dr. P.N. Mbugua, Nairobi, Kenya
Dr. N.A. Musharaf, Wad Medani, Sudan
Dr. J.O. Ngoupayou, Yaoundé, Cameroon
Dr. A. Provost, Maisons-Alfort, France
Dr. A.J. Smith, Roslin, Scotland

Working group reports were received and discussed exhaustively. It was finally agreed that there is urgent need for:

(i) interdisciplinary research programmes to be designed and executed by cooperating scientists and institutions from Africa and Europe;
(ii) coordinated international action for development with direct impact on improvement of smallholder poultry productivity, economic efficiency and profitability;
(iii) a network structure as a cost-effective means of coordinating efforts in the various research and development activities in Africa.

RESEARCH ACTIVITIES

The need for research in the following priority areas was agreed:

1. Epidemiological assessment of the different strains of Newcastle disease and evaluation of the efficacy of traditional remedies, combined vaccines (e.g. MCD, Gumboro, fowl pox or fowl cholera) and new vaccines (V, and recombinant pox virus) with regard to ease of field application, cost, integration into the feeding and management system and long-term environmental and public health implications.

2. Evaluation of the genotypes (for example for marker genes) and their relationship to productivity in the different poultry species (particularly chicken, guinea fowl, ducks and geese)
raised singly or in combination under the three types of smallholder system in different ecological zones in Africa. Of particular importance is the study of the ability of different poultry species and breeds to utilise high fibre and unconventional feeds for egg and meat production.

3. Socio-economic analysis of the efficiency of the smallholder production system in relation to labour and animal productivity, rural food security, stability of the rural labour force (rural-urban migration), and potential contribution to family incomes (especially of women). Assessment of the sustainability of the various technological interventions within the three types of smallholder production systems.

DEVELOPMENT ACTIVITIES

1. Collection and compilation of feedstuffs and assessment of their nutritive value.
2. Promotion of smallholder producers’ associations and their linkage with European partner associations.
3. Installation of a regional centre for training, research and development for poultry (and other small domestic stock) in Africa.

INTERNATIONAL COOPERATION

The need for an African Network on Rural Poultry Development, ANRP, (Réseau Africain pour le Développement de l’Aviculture en milieu Rural, RADAR) was unanimously accepted. The objectives of the network will be to promote

(i) the documentation of results and the dissemination of information
(ii) the coordination of training programmes for research and development personnel
(iii) the identification of research and development priorities, funding sources and cooperation opportunities
(iv) the development of research and development protocols

The Network will have an Advisory Committee and a Steering Committee. Advisory Committee members will be representatives of donors, African and European institutions and international organisations such as: OAU-STRC, IBAR, ADB, EC-DGVIII and DGXII, CTA, IEMVT, IMT, CTVM, GTZ, FAO, IFAD, IAEA.

The Steering Committee membership was approved as follows:

Dr. E.B. Sonaiya - Convener/Coordinator
Dr. W. Bessei
Dr. J.O. Ngoupayou
Dr. N.A. Musharaf
Dr. J.G. Bell
Mrs. Lul Said Ahmed
The Steering Committee will perform the following functions:

1. approach potential Advisory Committee members
2. search for funds
3. identify regional and national coordinators
4. assemble and channel information on research grants, training programmes, exchange visits to Network members
5. encourage and facilitate inter-disciplinary as well as African-European cooperation in research, development and training activities
6. organise, every 2 years, meetings of Network members.

1. RESULTATS DU SEMINAIRE

tels qu'ils furent formulés par la Réunion Interdisciplinaire des Présidents le 12 octobre 1990

PRESIDENT: Prof. Horst, Berlin, RFA
SECRETaire et RAPPORTEUR: Dr Sonaiya, Ile-Ife, Nigéria

PARTICIPANTS:

Dr J.C. Bell, Rabat, Maroc
Dr W. Bessei, Stuttgart, Allemagne
Dr Ir.F. Demey, Anvers, Belgique
M Giossis, Athènes, Grèce
Dr P.N. Mbugua, Nairobi, Kenya
Dr N.A. Musharaf, Wad Medani, Soudan
Dr J.D. Ngoupayou, Yaoundé, Cameroun
Dr A. Provost, Maisons-Alfort, France
Dr A.J. Smith, Roslin, Ecosse

Les participants ont discuté en détail les rapports des groupes de travail. Ils ont finalement convenu qu'il était urgent:

(i) de mettre au point des programmes de recherche interdisciplinaire et de les faire mettre en pratique dans le cadre d'une coopération entre scientifiques et institutions d'Afrique et d'Europe;
(ii) d'envisager une action internationale coordonnée pour le développement qui aurait un impact direct sur l'amélioration de la productivité, du rendement économique et de la rentabilité du petit élevage avicole;
(iii) d'élaborer une structure de réseau comme instrument efficace de réduction des coûts en vue de coordonner les efforts au sein des différentes activités de recherche et de développement en Afrique.
ACTIVITÉS DE RECHERCHE

Les participants ont convenu qu’il était nécessaire d’effectuer des recherches dans les domaines prioritaires suivants:

1. Évaluation épidémiologique des différentes souches de la maladie de Newcastle et évaluation des remèdes traditionnels, des vaccins combinés (par exemple MCD, Goumboro, variole et choléra aviaires) et des nouveaux vaccins (V4 et virus recombinant de la variole) en ce qui concerne la facilité d’application pratique, les frais, l’intégration dans le système d’alimentation et de management et les implications à long terme sur l’environnement et la santé publique.

2. Évaluation des génotypes (par exemple pour les gènes marqueurs) et leur rapport avec la productivité des différentes espèces de volailles (en particulier les poulets, les pintades, les canards et les oies) élevées seules ou à plusieurs et ce, selon les trois modèles de petit élevage dans différentes zones écologiques d’Afrique. Il faut particulièrement mettre l’accent sur l’étude de la capacité des différentes espèces et races de volailles à utiliser les fibres et les aliments non conventionnels pour la production d’œufs et de viande.

3. Analyse socio-économique du rendement du système de petite production par rapport à la disponibilité de la main-d’œuvre et la productivité des animaux, à la sécurité alimentaire en milieu rural, à la stabilité de la main-d’œuvre rurale (migration des campagnes vers les villes) et la part potentielle que la volaille représente dans les revenus familiaux (en particulier des femmes). Estimation de la durabilité des différentes interventions technologiques au sein des trois types de production à petite échelle.

ACTIVITÉS DE DÉVELOPPEMENT

1. Rassemblement et compilation de données sur les produits alimentaires et estimation de leur valeur nutritive.

2. Encouragement des associations de petits producteurs et de leurs liens avec les associations analogues européennes.

3. Installation d’un centre régional pour la formation, la recherche et le développement en matière de volaille (et autres petits animaux) en Afrique.

COOPERATION INTERNATIONALE

Les participants ont confirmé à l’unanimité qu’il était nécessaire de créer un Réseau Africain pour le Développement de l’Aviculture en Milieu Rural, (RADAR). Le réseau aura les objectifs suivants:

(i) diffusion des informations et de la documentation sur les résultats de recherche;

(ii) coordination des programmes de formation destinés au personnel de la recherche et du développement;

(iii) définition des priorités en matière de recherche et de développement, identification des sources de financement et des possibilités de coopération;

(iv) rédaction de protocoles de recherche et de développement.
Le Réseau disposera d’un Comité Consulatif et d’un Comité de Pilotage. Les membres du Comité Consulatif seront des représentants des donateurs, des institutions africaines et européennes, ainsi que des organisations internationales telles que: OAU-STRC, IBAR, ADB, EC-DGVIII et DGXII, CTA, IEMVT, IMT, CTVM, GTZ, FAO, IFAD, IAEA.

Les personnes suivantes ont été agréées en tant que membres du Comité de Pilotage:

Dr E.B. Sonaiya - Convocateur/Coordinateur
Dr W. Bessei
Dr J.D. Ngoupayou
Dr N.A. Musharaf
Dr J.G. Bell
Mme Lul Said Ahmed

Le Comité de Pilotage assumera les tâches suivantes:

1. contacter des membres potentiels du Comité de Consultation;
2. rechercher des fonds;
3. identifier les coordinateurs régionaux et nationaux;
4. rassembler et canaliser les informations relatives aux subventions pour la recherche, aux programmes de formation, aux visites d’échanges entre membres du Réseau;
5. encourager et faciliter les travaux interdisciplinaires ainsi que la coopération africo-européenne dans les domaines de la recherche, du développement et de la formation;
6. organiser des rencontres entre membres du Réseau tous les deux ans.
2. SUMMARIES FROM THE WORKING GROUPS

2.1 "BREEDING AND REPRODUCTION" (WG 1) AND "HUSBANDRY, HEALTH AND HYGIENE" (WG 2)

CHAIRMAN: Dr. A. Provost, France

VICE-CHAIRMAN: Prof. P. Horst, Germany

RAPPORTEUR: Dr. J.G. Bell, Morocco

MEMBERSHIP:

Prof. D.F. Adene, Nigeria
Dr. G. Agbede, Benin
D. Cheihane, Comoros
A.T. Chrisostome, Benin
Dr. D.A. Ehlihardt, Netherlands
Prof. M. El Houadfi, Morocco
Prof. F. Ellendorf, Germany
D. Houkonnou, CTA
M. Kane, Mali
Dr. E. Nkodia, Congo
Dr. C.C. Nwosu, Nigeria
Dr. Ch. Nwosuh, Nigeria
Dr. Z. Ouandaogo, Burkina Faso
Mrs. K. Richards, Gambia
Dr. R. Schmoldt, Germany
Dr. C. Soares, Portugal
Mrs. A. Tserveni-Ghostis, Greece
A.L. Yannakopoulos, Greece

Reports were given on the state of affairs in Burkina Faso, Congo, Cameroon, Comoros, The Gambia, Mali, Mauritania, Morocco, Nigeria and Zaire. These will not be reported in detail, since this has already been done by Dr. Sonaiya, but a number of important reoccurring points will be mentioned. Guinea fowl were reported to be present and used in small scale systems in significant numbers in several countries. Attempts to improve low genetic potential of fowl stock through the introduction of cocks were described but these had generally failed due to a lack of continuity. The crucial problems in husbandry stressed by several reporters were low reproductive ability of local fowl and high losses due to various reasons. Newcastle disease (ND) was reported to be the most important disease by every contributor without exception and mortality up to 100% was reported. Infectious
Bursal disease was reported to occur in a number of countries (Nigeria, Mauritania, Comoros). The development of some antigenic vaccines in Nigeria and a number of traditional disease remedies were reported.

RECOMMENDATIONS FOR RESEARCH

a) Breeding

- experiments to improve local strains by cross breeding with exotic strains, back crosses and other combinations, followed by on-farm evaluation.
- research on the selection of progeny with high and low resistance to diseases.
- evaluation of the effect of marker genes on quantitative performance traits and the use of molecular genetic methods for analysing the relationship between genetic resources in regional fowl and guinea fowl populations,
- at the same time as breeding experiments are undertaken local genetic resources should be conserved by the foundation of gene banks to avoid the loss of valuable characteristics such as maternal ability, adaptability and resistance to specific diseases.

b) Reproduction

- research into brooding and hatching methods. There was considerable debate as to whether artificial hatching methods were appropriate to the village situation. The possibility of having some hens for laying and some for hatching was mentioned as a solution to the conflict between brooding and breeding requirements.
- evaluation of the comparative productivity of fowl, guinea fowl and turkeys in different regions and production systems.

c) Husbandry and hygiene

- investigation into housing design suitable for ventilation and disinfection and its effect on animal performance.

d) Disease

- further epidemiological research into the prevalence of diseases, particularly in regions where little information is available.
- trials of new vaccines for Newcastle disease, particularly the heat resistant V4 vaccine which can be used on food, and recombinant vaccines; determination of the best ways to apply the vaccines; field trials following laboratory evaluation.
- evaluation of the vaccination procedure used in Burkina Faso and other regions.
- trials of combined vaccines against several diseases, such as Newcastle disease, Gumboro disease and fowl typhoid.
- development of ELISAs for Newcastle disease to permit distinction between antibodies against a recombinant Newcastle disease vaccine and wild type virus.
- development of an ELISA suitable for the detection of antibodies against different strains of Infectious Bursal disease virus in Africa.
- research into traditional remedies.

e) International cooperation

- numerous contributors proposed the creation of an international network for the coordination of research into Newcastle disease in village poultry in Africa.
- it was suggested that uniform experimental protocols be adopted as far as possible for Newcastle disease vaccination trials in different countries to permit the comparison of results.
- for research into poultry populations it was suggested that a uniform questionnaire be adopted to permit analysis or results from different countries on the same basis.
- the creation of a coordinated research network for serological monitoring using ELISAs was suggested.
- establishment of a centre for breeding lines with specific productive adaptability to tropical environments and the creation of an international testing programme.

RECOMMENDATIONS FOR DEVELOPMENT

Apart from the development aspects implied in the research proposed, the following development proposals were made:

- training of teams of vaccinators as has been done in Burkina Faso
- training of extension workers, including a whole package of skills such as vaccinating, husbandry etc.
- training of veterinarians in management
- privatisation of schemes where no outside funding is available
- development of housing, including a simple night shelter, and suitable equipment.

2.1 "SELECTION ET REPRODUCTION" (GT 1) ET "ELEVAGE, HYGIENE ET MALADIES" (GT 2)

PRESIDENT: Dr A. Provost, France
VICE-PRESIDENT: Prof. P. Horst, Allemagne
RAPPORTEUR: Dr J.G. Bell, Maroc
MEMBRES:

Prof. D.F. Adene, Nigéria
Dr G. Agbede, Benin
D. Cheihane, Comores
A.T. Chrisostome, Bénin
Dr D.A. Ehlihardt, Pays-Bas
Prof. M. El Houdfi, Maroc
Prof. F. Ellendorf, Allemagne
D. Hounkonnou, CTA
M. Kane, Mali
Dr E. Nkodia, Congo
Dr C.C. Nwosu, Nigéria
Dr Ch. Nwosuh, Nigéria
Dr Z. Ouandaogo, Burkina Faso
Mme K. Richards, Gambie
Dr. R. Schmoldt, Allemagne
Dr. C. Soares, Portugal
Mme A. Tserveni-Ghliossis, Grèce
A.L. Yannakopoulos, Grèce

Il y eut des exposés sur la situation au Burkina Faso, au Congo, au Cameroun, aux Comores, en Gambie, au Mali, en Mauritanie, au Maroc, au Nigéria et au Zaïre. Nous n'en livrerons pas les détails, étant donné que cela a déjà été fait par Dr. Sonayya, mais nous mentionnerons un certain nombre de points importants qui se répètent. Nous avons entendu dans les exposés que la pintade est présente et utilisée en grand nombre dans plusieurs pays et ce, dans des élevages à petite échelle. Les tentatives d’améliorer le bas niveau de potentiel génétique de la volaille grâce à l’introduction de coqs ont été décrites, mais elles ont généralement échoué en raison du manque de continuité. Plusieurs conférenciers ont souligné que la faible capacité de reproduction de la volaille locale et les pertes importantes d’origines diverses, représentent un problème crucial pour l’élevage. Tous les orateurs sans exception ont cité la maladie de Newcastle comme étant la maladie la plus répandue. Ils ont relaté des taux de mortalité pouvant atteindre 100 %. La maladie infectieuse de Bursal fut citée comme apparaissant dans un certain nombre de pays (Nigéria, Mauritanie, Comores), ainsi que certains vaccins d’antigènes au Nigéria. On présenta aussi certains remèdes traditionnels.

RECOMMANDATIONS POUR LA RECHERCHE

a) Sélection

- Expériences visant à améliorer les espèces locales en les croisant avec des espèces exotiques, en procédant à des croisements en retour et autres combinaisons, expériences qui seront suivies par des estimations sur le terrain.
- Recherche portant sur la sélection des lignées selon leur résistance aux maladies.
- Évaluation de l’effet des gènes marqueurs sur les caractéristiques de production et l’utilisation de méthodes de génétique moléculaire pour l’analyse des rapports entre les ressources génétiques des espèces locales de volaille (y compris la pintade).
- Un grand nombre d'orateurs ont insisté sur le fait qu'il est impératif de conserver les ressources génétiques locales en créant, par exemple, des banques de gènes, au moment de ces expériences, et ce, afin d'éviter que ne disparaissent des caractéristiques de valeur, telles les facultés de reproduction, la capacité d'adaptation et la résistance à certaines maladies spécifiques.

b) Reproduction

- Recherches sur les méthodes de couvaison et d'éclosion. Il y eut des discussions considérables visant à déterminer si les méthodes artificielles de couvaison étaient adaptées à la situation des villages. La possibilité d'avoir des poules pondeuses et des poules couveuses fut mentionnée comme étant une solution au conflit opposant les exigences de la couvaison à celles de la sélection.
- Estimation comparative de la productivité des poules, des pintades et des dindes, dans différentes régions et systèmes de production.

c) Elevage et hygiène

- Recherches concernant une conception d'abri adaptable pour ce qui est de la ventilation et de la désinfection et les répercussions sur la production.

d) Maladies

- Recherches épidémiologiques plus poussées sur la prévalence des maladies, en particulier dans les régions pour lesquelles on dispose de peu d'informations.
- Tests de nouveaux vaccins contre la maladie de Newcastle, en particulier du vaccin V4 résistant à la chaleur et pouvant être appliqué aux produits alimentaires, et de vaccins recombinants. Détermination des moyens les plus efficaces pour appliquer les vaccins; tests sur le terrain à la suite des estimations.
- Evaluation de la méthode de vaccination utilisée au Burkina Faso et dans d'autres régions.
- Test de vaccins combinés contre plusieurs maladies comme la maladie de Newcastle, la maladie de Gomboro et la typhoïde des poules.
- Mise au point d'ELISAS pour la maladie de Newcastle permettant de faire la distinction entre les anticorps produits contre un vaccin recombinant contre la maladie de Newcastle et le virus à l'état sauvage.
- Mise au point d'un ELISA adapté à la détection d'anticorps contre différentes souches du virus de la maladie infectieuse de Bursal en Afrique.
- Recherches portant sur les remèdes traditionnels (Voir également les paragraphes sur la coopération internationale et l'élevage).

e) Coopération internationale

- De nombreux orateurs ont proposé la création d'un réseau international pour la coordination de la recherche portant sur la maladie de Newcastle chez la volaille des villages en Afrique.
- On a suggéré de mettre au point autant que possible des protocoles uniformes d'expérience pour les essais de vaccination contre la maladie de Newcastle dans différents pays de manière à pouvoir comparer les résultats obtenus.
- Pour la recherche sur les colonies de volailles, on a suggéré d'adopter un questionnaire uniforme de manière que les analyses et les résultats venant de différents pays aient la même base.
- On a suggéré la création d'un réseau coordonné de recherches pour un contrôle sérologique utilisant ELISAs.
- Ouverture d'un centre de sélection avec une adaptabilité productive spécifique aux environnements tropicaux et la création d'un programme international de tests.
RECOMMANDATIONS POUR LE DEVELOPPEMENT

Outre les aspects de développement impliqués dans la recherche proposée, nous avons fait les propositions de développement suivantes:
- Formation d'équipes de vaccinateurs, comme cela a été fait au Burkina Faso.
- Formation élargie des travailleurs, incluant tout un ensemble de compétences techniques, comme la vaccination, l'élevage etc.
- Formation des vétérinaires pour le management.
- Privatisation des programmes pour lesquels on ne dispose d'aucun fonds extérieur.
- Mise au point d'un logis, y compris un simple abri pour la nuit et d'équipements adéquats.
2.2. "FEEDING AND FEED RESOURCES" (WG 3)

CHAIRMAN AND RAPPORTEUR: Dr. N.A. Musharaf, Sudan
VICE-CHAIRMAN: Dr. P.N. Mbugua, Kenya
SECRETARY: Dr. E.A. El Zubeir, Sudan

MEMBERS:
Dr. Odi Diambra, Benin
Mr. K. Kulube, Zimbabwe
Mrs. Lul S. Ahmed, Somalia
Dr. C. Olaboro, Uganda
Dr. A.J. Smith, United Kingdom
Dr. S. Williams, Ghana

Country reports from Sudan, Zimbabwe, Somalia, Kenya, Uganda and Ghana were presented. These reports highlighted the problems associated with village poultry nutrition and feeding.

The situation with regard to the feeding of poultry by smallholders in Africa was reviewed through reports presented by researchers from several African countries. It became clear that the low productivity of birds under these conditions is due to a number of causes including: inadequate feeding, prevalence of diseases and lack of sound management. The competition between people and poultry for cereal grains necessitates the continuation of efforts to search for alternative energy sources for poultry. The need for such foods is particularly apparent during droughts and in seasons when the rainfall is below normal. There is evidence from some African countries that millet, cassava and sweet potato can serve such a role.

Great interest was also shown by many African countries in using pulse seeds as sources of protein for poultry feed. These include pigeon peas and lupin. Other non-conventional protein sources that have been tried on a small scale include termites, earthworms and dried poultry manure.

Under rural conditions a valuable high-protein product can be obtained by drying ruminal contents and blood from slaughtered animals and mixing them together.

The working group emphasises that the use of some feeding resources in Africa is limited by the presence of certain toxins. The majority of these toxins are present in plant protein supplements and the important ones are gossypol, tannin and aflatoxin. Simple methods of detoxification are needed to overcome this problem and
there is an encouraging finding that soaking of high-tannin sorghum in wood ash extract or water overnight could reduce its tannin level by 80 and 40 %, respectively. As a result of the above discussions it became clear that there are a number of gaps in our knowledge of the nutrition of rural poultry. To fill these gaps the following remedies were proposed by the group:

1. A review of the existing literature has shown that little information is available on the management and productivity of village flocks in Africa. In order to make any recommendations on ways to improve the productivity of these flocks, it is important to have baseline data on the state of village poultry. Baseline data should not only cover nutrition but rather all aspects of smallholder poultry production. To achieve the above objectives a "survey of village poultry production" was recommended. The survey would assess: (i) production characteristics, (ii) flock size per household, (iii) what the birds eat, (iv) whether the farmers have taken any steps to increase production and (v) if so, what kinds of steps.

The researchers should be motivated to carry out this kind of survey by (i) providing them with transport, (ii) subscription to journals, (iii) and facilitating their attendance at international meetings. In return, the researchers will be expected to provide progress reports at specified time intervals.

2. There is a dearth of information available to poultry nutritionists in Africa. Although it is known that some of this information is available, it is not well distributed throughout the Continent. This lack of information is particularly noticeable in the case of reciprocal transfers between Francophone and Anglophone countries. To overcome this problem, the following is proposed:

"The collection and compilation of existing information on the nutrient composition of African foodstuffs and factors limiting their use. Additional studies should be made of the nutritive value of non-conventional foodstuffs. The non-conventional foodstuffs to be investigated should be identified by scientists in African countries. They should be given their scientific names and their importance and availability should be stated".

3. Unlike the situation in Europe and North America, domestic poultry are generally fed on high fibre diets in Africa. In feed allowance tables published in USA, UK and France, fibre is not usually mentioned. Consequently, there is a need to study the utilization of fibre by local and exotic birds in order to be able to advise local producers on the use of these feedstuffs. Therefore a study is proposed on the "Utilization of high fibre diets in indigenous and exotic breeds (types) of chickens".
PARTNERS

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FINANCE ORGANISATIONS

- EEC
- ODA
- French Government
- World Bank
- DANIDA
- FINIDA
- IFS

COORDINATION

1. Appointment of local coordinators in all participating countries. Employers should be approached to release these people for a set number of days each year to undertake their duties to the network.

2. A convenor should be appointed whose duty will be to convene a meeting of a steering committee of few persons once a year.

3. The duties of this committee will be to coordinate the work programme and to organize, through external assessors, assessment of the progress made on the various projects.

4. Coordinators will receive financial assistance for local travel, literature and for capital expenditure and consumables to enable them to undertake scientific investigations.

2.2 “ALIMENTATION ET RESSOURCES ALIMENTAIRES” (GT 3)

PRESEIDENT et RAPPORTEUR: Dr N.A. Musharaf, Soudan

VICE-PRESEIDENT: Dr P.N. Mbugua, Kenya

SECRETAIRE: Dr E.A. El Zubair, Soudan
MEMBRES:

Dr Odi Diambra, Bénin
Mr K. Kulube, Zimbabwe
Mme Lul S. Ahmed, Somalie
Dr G. Olaboro, Ouganda
Dr Smith, Royaume-Uni
Dr S. Williams, Ghana

Des exposés se rapportant au Soudan, au Zimbabwe, à la Somalie, au Kenya, à l’Ouganda et au Ghana ont mis en évidence les problèmes liés à la nutrition et à l’alimentation de la volaille en zone rurale.

Des exposés présentés par des chercheurs venus de différents pays africains ont permis de passer en revue la situation pour ce qui est de l’alimentation de la volaille par les petits éleveurs. Il ressort que le bas niveau de productivité des oiseaux (dans ces conditions) est dû à un certain nombre de facteurs, à savoir une alimentation inadéquate, la fréquence des maladies et l’absence de cohérence au niveau du management. En raison de la concurrence entre êtres humains et animaux pour les céréales, il est nécessaire de poursuivre les efforts de recherches afin de trouver d’autres sources d’énergie pour la volaille. Le besoin de tels aliments se fait particulièrement sentir en périodes de sécheresse et pendant les saisons où la pluviosité est inférieure à la normale. Il a été démontré dans quelques pays africains que le millet, le manioc et la patate douce peuvent jouer ce rôle.

De nombreux pays africains ont manifesté de l’intérêt pour l’utilisation de graines de légumineuses, entres autres des pois et des lupins, comme sources de protéines dans l’alimentation des volailles. D’autres sources de protéines ont été testées à petite échelle, parmi lesquelles les termites, les vers de terre et le fumier de volaille séché.

En milieu rural, on peut obtenir un produit de valeur riche en protéines à partir d’animaux abattus, en desséchant le contenu des panse de ruminants et le sang et en les mélangeant.

Le groupe de travail souligne que l’utilisation de certaines sources alimentaires est limitée en Afrique par la présence de certaines substances toxiques. On trouve la plus grande partie de ces substances dans les végétaux, sources complémentaires de protéines. Les plus importantes sont le gossypol, le tannin et l’afatoxine. De simples méthodes de détoxication sont nécessaires afin de surmonter ce problème et on obtient des résultats encourageants en trempant du sorgo riche en tannins dans de l’extrait de cendres de bois ou dans de l’eau pendant la nuit, ce qui permettrait de réduire de 80 % et 40 % respectivement la teneur en tannins.

Les discussions mentionnées ci-dessus ont clairement fait ressortir un certain nombre de lacunes dans nos connaissances concernant l’alimentation de la volaille rurale. Afin de combler ces vides, le groupe de travail a fait les propositions suivantes:

1. La passage en revue de la littérature existante a montré qu’il y a peu d’informations sur la gestion et la productivité des poulaillers des villages africains.

Pour pouvoir recommander des moyens d’améliorer la productivité de ces poulaillers, il est essentiel d’obtenir des données de base sur l’état de la volaille des villages. Ces données de base ne doivent pas se limiter à la nutrition mais couvrir aussi tous les aspects de la production des petits élevages de volailles.

Pour atteindre ces objectifs, une “Etude de la production de volailles en zone rurale” a été recommandée afin d’établir: (i) les caractéristiques de la production, (ii) la taille des poulailliers par foyer, (iii) ce que les oiseaux mangent, (iv) si le fermier procède à des interventions en vue d’augmenter la production et (v) le cas échéant, les types d’intervention.”
Il faudrait encourager les chercheurs à réaliser cette étude (i) en offrant des subventions pour les transports, (ii) par des abonnements aux journaux, (iii) et en facilitant leur participation à des rencontres internationales. En retour, les chercheurs seraient tenus de fournir des rapports périodiques à des intervalles de temps spécifiques.

2. Les nutritionnistes de la volaille en Afrique manquent cruellement d'informations. On sait que certaines de ces informations existent mais ne sont pas disponibles sur le continent. Ce manque d'information est particulièrement évident dans les cas de transferts réciproques entre les pays francophones et les pays anglophones. Afin de régler ce problème, il est proposé de:


3. En Afrique, l'alimentation des volailles domestiques est généralement riche en fibres, ce qui n'est pas le cas en Europe et en Amérique du Nord. La fibre n'est généralement pas mentionnée dans les tables de rations alimentaires publiées aux Etats-Unis, dans le Royaume-Uni et en France. Par conséquent, il est nécessaire d'étudier l'utilisation de la fibre chez les oiseaux locaux et exotiques afin d'être en mesure de conseiller les producteurs locaux sur l'usage de ces produits alimentaires. Nous proposons l'expérience suivante afin de réaliser cet objectif.

"Une étude de l'utilisation de régimes riches en fibres sur les races de poulets locales et exotiques."

Partenaires

Afrique
Kenya
Soudan
Zimbabwe
Nigéria
Sénégal
Côte d'Ivoire
Ouganda
Ghana
Bénin
Madagascar

Europe
France
Grande-Bretagne
Allemagne
Pays-Bas
Grèce

Organisations financières:

CEE
ODA
Le Gouvernement français
Banque Mondiale
DANIDA
FINIDA
F.S.I.
Coordination:

1. Nomination de coordinateurs locaux dans tous les pays participants. Il faudrait prendre contact avec les employeurs de manière que ces coordinateurs soient dégagés de leurs obligations pendant un nombre fixe de jours tous les ans et qu’ils puissent accomplir leur tâche auprès du réseau.

2. Il faudrait nommer un "responsable d'assemblée" dont la tâche consisterait à convoquer une fois par an la réunion d'un comité de direction composé de quelques personnes.

3. Le travail de ce comité consisterait à coordonner le programme de travail et à organiser, grâce à des contrôleurs externes, l'évaluation des progrès faits par les différents projets.

4. Les coordinateurs recevront une aide financière pour leurs déplacements locaux, la littérature, le capital et les produits consommables, et pour leur permettre de mener des recherches scientifiques.
2.3 "ECONOMIC, FINANCIAL AND MARKETING DETERMINANTS OF POULTRY DEVELOPMENT - REQUIREMENTS TO SUPPORT PRIVATE INITIATIVES" (WG 4)

CHAIRMAN AND RAPPORTEUR: Dr. E.B. Sonaiya, Nigeria

VICE-CHAIRMAN: Dr. J.D. Ngoupayou, Cameroon

MEMBERS:

Dr. T. Viegas, European Commission DG XII
Th. Chinloy, World Bank
B.G. Upindi, Malawi
U. Amogu, Nigeria

Country reports from Malawi and Cameroon were presented. These highlighted government support and limited private enterprise.

Background

Previous poultry schemes based on large-scale projects dependent on external resources have been largely unsuccessful. The main reason for this high rate of failure is that the projects could not be sustained once external support ceased. A large proportion of the poultry production is conducted in the smallholder system (70/80 %) and this sector should be developed in such a way as to improve labour productivity and animal productivity, family income and food security. Smallholder poultry development can help to meet the rising demand from the urban areas, especially if the farms are situated in peri-urban areas. Smallholder farms in the rural areas can provide rural employment and thus reduce the rural-urban migration. The greatest increase in population in developing countries occurs in the rural areas whereas food imports do not serve the needs of the rural areas. The smallholder poultry producer would directly serve the rural areas and the surplus can be channelled to the cities to offset imports of frozen chickens.

A STRATEGY FOR DEVELOPMENT

Requirement for increased labour and animal productivity

We need to increase both labour- and animal productivity. But increases in labour productivity need increases in animal productivity. If we do not increase labour productivity then rural labour will move to the urban areas. Therefore there is a need for research and development information to increase animal productivity.
High priority for disease control and prevention

Because of the prevalence of epidemic and parasitic diseases, the marketable surplus is either low or non-existent. Disease control and prevention then assumes a high priority, as reduction in the prevalence of disease will markedly improve poultry productivity, not only through a reduction in mortality but also through improved growth and reproduction. Disease control, particularly of Newcastle disease, is usually limited by the perishable nature and mode of application of prophylactic and therapeutic inputs.

Improved supply and distribution of production inputs

Transport costs and general trading costs limit the supply of inputs for smallholder poultry producers in the rural areas. Peri-urban producers are less affected by these limitations. Delivery and use of vaccines, drugs, feed and day-old chicks can only be improved if they are associated with an added-value provided by more efficient marketing systems which will transfer a higher percentage of the sale price to the producer. Therefore emphasis needs to be placed on research and development activities which will provide information that will increase the efficiency of supply systems.

The need for efficient product marketing channels

The small size of operation and the large number of smallholder producers result in gross inefficiencies in the marketing system. This is due to the lack of proper organization in the marketing channels which means that individual producers bear the whole cost of their marketing. Producers' associations for the supply of inputs and product marketing should be encouraged. Such systems will protect the interests of individual producers and attract technical assistance and cooperation which would be impossible for an individual smallholder.

Potential for other poultry species

Apart from chickens, other poultry species have potential for development. These species include ducks, geese and guinea-fowl. It should be stressed that the comparative advantages of these species lie in their higher disease tolerance or resistance and the relative lack of dependence on grain-based feeds.

Research and development activities should be designed to integrate all species in poultry development.

Tackling socio-economic problems

Socio-economic problems such as rural and peri-urban unemployment, insufficient food supply to urban centres, instability of the rural labour force (rural-urban migration, especially of the youth) can be greatly reduced by smallholder poultry production.
Research effort needs to be mounted to ascertain the potential contribution of smallholder poultry production to family incomes and thus to the solution of these problems.

TOWARDS A STRATEGY FOR THE DEVELOPMENT OF SMALLHOLDER POULTRY PRODUCTION IN AFRICA

Objectives

To increase rural and peri-urban productivity and family incomes through increased poultry production.

To ensure a high level of food security and also to raise nutritional levels of rural and peri-urban families.

Strategy

Achievement of these objectives requires a concerted effort incorporating research, development and training. A coherent strategy should emphasize, but not be limited to, the following:

Identification of interdisciplinary research requirements and programmes both at the strategic and adaptive levels.

Identification of development efforts for the two target groups - rural and peri-urban.

Delivery of technological assistance to producers’ associations with regard to input supply and product marketing.

The continuous training and retraining of technical staff involved in smallholder poultry production at all levels.

Operationality

The first step in the implementation of the strategy must be to set up an executive committee.

Completion of draft of strategy.

Initiation of regional sub-divisions of the African Network of Rural Poultry Development.

Request of support from donors for:

- Establishment of regional networks
- Dissemination of existing technology
- Stimulation of direct research cooperation links
- Stimulation of cooperation between producer associations, North and South

Strengthening of North-South research links with emphasis on interdisciplinary and on-farm adaptive research on socio-economic, health and productivity and genetic resource development.
2.3 "FACTEURS DETERMINANTS DE L’ÉCONOMIE, DES FINANCES ET DU MARKETING DANS LE DéVELOPPEMENT DE LA VOLAILLE – NECESITÉ DE SOUTENIR LES INITIATIVES PRIVÉES" (GT 4)

PRESIDENT ET RAPPORTEUR: Dr. E.B. Sonaiya, Nigéria

VICE-PRESIDENT: Dr J.D. Ngoupayou, Cameroun

MEMBRES:

Dr T. Viegas, Commission Européenne DG XII
Th. Chirloy, Banque Mondiale
B.G. Upindi, Malawi
U. Amogu, Nigéria

Des exposés se rapportant au Malawi et au Cameroun ont mis en évidence l’aide gouvernementale et le manque d’initiatives privées.

Arrière-plan:

Les programmes antérieurs concernant l’agriculture, basés sur des projets à grande échelle et subordonnés à des ressources externes, n’ont pas été fructueux. En raison de ces limites, les projets n’ont pu être maintenus après la disparition de l’aide externe.

Une grande partie de la production de volailles est réalisée selon le système des petits éleveurs (70/80 %), système qu’il faut développer de manière que les petits éleveurs puissent améliorer à la fois la productivité de la main-d’œuvre, celle des animaux, les revenus familiaux et la sécurité alimentaire.

Le développement des petits élevages de volailles pourrait aider à répondre à la demande croissante des régions urbaines, en particulier si ces élevages se trouvent à la périphérie des villes.

Les petits élevages de volailles situés en zones rurales peuvent fournir des emplois ruraux et réduire ainsi la migration des campagnes vers les villes. Dans les pays en voie de développement, ce sont les régions rurales qui connaissent la plus forte croissance de population, mais les importations ne sont pas destinées à couvrir les besoins alimentaires des régions rurales. Le petit éleveur de volailles fournira les régions rurales et le surplus pourra être canalisé de manière à compenser les importations de poulets surgelés destinés aux régions urbaines.

CONDITIONS REQUISES POUR LA MISE AU POINT D’UNE STRATEGIE

Besoin d’augmentation de la productivité de la main-d’œuvre et des animaux

Il faut augmenter à la fois la productivité de la main-d’œuvre et celle des animaux. Mais toute augmentation de la productivité de la main-d’œuvre suppose une augmentation de la productivité animale. Si nous n’augmentons pas la productivité de la main-d’œuvre, la main-d’œuvre rurale émigrera vers les régions urbaines.
C'est pourquoi des informations sur la recherche et le développement sont nécessaires afin d'augmenter la production animale.

**Forte priorité au contrôle et à la prévention sanitaire**

Eu égard à la grande fréquence des maladies épidémiques et parasitaires, le surplus susceptible d'être vendu est soit très bas, soit inexistant. Le contrôle et la prévention sanitaires sont donc hautement prioritaires, car la réduction de la prévalence des maladies améliorera considérablement la productivité de la volaille, non seulement en raison de la baisse de la mortalité mais aussi en raison de l'amélioration de la croissance et de la reproduction.

L'utilisation de moyens de protection sanitaire, en particulier contre la maladie de Newcastle, est généralement limitée par la nature périssable et le mode d'application de ces moyens. Ces contraintes s'appliquent surtout aux régions rurales.

**Amélioration de l'approvisionnement et de la distribution d'intrants de production**

Les petits éleveurs des régions rurales sont obligés de restreindre les commandes d'intrants en raison des frais de transport et des frais généraux de vente. Les éleveurs des régions périurbaines sont moins concernés par ces restrictions. La livraison et l'utilisation de vaccins, de médicaments, d'aliments et de poussins d'un jour ne pourront être améliorées qu'à la faveur d'une augmentation de la valeur due à des systèmes de marché plus efficaces qui permettront au producteur de percevoir un plus grand pourcentage du prix de vente. C'est la raison pour laquelle il faut mettre l'accent sur les activités de recherches et de développement qui fourniront les informations qui permettront d'accroître l'efficacité des systèmes d'approvisionnement.

**Le besoin de réseaux commerciaux efficaces**

La petite taille d'opération et le grand nombre de petits éleveurs provoquent de graves insuffisances dans le réseau commercial. Cela est dû au manque d'organisation appropriée dans les réseaux commerciaux, manque qui conduit certains producteurs individuels à supporter l'ensemble des frais de commercialisation.

Il faudrait encourager la formation d'associations de producteurs pour l'approvisionnement en intrants et la vente des produits. Ce genre de systèmes protégerait les intérêts des producteurs individuels et attirerait l'aide et la coopération techniques qu'un petit éleveur isolé ne pourrait s'offrir.

**Possibilités de développement pour d'autres espèces de volailles**

Outre les poulets, d'autres espèces de volailles pourraient être développées, à savoir les canards, les oies et les pintades. Il faudrait insister sur le fait que les avantages comparatifs de ces espèces sont leur plus grande tolérance ou résistance à la maladie et leur indépendance relative vis-à-vis des produits alimentaires à base de grains.

Il faudrait mettre au point des activités de recherches et de développement intégrant toutes les espèces dans le développement de l'aviculture.

**Réduction des problèmes socio-économiques**

Trois problèmes socio-économiques pourraient être atténués grâce à la petite aviculture: le chômage rural et périurbain; l'insuffisance de l'approvisionnement des centres urbains en produits alimentaires; l'instabilité de la main-d'œuvre rurale (migration des campagnes vers les villes, en particulier des jeunes).
Il faut accentuer les efforts de recherches afin d’évaluer le rôle que peut jouer le petit élevage de volailles dans les revenus des familles et, par conséquent, dans le règlement de ces problèmes.

VERS UNE STRAGÉGIE DE DÉVELOPPEMENT DU PETIT ELEVAGE DE VOLAILLES EN AFRIQUE

Objectifs

- Accroître la productivité et les revenus des familles dans les régions rurales et périurbaines en augmentant la production de volailles.
- Assurer un haut niveau de garantie de l’alimentation et améliorer la nutrition des familles rurales et périurbaines.

Marche à suivre

La réalisation de ces objectifs nécessite un effort concerté intégrant la recherche, le développement et la formation. Une stratégie cohérente doit mettre l’accent sur les points suivants sans s’y limiter:

- Identification des besoins et des programmes de recherches interdisciplinaires, aussi bien au niveau stratégique qu’au niveau d’adaptation.
- Identification des efforts de développement pour les deux groupes cibles, la population rurale et la population périurbaine.
- Aide technologique aux associations de producteurs en ce qui concerne l’approvisionnement en intrants et la vente des produits.
- Formation et recyclage permanents du personnel technique engagé à tous les niveaux dans le petit élevage de volailles.

Mise en œuvre

- La première étape de mise en œuvre de la stratégie consistera à former un comité exécutif.
- Parachevement de la stratégie ébauchée.
- Demande d’aide à des donateurs pour:

  l’établissement de réseaux régionaux,
  la propagation de la technologie existante,
  l’encouragement de liens directs de coopération pour la recherche,
  la promotion de la coopération entre les associations de producteurs du Nord et du Sud.

- Le renforcement des liens de recherches Nord-Sud, en mettant l’accent sur la recherche interdisciplinaire et adaptable sur le terrain et portant sur le développement socio-économique, sanitaire et de la productivité ainsi que des ressources génétiques.
2.4 "EXTENSION SERVICES" (WG 5)

CHAIRMAN: Dr. W. Bessei, Germany
VICE-CHAIRMAN: Ir. H. Broekhuizen, Netherlands
RAPPORTEUR: Dr. K. Manwana, Zaire

MEMBERS:
K. Aklobessi, Togo
Prof. H. R. Branckaert, FAO
Prof. L. Cavalchini, Italy
Mrs. Lul Said Ahmed, Somalia
Mrs. Dr. A. Klavdianou-Papadaki, AFR, Greece
Mrs. E. Yerbanga, Burkina Faso
Dr. Ir. F. Demey, Belgium

Introduction and current situation

Several national reports were presented and discussed. It became
apparent that while the structures differ from one country to
another, the objective is the same. Thus the projects in Somalia
and Togo try to work within the structure of the national exten-
sion service. The situation is similar in Burkina Faso, but in
this country the projects enjoy greater autonomy, while in Zaire
the initiative is completely in the hands of the villagers who
are the beneficiaries.
For most of the other countries there are unfortunately not yet
any appropriate structures for the development of village poultry
production, or for rearing of small animals in general.

Constraints

1. There is a lack of awareness on the part of the political
 authors, which explains the absence of development strate-
gies for poultry production. The losses resulting from this
negligence are quite substantial.

2. Constraints in training, information and extension services:

- Altogether there are only a few specialised training centres
in Africa.

- The training provided in these centres appears to be ori-
  ented towards industrial poultry production, while village
  poultry production remains the largest sector in national
  production.
- The extension officers generally only have very limited knowledge in the field of poultry production, and this knowledge is usually theoretical.

- Logistic means for the transmission of the information are weak.

- In most cases the infrastructure is still in an embryonic stage, if it exists at all.

3. A number of prejudices persist with regard to the importance of this type of production, even among the staff who have been trained for this purpose.

4. The main target group is women and children, which must be taken into account when developing the guidance approach and methodology of implementation.

Proposals and recommendations

1. It appears that training in poultry keeping and even in the field of keeping small animals altogether should be provided at three levels:

   - At the higher level
     A few high-level technicians familiar with their national problems will be given intensive specialist training abroad. They will be concerned particularly with planning and organising poultry production in their own countries. In the course of their specialist training they will be requested to present a paper on a specific subject of the development of their national poultry production. This work may be carried out within the context of a joint project between African and foreign institutions.

   - At the intermediate level
     A greater number of senior technicians will be more particularly commissioned to train the trainers. These persons will have completed secondary school plus two years of higher education. They will attend a six-month theoretical and practical training course in an institution established for this purpose.

   - At the basic staff level
     This level will be chiefly composed of extension officers already in service, who will be given supplementary training in poultry production and possibly in keeping small animals in general. This training will be provided by the preceding level in workshops or refresher seminars within the framework of a continuous upgrading programme.

2. It is necessary for training to be continuous. This presupposes periodic organisation of refresher courses for officers who have already received training.
3. Bearing in mind the fact that no appropriate institution exists at the present time, special attention must be paid to
the training of the senior technicians. For this purpose the following solutions are proposed:

- The establishment of a specialist training, information and
documentation centre.

- The organisation of seminars or training sessions in various
countries with the necessary infrastructure for such essen-
tially practical training.

- The setting up of a logistics centre and a mobile team
capable of providing training and disseminating information
at a regional or national level.

- In addition to providing training, information and documen-
tation activities, the type of institution suggested will
also conduct multiple-location research and development
tests.

- It is recommended that this type of institution should not
be limited to poultry production but should also gradually
include all other activities involved in the keeping of
small animals.

- The methodology used should take into account all persons
involved in the development of keeping of small animals,
e.g. women, children, craftsmen etc.

- It is recommended that a meeting be organised as soon as
possible to discuss and specify the details of establishing
this kind of institution. This consultation could be
organised jointly by FAO and CTA.

2.4 "FORMATION ET VULGARISATION" (GT 5)

CHAIRMAN: Dr W. Bessels, Allemagne

VICE-CHAIRMAN: Ir H. Broekhuizen, Pays-Bas

RAPPORTEUR: Dr K. Manwana, Zaire
MEMBRES:

K. Aklobessi, Togo
Prof. H. R. Branckaert, FAO
Prof. L. Cavalchini, Italie
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Mme Dr. A. Klavdianou-Papadaki, AFR, Grèce
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Dr Ir F. Demey, Belgique

Introduction et situation actuelle

Plusieurs rapports nationaux ont été présentés et commentés. Il apparaît que les structures diffèrent d'un pays à l'autre tout en suivant un objectif commun. Ainsi, les Projets en Somalie et au Togo essaient de s'insérer dans les structures nationales de vulgarisation; la démarche est comparable au Burkina Faso, mais ce dernier bénéficie d'une plus grande autonomie tandis qu'au Zaïre, l'initiative est entièrement entre les mains des bénéficiaires que sont les villageois.

Pour la plupart des autres pays, il n'existe malheureusement pas encore à l'heure actuelle de structures appropriées pour le développement de l'aviculure villageoise ou celui du petit élevage en général.

Les problèmes

1. Il y a un manque de prise de conscience des autorités politiques, d'où l'absence de stratégies pour le développement de l'aviculure alors que les pertes occasionnées par cette indifférence sont très importantes.

2. Problèmes de formation, d'information et de vulgarisation:

   - Dans l'ensemble, il n'existe que peu de centres de formation spécialisée opérationnels en Afrique.
   - La formation qui y est dispensée paraît être orientée vers l'aviculure industrielle alors que l'aviculure villageoise reste prépondérante dans les productions nationales.
   - En général, les agents de vulgarisation n'ont que des notions très limitées, et le plus souvent théoriques dans le domaine de l'aviculure. Les moyens logistiques alloués pour la transmission de l'information sont insuffisants.
   - Dans la plupart des cas, les infrastructures, lorsqu'elles existent, restent à l'état embryonnaire,

3. De nombreux préjugés subsistent quant à l'intérêt à accorder à ce type de production, même chez les cadres qui ont été formés à ces fins.

4. Le groupe cible concerné est représenté essentiellement par les femmes et les enfants, de sorte que l'enseignement demeure difficile et nécessite une méthodologie appropriée.

Propositions et recommandations

1. La formation en aviculture et même dans le domaine du petit élevage en général devrait être dispensée à trois niveaux.
- Au niveau supérieur
  Quelques techniciens de haut niveau maîtrisant les problèmes nationaux acquerront une spécialisation poussée à l'étranger.
  Ils seront plus particulièrement chargés de la planification et de l'organisation de l'aviculture dans leur pays.
  Au cours de leur spécialisation, ils devront présenter un travail sur un sujet spécifique du développement de l'aviculture nationale.
  Ce travail pourrait être effectué au sein d'un projet de jumelage entre institutions africaines et étrangères.

- Au niveau intermédiaire
  Un effectif suffisant de techniciens supérieurs sera plus particulièrement chargé de la formation des formateurs. Ces agents auront accompli leurs études secondaires et deux années d'enseignement supérieur. Ils suivront une formation théorique et pratique de six mois dans une institution mise en place à cet effet.

- Au niveau de l'encadrement de base
  Il s'agira le plus souvent des agents de vulgarisation déjà en place à qui il sera dispensé une formation complémentaire en aviculture et éventuellement dans le petit élevage en général.
  Cette formation leur sera fournie par les techniciens du niveau précédent au cours d'ateliers de travail ou de séminaires de recyclage dans le cadre d'un programme de formation continue.

2. Il est nécessaire que la formation soit continue. Ceci suppose l'organisation périodique de cours de recyclage du personnel en place déjà formé.

3. Étant donné qu'il n'existe pas, à l'heure actuelle, d'institutions fonctionnelles appropriées, la formation des techniciens supérieurs requiert une attention toute particulière.
   Il est proposé à cet effet les solutions suivantes:
   - La création d'un centre spécialisé de formation, d'information et de documentation.
   - L'organisation de séminaires ou sessions de formation dans différents pays possédant l'infrastructure nécessaire à cet enseignement essentiellement pratique.
   - L'installation d'un centre logistique et d'une équipe mobile pouvant dispenser la formation et diffuser l'information au niveau régional ou national.
   - En plus de ces activités de formation, d'information et de documentation et pour appuyer celles-ci de manière efficace, le type d'institution retenu organiserait également des essais multilocaux de recherche-développement.
   - Il est vivement recommandé que ce type d'institution ne se limite pas à l'aviculture mais prenne graduellement en charge toutes les autres activités de petit élevage.
   - La méthodologie utilisée devra prendre en compte tous les acteurs du développement des petits élevages, à savoir les femmes, les enfants, les artisans etc.
   - Il est recommandé d'organiser dans les meilleurs délais une réunion de consultation pour préciser les modalités d'installation de ce type d'institution. Cette consultation pourrait être organisée conjointement par la FAO et le CTA.
3. Technical Papers

3.1 The Context and Prospects for Development of Smallholder Rural Poultry Production in Africa

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Abstract

Smallholder rural poultry production is an appropriate system that makes the best use of locally available resources. Rural poultry are important providers of eggs and meat as well as being valued in religious and cultural life. There are about 1.5 billion poultry of all species in the small-scale rural farms, making up more than 70% of the total poultry population in Africa. The three production systems for rural poultry — free range, backyard and small-scale — have flock sizes of 5 - 10, 5 - 15, 20 - 100 and a productivity of 10 - 40, 30 - 60, 80 - 150 eggs/hen/year, respectively. Body weight of 1.2 kg and 800 g are obtained at 32 weeks for normal size and dwarf breeds of local chickens in the traditional system. Newcastle is the most important disease. Other important diseases are Gomboro, coccidiosis, fowl pox, fowl typhoid, fowl cholera and pediculosis. A coordinated programme involving breeding, feed, health management, entrepreneur development and information management is suggested for the development of smallholder rural poultry production in Africa. The African Network on Rural Poultry Development can coordinate the programme.

Résumé

La petite production rurale de volaille est un système approprié qui exploite au mieux les ressources disponibles sur le plan local. Les volailles rurales sont d'importants fournisseurs d'oeufs et de viande et sont également précieuses dans la vie religieuse et culturelle. Si l'on tient compte de toutes les espèces, il y a environ 1,5 millions de volailles dans les petites fermes rurales, ce qui représente plus de 70% du total des colonies de volailles africaines. La taille des colonies des trois systèmes de production, à savoir élevage en liberté, élevage en basse-cour et élevage à petite échelle, varie respectivement de 5 à 10, de 5 à 15 et de 20 à 1000 poules et leur productivité de 10 à 40, de 30 à 60 et de 80 à 150 œufs/an. Au bout de 32 semaines, on obtient, dans le système traditionnel, des poids respectifs de 1,2 kg et 800 g pour les espèces indigènes de poulets de taille normale et de taille naine. La maladie la plus importante est celle de Newcastle. D'autres maladies importantes sont le Gomboro, la coccidiose, la variole, la typhoïde et le choléra de la volaille, ainsi que la pédiculose. On suggère l'élaboration d'un programme coordonné impliquant l'élevage, l'alimentation, le management sanitaire, le développement de l'esprit d'entreprise et le management de l'information afin de développer la petite production rurale de volaille en Afrique. Le Réseau Africain pour le Développement de l'Aviculture en Milieu Rural pourrait se charger de la coordination du programme.
INTRODUCTION

Many African countries are situated in ecologically difficult areas. Some have scarce or intermittent rainfall, which, coupled with very high ambient temperatures make crop production precarious. Others experience abundant rainfall but because of poor soil drainage, overcultivation or overgrazing, suffer soil erosion. In either case, the capacity for crop production for food, feed and fibre supply is compromised.

With this in mind, it is often stressed that ruminants are the main options for livestock development in Africa because we produce far more grass and fibrous by-products than grains and protein legumes. In addition, it is further pointed out, poultry and pigs compete with man for the insufficient food grains produced and that these non-ruminants need to be intensively raised in order to maximise returns and productivity. It is therefore relevant to ask at the outset whether we should be trying to develop small-scale rural poultry production in Africa.

As graphically illustrated by Preston and Leng (1989), the increasing trend toward global warming due to the greenhouse effect of gases like methane and carbon dioxide dictate a shift towards the promotion of non-ruminant animals like poultry and pigs. Poultry production does not contribute appreciable amounts of greenhouse gases to the environment and is thus "umweltfreundlich". This environmental advantage is realised most with small-scale rural poultry production systems where there is no build-up of manure.

In virtually every African country, a variety of economic, sociological and political factors preclude investment in the housing, machinery, feed and other inputs required for the high input-high output poultry production systems of industrialised countries. At present, African countries do not have the resources to sustain the levels of production recommended for exotic hybrids nor can they afford to import them. Rather, they have indigenous breeds and strains which are generally much better adapted to environmental stresses such as heat, humidity and high fibre diets.

Yet in attempting to meet the demands of their growing urban populations, even some of the least developed countries have imported technological packages consisting of high yielding stock and compound rations to feed them, and vaccines and drugs for disease control. The many mistakes which have been made through this approach have shown that, except in very special circumstances, it is not what is required. Certainly, for small-scale farmers who form the food production base, it is largely irrelevant. For these farmers, and indeed for the countries as a whole, the greatest need is to improve their own production systems making the best possible use of locally available resources.

THE PRESENT STRUCTURE OF PRODUCTION

In Africa, rural poultry is truly the invisible animal as it is hardly counted in wealth ranking as cattle, sheep and goats are. Yet, they are important as providers of egg and meat and find various uses in religious and cultural life. The birds are very
small in body weight (about 1-1.5 kg) and so have very much lower feed requirements than all other domesticated livestock. They have the shortest generation interval as each hen produces at least 30 eggs and 15 chicks every year (Manwana, 1990). They are therefore ideal animals for small-scale farmers and are ubiquitous throughout Africa, forming the largest population of vertebrate animals (domesticated or wild) found on the continent.

Population:

FAO (1986) estimated the population of chickens in Africa to be 772 million. Of the 21 countries to be reported upon at this seminar, rural chickens make up more than 70% of total chicken population in 18 of them. In Côte d’Ivoire, rural flocks account for 53% of total population (Diambra, 1990), while in Zimbabwe the rural proportion is only 30% (Kulube, 1990). Using a weighted average for all countries, Africa probably has up to 700 million chickens in small-scale rural farms. As earlier reported (Sonaiya, 1990 a) rural poultry farms are usually mixed in flock composition with chickens in the majority at about 90% of the flocks without guinea fowls. Where there are guinea fowls or ducks in the flock, chicken proportions are usually about 50 and 70% respectively. Reflecting all poultry species in the flock, Africa has about 1.5 billion birds in the millions of small-scale rural farms.

Social and economic importance:

Rural poultry represents a significant part of the rural economy in particular and of the national economy as a whole. In Burkina Faso, for example, Ouandaogo (1990) reports that the 25 million rural poultry produce 15,000 tonnes of meat out of which 5,000 tonnes are exported, adding about US $ 19.5 million to annual export earnings. Similarly, Diambra (1990) reports that Côte d’Ivoire imports every week, 37,000 local chickens from Burkina Faso at a cost price in Abidjan of US $ 3.90/kg and 3,200 tonnes of eggs at cost of 540 CFA/doz. These result in the addition of US $ 27.1 million to the annual import bill. Rural poultry in Africa as a whole represents an asset value of US $ 5.75 billion. Besides the provision of employment and easily disposable income for small-scale farmers, particularly in the off-season from cropping, rural poultry integrates very well into other farming activities as it requires very little time and investment. There are reports (Mali, Togo, Ghana) of portable rural poultry systems in which the farmer carries (or grazes) the fowls along the way to the farm site (Kane, 1990; Aklobessi, 1990), tethers them while he farms and brings portions of anthills to the tethered fowls (Williams, 1990).

All reporters at this seminar mentioned that rural poultry plays a significant role in the cultural life of rural people in the following ways: as gifts to visitors and relatives; as starting capital to youths and newly married maidens, as sacrificial offerings in traditional worship. In recent years, rural poultry has come to assume a much greater role as a supplier of meat and animal protein for both rural and urban dwellers. This is because of droughts and diseases (rinderpest and trypanosomiasis) which have greatly reduced productivity and growth of large and small ruminant animals. Since pork is counter-indicated in many religions and cultures, poultry can be seen to be the most suited as a source of meat.
Production systems:

There are three distinguishable systems for rural poultry production in Africa. They are the free-range, backyard and small-scale systems. The free-range system is termed "traditional" or "village" system by most reporters. The backyard system is an extensive system in which poultry are part-confined within a fenced yard or merely within an overnight shelter. It is called "family" or "subsistence" in some reports. In the small-scale intensive system small numbers (usually more than 50 but less than 500 birds) are produced along commercial lines. There are reports of some farmers keeping 500-1,000 birds, and they have been described as medium-scale farmers (Akolobessi, 1990; Ngoupayou, 1990; Olaboro, 1990).

There is no doubt that the availability of resource inputs - housing, cages, feed, drugs as well as time - dictates the choice of production system. Tzikara (1990) points out that in Uganda the flock size is 5-10 in the traditional system, 50-100 in the backyard, 50-200 in rural development projects with fund sources external to the village, and 200-500 in small-scale projects favoured in development action targeted towards women which are usually funded by international agencies.

Breed:

The systems, in addition to flock size, dictate the breeds, management process and productivity of the farm. The free range system uses almost exclusively local breeds as it has been found, from the fate of exotic cocks in the numerous cock exchange programmes, that exotic birds do not survive under this system. Distinct local breeds have been reported from Egypt - Fayoumi, Dandarawi and Dokky - (Mathur et al., 1989), Morocco - Beldi or Roumi - (El Houadfi, 1990), Sudan - Baladi and Betwil - (Mussharaf, 1990; El Zubeir, 1990; Osman, 1988), Cameroon - Dzaye, Tsabatha, Dongwe, Zarwa - (Ngoupayou, 1990) and Mali - Kokochie - (Kane, 1990; Kassambra, 1990). Whether these names represent true breeds or mere phenotypic descriptions needs to be determined as the farmers in one small locality in Nigeria (Kano) mentioned ten different types of local chickens (Oria and Sonaiya, 1990). There were some reports of local birds having the ability to use high fibre feeds (Diambra, 1990; El Houadfi, 1990).

The backyard system uses both local and improved breeds. It is a common practice for families to purchase hybrid cockerels or broilers and leave them in the family yard until needed. The small and medium scale systems invariably use improved hybrid strains of chickens. With other poultry species such as guinea fowl, pigeons, geese and to some extent ducks and turkeys, all systems of production utilise "local" birds.

The identification of birds as local is purely for convenience as there has been at least one attempt at cross breeding in each African country. This being so, the existing birds are crosses, to various degrees, of the local birds with the exotic breeds of choice for these programmes, that is: Rhode Island Red, Leghorn and Wyandotte for chicken; Aylesbury, Rouen, Indian Runner, Khaki Campbell and Pekin for ducks; and White Roman and Chinese for geese (Sonaiya, 1990b).
Productivity:

Except in the absolute free-range system, all birds receive some supplementation based on available grains, by-products, food scraps and compounded feed which is fed ad libitum in the small-scale system.

Productivity observed increases in direct proportion to the level of confinement. Under the free-range and backyard systems, egg production by chickens is 30-100 per year. Under these systems, ducks produce 30-40 eggs, turkeys 60-80 eggs, and guinea fowl 100-120 eggs per year. In Mali, hatchability is reported to be uniformly high in guinea fowl (80-84 %) but is much lower in chickens (60-70 %). In Nigeria, it was reported (Ayorinde, 1990) that because of the extreme nervousness of guinea fowl, chickens are used for hatching guinea fowl eggs and brooding keets.

Body weight of about 1.2 kg (normal size) and 800 g (dwarf) is achieved by chickens in about 32 weeks. Productivity in the small-scale commercial system is similar to that of large-scale commercial poultry provided there is no disease outbreak.

Disease and predators:

Newcastle is the most important disease recognised in all countries. Mortality due to Newcastle disease is however variable. Reports cited mortality of 50 % of the flock in Togo and Sudan, 70 % in Nigeria, 80 % in Comoros, 90 % in Zaire and 100 % in Morocco. Season also has an effect as severity is higher in the dry season.

While the importance of Newcastle is recognised, conventional vaccination techniques are expensive to use and do not provide adequate cover and protection for rural birds which have been identified as reservoir source of infection for the commercial flocks (Bell & Mouldou, 1988). Efforts such as those of Nwosu (1990) at the Nigerian Veterinary Research Institute should be intensified to understand the aetiology of this devastating disease. A pilot study on the use of orally fed ND vaccines has been carried out in the Gambia (Andrews, 1990) and is being considered in Nigeria (Okunaiya et al., 1990). Other diseases mentioned include Gomboro, Coccidiosis, fowl pox, fowl typhoid, fowl cholera, external and internal parasites. Pediculosis is a very pervasive plague of rural poultry in Africa.

PROSPECTS FOR DEVELOPMENT

It is commonly assumed that small-scale farmers know best what is good for them and that changes from outside do more harm than good. However, it must also be said that there are inevitable gaps in farmers' indigenous knowledge resulting from isolation and lack of scientific research and expertise. In addition, where technology transfers have floundered, this has invariably been because there was no clear understanding of the target production systems, the constraints of these systems and the ways of overcoming them. The real challenge for us who care about improving poultry production and the welfare of the rural poor in Africa is to assist in obtaining and applying this information. At the same time, it is important to be realistic about expectations. In Europe and North America the widespread uptake of new methods often takes five to ten years. In Africa, the time scale can
easily be twice as long, because of the poor to non-existent livestock extension system.

Breeds:

- Improvement of productivity of local chickens:
  Wherever the trouble has been taken, it has been found that there are highly productive indigenous birds (Mathur et al., 1989; Nwosu, 1979). The task is to identify all such breeds, to determine and, if possible, alleviate factors which contribute to variability within and between them. The selected birds can then be used for crossing to improve production further.

- Promotion of other poultry species:
  Waterfowl (ducks and geese) provide the opportunity for better utility of water and pasture resources in Africa that can generate additional food and income for rural communities. These birds can be combined with other systems such as rice and fish. They are more heat tolerant and less susceptible to disease than chickens. They use alternative natural feed resources, such as grass, water hyacinth and snails.
  There is, however, still a lack of information about production characteristics of locally available breeds and insufficient knowledge of the most suitable exotic breeds and breeding strategies.

Productivity:

The great differences in productivity between extensive and intensive poultry production are due largely to differences in how the animals are managed. In industrial poultry, housing and management and even the breeds and strains used are fairly stereotyped whereas under extensive systems these vary enormously. For example, there are millions of smallholder rural farms where mixed flocks of poultry species are kept in the same area with other livestock (as in the cattle kraal system described by Atteh, 1990) and even with people (Ahmed, 1990). Many of these farmers regard poultry as, at best, a secondary or tertiary occupation, something to be done before or after the real day’s work (Sonaiya and Olori, 1990). Instead of compounded feeds, birds belonging to small-scale producers rely on insects, worms, left over food and the few grains used mainly to ensure control. It is only in a few cases that available feed ingredients are offered in a combination which invariably will not be balanced and may in fact be deleterious if the birds are restricted and so unable to scavenge for the balance of nutrients required.
  These diversities in breeds and strains, in the feed resources available and in the environmental and management systems make it difficult to develop strategies for improvement which are of widespread applicability. In addition, very little research has been undertaken to determine existing or potential levels of productivity. There is therefore the urgent need to carry out such baseline studies in all countries.

Disease Control:

Rural poultry suffer losses from predators and from diseases caused by viruses, bacteria and parasites. The losses attributable to morbidity are not known but more than 750 million chicks, guinea keets and ducklings die each year as a result of various
infections. In addition, predators, particularly hawks, snakes, dogs, cats and rats kill or wound an approximate 75 million poultry every year. Surviving birds show various signs of sickness depending on the type of infection. Many lose appetite, do not grow, lay eggs, hatch nor brood their young, resulting in huge losses of revenue and food to the village, countries and Africa as a whole. There are further costs. Rural poultry has been identified as reservoir hosts for pathogenic organisms causing ND in industrial chickens which is more financially disastrous because of the high capital investment required in that sector. The cost of vaccinating all the rural chickens against ND by the traditional water route and intra-muscular injection for Nigeria has been estimated at US $ 3.8 million (Okunaiya et al., 1990). The traditional method is geared towards birds in captivity and not in free-range systems.

The challenge is clear, that is, to develop and validate specific methods of disease diagnosis, monitoring and control that are specifically applicable to the extensive and semi-intensive systems. The various methods of vaccine application on a large scale need to be critically evaluated and if necessary modified. Fortunately poultry do not roam too far from the homestead and unlike cattle do not cross national borders during their productive life. Therefore poultry disease outbreaks are contained within the incident countries and such individual countries can devise their own programme for rural poultry disease control. Such country efforts should be coordinated at the continental level and assisted by such bodies as the Inter-African Bureau of Animal Resources (IBAR), the International Laboratory for Research on Animal Diseases (ILRAD), the Scientific and Technical Research Committee of the Organisation of African Unity (OAU-STRC) and technically supported by the FAO/IAEA.

With adequate funding from major international and bilateral donors, a continent-wide campaign to arrest the onslaught of Newcastle disease can be developed (i.e. PANDEC - Pan African Newcastle Disease Eradication Campaign) pattern after the Pan African Rinderpest Campaign, for it will similarly require the establishment of a sero-monitoring network and development of kits for rapid field monitoring and virus neutralisation.

Development approach:

Growth is possible without development or research, but development represents true progress. Development itself involves research at all levels - from the most sophisticated laboratory to the smallest farm. There is need for a very close working relationship between scientists and neighbouring farmers in order to obtain local support within the farming communities for trying out new methods based on research. The research required at each of these levels must be clearly defined.

What is needed is a coordinated programme which addresses the problems of breeding, feeding, housing and disease control and is specifically directed at the small farmer. The programme should encourage research geared towards understanding indigenous poultry production systems and their weakness; development and testing new methods which will not only overcome these weaknesses but will also be affordable and sustainable. In short, a programme which encourages animal scientists, veterinarians, and social scientists to leave their laboratories and ally their knowledge with the local wisdom of farmers while at the same time imparting this knowledge to students and extension workers.
Many of the activities will be international in nature, either focusing on a problem that is of particular importance to a given region; or examining a problem of continental relevance such as evaluating the major gene phenotypes (naked neck, frizzled feather and dwarf), finding alternative feed ingredients, or developing alternate methods for ND vaccine administration. Every effort must be made to encourage an interdisciplinary approach to problems.

The coordinated programme will require the support of a strong laboratory which will provide services to screen potentially useful feedstuffs for their nutritional value before these materials are used in expensive animal experiments and feeding trials. Such a laboratory centre can also serve to train African poultry scientists in nutritional, statistical and extension methods that are necessary for successful projects in rural poultry production and development.

The following activities should clearly be included in the coordinated programme:

A. Breeding and reproduction

- Evaluation and selection of indigenous breeds: there are many types, breeds and strains of indigenous poultry in Africa which are well adapted to their environment. There is need for their genetic improvement in order to: improve their productivity within the African environment; make use of the improved indigenous birds in crossing with imported exotic birds; and conserve the desirable genes (e.g. for disease resistance) of the indigenous breed for future breeding.

- Evaluation and adaptation of imported breeds in the hot climate:
  basic breeding projects conducted in collaboration with foreign breeding farms should provide adequate data about local breeds and guidelines on the best route for genetic upgrading.

- Developing of hatching and starting centres (cooperative or private) to produce day-old-chicks, keets, ducklings, poulets and goslings and raise them to 28 days before delivery to farmers.

B. Feed research and development

- Alternatives, substitutes and supplements must be sought in order to minimize feed and ingredient importation.

- In countries with coasts, marine animal meal potentials must be exploited (e.g. Shrimp head meal, fish offal, Periwinkle); in landlocked countries, slaughter house by-products must be harvested, developed and utilised (e.g. vegetable carried blood meal, see Sonaiya, 1989).

- The growth of small-scale feed mixing concerns (either cooperative or private) is essential for real development.

C. Health management

- Regional cooperation in vaccine production, disease surveillance, control and monitoring must be developed to maximise the efficient use of available human and material resources on the continent.

- Training on a regional basis in disease diagnosis, epidemiology, environmental sanitation and disease prevention, must be provided.
D. Entrepreneur development

- There is need for a strong effort to nurture (incubate) entre-
preneurs in input sources for poultry production: feedstuff
suppliers, equipment manufacturers, hatcheries, chick starting
centres, pharmaceuticals, meat and egg producers, marketers,
slaughter and processing plants, caterers, financial services.
- Cooperatives are strongly indicated in an effort to involve
people in production and marketing, and to develop closer links
between producers, retailers and consumers of poultry eggs and
meat.

E. Information Management

- Development, documentation and dissemination of information on
the appropriate methods of data generation, collection, colla-
tion, storage, retrieval and application in the field.
- Agricultural schools, research institutes, universities,
Government ministries and parastatals, non-governmental organi-
sations and the private sectors must all be actively involved.
- The information gathered can be used to promote rural poultry
in primary and secondary schools as well as in a poultry advis-
sory system which is at the moment virtually non-existent in
Africa.

To coordinate these five activity areas and others that will be
suggested, the nascent African Network on Rural Poultry Develop-
ment (Sonaiya, 1990c) appears ideally suitable.

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Fig. 1: Reportable countries and their figures in millions.
Table 1: Socio-economic importance of rural poultry in 10 selected African countries

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Table 2: Characteristics of rural poultry production systems

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<tbody>
<tr>
<td>Type of owner</td>
<td>Peasant</td>
<td>Family (rural and suburban)</td>
<td>Individual Cooperatives</td>
</tr>
<tr>
<td>Birds used</td>
<td>Local breeds</td>
<td>Local and Exotic</td>
<td>Local and Exotic</td>
</tr>
<tr>
<td>Source and Disposal of</td>
<td>Gifts consumption</td>
<td>Gifts, Local market, con-</td>
<td>Local markets supply/</td>
</tr>
<tr>
<td>birds</td>
<td></td>
<td>sumption</td>
<td>cooperatives consumption</td>
</tr>
<tr>
<td>Flock size</td>
<td>5 - 10</td>
<td>5 - 15</td>
<td>20 - 100</td>
</tr>
<tr>
<td>Housing/cages</td>
<td>None</td>
<td>Makeshift</td>
<td>Purpose built</td>
</tr>
<tr>
<td>Feed (supplements)</td>
<td>None</td>
<td>Grains, food scraps, uncon-</td>
<td>Compounded feed, un-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ventional feed</td>
<td>ventional feed</td>
</tr>
<tr>
<td>Health Management</td>
<td>None</td>
<td>Traditional</td>
<td>Traditional</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Modern</td>
</tr>
<tr>
<td>Mean annual egg</td>
<td>10 - 40</td>
<td>30 - 60</td>
<td>80 - 150</td>
</tr>
<tr>
<td>production per hen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult body weight</td>
<td>0.8 - 10</td>
<td>1.2 - 1.8</td>
<td>1.5 - 2.5</td>
</tr>
</tbody>
</table>
### Table 3: Poultry breeds of Africa

<table>
<thead>
<tr>
<th>Country</th>
<th>Breed</th>
<th>Characteristics</th>
<th>Reporters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morocco</td>
<td>Beldi</td>
<td>fibre handling ability</td>
<td>El Houadfi, 1990</td>
</tr>
<tr>
<td></td>
<td>Roumi</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>Fayoumi</td>
<td>-</td>
<td>Mathur et al., 1989</td>
</tr>
<tr>
<td>Comoros</td>
<td>Dandarawi</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dokky</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>Baladi</td>
<td>Medium size, Meat type (1.6 kg Bw). Small comb low egg production</td>
<td>Musharaf, 1990</td>
</tr>
<tr>
<td></td>
<td>Betwil</td>
<td>Medium size, Egg-type</td>
<td>El Zubeir, 1990</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Dzaye</td>
<td>White feathers</td>
<td>Osman, 1988</td>
</tr>
<tr>
<td></td>
<td>Tsabatha</td>
<td>Grey, black and white feathers, Meat-type</td>
<td>Ngoupayou, 1990</td>
</tr>
<tr>
<td></td>
<td>Dongwe</td>
<td>Black feathers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zarwa</td>
<td>Layer strain</td>
<td></td>
</tr>
<tr>
<td>Mali*</td>
<td>Kokochié</td>
<td>Black &amp; White feathers</td>
<td>Kane, 1990</td>
</tr>
<tr>
<td></td>
<td>Balachié</td>
<td>Frizzled feathers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kolo-kochié</td>
<td>Naked body</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Touloukenché</td>
<td>Red spotted comb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Centi-croché</td>
<td>Five digits</td>
<td></td>
</tr>
</tbody>
</table>

#### Nigeria Yoruba Hausa names

<table>
<thead>
<tr>
<th>Breed</th>
<th>Characteristics</th>
<th>Reporters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaradidan Ja</td>
<td>Smooth feathers, basically red with some black at the tip</td>
<td>Sonaiya, and Olori, 1990</td>
</tr>
<tr>
<td>Adiye dudu Beki</td>
<td>Smooth feathers, black all over</td>
<td>Oria and Sonaiya, 1990</td>
</tr>
<tr>
<td>Adiye funfun Ferri</td>
<td>Smooth feathers, white</td>
<td></td>
</tr>
<tr>
<td>Abolorun Pingi</td>
<td>Bare neck</td>
<td></td>
</tr>
<tr>
<td>Asa</td>
<td>Shazumama Frizzled feather</td>
<td></td>
</tr>
<tr>
<td>Arupe</td>
<td>Durugu Dwarf</td>
<td></td>
</tr>
<tr>
<td>Opipi</td>
<td>Without flight feathers</td>
<td></td>
</tr>
<tr>
<td>Goloba</td>
<td>Godogodo Long legged</td>
<td></td>
</tr>
<tr>
<td>Wakewake</td>
<td>Mottle coloured</td>
<td></td>
</tr>
<tr>
<td>Danya</td>
<td>Light brown with some</td>
<td></td>
</tr>
<tr>
<td>Ferri</td>
<td>mottling of white and black</td>
<td></td>
</tr>
<tr>
<td>Kwoi</td>
<td>Layer strain. Mottle colour</td>
<td></td>
</tr>
<tr>
<td>Makera</td>
<td>of silver, black and white</td>
<td></td>
</tr>
</tbody>
</table>

* Kassambara, 1990 describes 15 breeds of chicken and four breeds of guinea fowl based entirely on feather colour.
## Table 4: Unconventional feedstuffs for poultry

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Poultry species</th>
<th>Reporter (country)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sang (Blood)</td>
<td>Chicken</td>
<td>Kassambara, 1990 (Mali)</td>
</tr>
<tr>
<td>Contenu de rumen (Rumen content)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residus de cultures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maraîchères (Market garden refuse)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miettes de pain (bread crumbs)</td>
<td>Chicken</td>
<td>El Houadfi, 1990 (Morocco)</td>
</tr>
<tr>
<td>Insects (cafards, mouches)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vers (earthworms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Le son</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste corn</td>
<td>Chicken</td>
<td>Ngoupayou, 1990 (Cameroun)</td>
</tr>
<tr>
<td>Broken rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice husk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyperus bulbs</td>
<td>Guinea fowl</td>
<td>Ayorinde, 1990 (Nigeria)</td>
</tr>
<tr>
<td>SO premix (from ash, leaves adsoil)</td>
<td>All species</td>
<td>Ochetim, 1987 (Uganda, Papua)</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Chicken</td>
<td>Sonaiya and Olori, 1989 (Nigeria)</td>
</tr>
<tr>
<td>Processed cassava residues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed corn residues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pawpaw seeds and fruit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cowpea testa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palm oil sludge</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Traditional preparations for health management

<table>
<thead>
<tr>
<th>Name</th>
<th>Scientific Name</th>
<th>Indication</th>
<th>Reporter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucalyptus</td>
<td><em>Eucalyptus</em> sp</td>
<td>-</td>
<td>El Houadfi, 1990</td>
</tr>
<tr>
<td>Oignon</td>
<td><em>Allium cepa</em></td>
<td>-</td>
<td>(Morocco)</td>
</tr>
<tr>
<td>&quot;Good Hope&quot;</td>
<td>-</td>
<td>Broad spectrum antibiotic</td>
<td>Olaboro, 1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Uganda)</td>
</tr>
<tr>
<td>Décotions</td>
<td><em>Khaya senegalensis</em></td>
<td>-</td>
<td>Kane, 1990</td>
</tr>
<tr>
<td>d'ecorces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>de planta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caficcedra</td>
<td></td>
<td></td>
<td>Kassambara, 1990</td>
</tr>
<tr>
<td>Pulpe de</td>
<td><em>Solanum incanum</em></td>
<td>-</td>
<td>(Mali)</td>
</tr>
<tr>
<td>Solanum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piment</td>
<td><em>Capsicum sp</em></td>
<td>-</td>
<td>&quot;</td>
</tr>
<tr>
<td>Poudre de</td>
<td></td>
<td>-</td>
<td>&quot;</td>
</tr>
<tr>
<td>Musaraigne</td>
<td></td>
<td></td>
<td>&quot;</td>
</tr>
<tr>
<td>Poudre de Nere</td>
<td><em>Parkia biglobosa</em></td>
<td>-</td>
<td>&quot;</td>
</tr>
<tr>
<td>Huile de palme</td>
<td><em>Elaeis quinensis</em></td>
<td>fowl pox</td>
<td>Aklobessi, 1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Togo)</td>
</tr>
<tr>
<td>&quot;Da - Aar&quot;</td>
<td><em>Aloe vera</em></td>
<td>diarrhoea</td>
<td>Ahmed, 1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Somalia)</td>
</tr>
<tr>
<td>Piment écrasé</td>
<td><em>Capsicum sp</em></td>
<td>-</td>
<td>Nkodia, 1990</td>
</tr>
<tr>
<td>Nkasa de savane</td>
<td>-</td>
<td>-</td>
<td>(Congo)</td>
</tr>
<tr>
<td>Cendre (Ash)</td>
<td></td>
<td>lice</td>
<td></td>
</tr>
<tr>
<td>Termites</td>
<td>order: <em>Isoptera</em></td>
<td>improves disease resistance in</td>
<td>Ayorinde, 1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td>guinea fowls</td>
<td>(Nigeria)</td>
</tr>
<tr>
<td>&quot;Tagiiri&quot; (the fruit)</td>
<td><em>Legenaria breviflora</em></td>
<td>Cocudiosis</td>
<td>Sonaiya, 1990</td>
</tr>
<tr>
<td>Hot pepper</td>
<td><em>Capsicum fruticans</em></td>
<td>Respiratory distress</td>
<td></td>
</tr>
</tbody>
</table>
Table 6: Rural poultry research and development activities

Breeding and Reproduction:
- Evaluation and selection of indigenous breeds
- Evaluation and adaptation of imported breeds in a hot climate
- Development of hatching and starting centres

Feed Research and Development:
- Development of alternatives, substitutes and supplements
- Development of small-scale feed mixing concerns

Health Management:
- Vaccine production and disease control
- Training on disease diagnosis and control

Entrepreneur Development:
- Input source entrepreneurs
- Cooperatives for production and marketing

Information Management:
- Documentation and dissemination
- Agricultural schools and institutions
- Poultry advisory system
3.2 EXPERIENCES WITH RURAL POULTRY DEVELOPMENT PROJECTS

W. Bessei,
Institut für Tierzucht, Postfach 700562,
7000 Stuttgart, GERMANY

Abstract

Rural poultry development projects have been planned and implemented in many developing countries. There are, however, no reliable data on success or failure which could serve as a scientific basis for planning or further activities. The lack of reliable data and communication of results has led in the past to repeated errors in the implementation of poultry projects. The general question on how to approach the village poultry keeper has not been solved so far. While some experts propose to work with the village communities as a group, others propose to select pilot poultry farmers who serve as direct counterparts of extensionists. The former method makes it possible to avoid disparity or jealousy between the farmers of a village. However, the implementation of such projects is difficult. The work with selected poultry farmers can only be successful if the selection is done properly and if those pilot farmers are actively involved in the process of information transfer. The main elements of rural poultry development are: disease control, genetic upgrading, improved feeding, housing and marketing. As improvements in all fields are not possible simultaneously, the development strategy has to schedule the above elements according to their priorities. It has been generally accepted that a disease control system should be given highest priority. Concerning the relative importance of the other elements of development there are differing opinions. This paper proposes to improve housing and feeding before genetic improvements are introduced.

Résumé

Des projets de développement en matière d'élevage de la volaille ont été élaborés et réalisés dans de nombreux pays en voie de développement. Néanmoins, il n'existe aucune donnée qui soit susceptible de servir de base scientifique à la planification d'autres activités. Le manque de données fiables et de communication des résultats a provoqué, dans le passé, des erreurs répétées lors de la réalisation des projets en rapport avec la volaille. La question générale sur la manière d'approcher l'éleveur rural de volaille n'a pas été résolue jusqu'à présent. Certains experts proposent de travailler avec les communautés villageoises en tant qu'entité, d'autres de sélectionner des éleveurs pilotes de volailles qui feront office de contreparties directes des extensionnistes. La première méthode permet d'éviter toute disparité ou jalousie entre les fermiers d'un village. Néanmoins, il est difficile de réaliser de tels projets. La collaboration avec des éleveurs de volailles sélectionnés peut être fructueuse si la sélection est bien faite et si ces fermiers pilotes sont activement
engagés dans le processus de transfert des informations. Les principaux éléments de développement de la volaille rurale sont les suivants: contrôle sanitaire, perfectionnement de la génétique, amélioration de l'alimentation, du logis et de la commercialisation. Étant donné qu'il n'est pas possible d'améliorer tous ces secteurs en même temps, il faut que la stratégie de développement classe ces éléments selon leur priorité. On part généralement du principe qu'il faudrait donner la priorité à un système de contrôle sanitaire. Les opinions diffèrent pour ce qui est de l'importance relative des autres éléments du développement. Cet exposé propose d'améliorer le logis et l'alimentation avant d'en arriver à l'amélioration de la génétique.

Introduction

Rural poultry development projects have been supported by government and non-government organisations (NGOs) in many developing countries. The results of these projects - their successes and failures - however, have not been well recorded and analysed. While considerable information is collected during the planning phase of projects, the information flow slows down during project implementation. Terminal reports of projects are in most cases not very critical, as both, donor and recipient parties, are not keen to admit errors or complete failure at the end of a project. Even less attention is given to the follow-up development of poultry projects after technical assistance has stopped.

This has serious consequences for further rural poultry development. A detailed analysis of success or failure is particularly important for field projects since their complexity makes it impossible to use the classical approach of exact replicated experiments, and any generalisation of findings has to be based on empirical data. This paper is an attempt to summarize, on the basis of reports and documents, our experience from project proposals, progress reports, terminal reports and a few reports on findings after technical assistance has ended in rural poultry development. Most of the information on rural poultry has not been published in generally accessible books or periodicals. It is hoped, however, that more data will be made available through the network on rural poultry in Africa in order to up-date the information basis and to correct - if necessary - the conclusions.

General development approaches

According to BEN DAVID (1985) rural poultry development measures should cover the whole village simultaneously. Awareness and extension activities for improved poultry keeping should be introduced through group-information and group-training. Group-training is time-saving and a large number of farmers can benefit directly from extension. Also, the participation of all farmers of a village prevents jealousy between villagers which can occur when only selected farmers participate in the programme as direct beneficiaries. A further advantage of involving the village as a whole is that all the poultry would be vaccinated. This reduces the risk of outbreak of infectious diseases. The distribution of inputs such as chicks and construction materials, the application for credits and the marketing of eggs are easier if the whole village is involved.
With regard to the expected "multiplier" effect, BEN DAVID (1985) suggested the knowledge acquired would spread rapidly from one village to another. In order to reduce the risk of poultry diseases it has been recommended that the selected villages should not be situated along big roads or near regional markets.

This strategy, however, has not proved successful for various reasons:

1. only a limited number of farmers in any village are usually interested in improved poultry raising;
2. the organisation of regular group training sessions including all farmers is difficult (if not impossible);
3. there is no evidence that the information spreads more easily from one village to another than among families within a village;
4. successful extension involving all farmers increases egg and poultry meat production so rapidly that the local market cannot absorb it. The situation becomes even more difficult when the village is far from big roads and regional markets.

Considering the above arguments most of the rural poultry development projects followed the strategy of selecting pilot farms as a tool of transfer of improved production systems. The implementation of this system can only be successful if the following are taken into consideration:

1. the selection of pilot poultry farmers has to be handled according to the traditional rules, e.g. in close consultation with village authorities;
2. care must be taken to ensure that the farmers selected have proved to be qualified and interested in poultry production;
3. agreements or contracts have to be made with those who are immediately concerned with poultry. In many African countries poultry is owned and looked after by women. In this case extension should address women directly and should not go through husbands as "middle men";
4. Care must be taken in offering incentives to pilot farmers. The need for incentives shows that there is no spontaneous and immediate interest in poultry development, and the project may collapse as soon as payment of incentives is terminated.

The following examples demonstrate the problems of the selection of pilot poultry farmers:

In a rural poultry project in the region of Niamey, Niger, a total of 40 pilot poultry raisers had been selected. They not only received improved breeding stock, construction material and equipment free of charge, but also cash incentives. The selected farmers did not develop any particular interest in poultry production. In many cases the construction material was not used for building chicken houses but for other purposes. Most of the stock distributed died or disappeared due to lack of interest and care. The heavy support of pilot farmers not only favoured selection of uninterested candidates but also discouraged neighbours from learning from pilot farms.

On the basis of this experience another approach was tried, with no cash incentives. Some equipment was provided at a subsidized price, after the farmer had provided his own contribution. For
example, construction material (wire mesh) was only distributed after the farmer had prepared the walls and roof of the poultry house. Hatching eggs or breeding stocks were only given after completion of the construction of the chicken house. Vaccination of the flock and extension services were provided free of charge. This procedure was very necessary at the beginning and it was observed that many neighbours who were not directly involved in the project imitated the improved chicken houses and bought improved breeds either from the government poultry farm or from pilot farmers. Economic calculations based on the assumption that eggs and meat were partly consumed by the family and partly sold on the local markets showed that rural poultry keeping could be self-sustained (Sauer and Bessei, 1984). The problem, however, was the cessation of the extension services which was supposed to ensure continuous vaccination and supply of some essential veterinary products, breeding stock, and were necessary some feed concentrate. A recent ex-post observation of a project with a similar approach showed that only 1 out of 60 pilot farms continued (Kobling, 1989). There are many factors that have contributed to the failure of the project. But it has to be assumed that irregular coverage by the extension service was the main reason. Since non-existent or non-functioning extension services is a widespread problem in Africa, we have to take that into consideration in project planning, and find development strategies which are independent of government extension services.

In Bangladesh, for example, the government livestock authorities have agreed to a system, where government services concentrate their activities in the area of production of improved breeding material, applied research, and training of trainers in poultry production, as subject-matter specialists. Training of village vaccinators, however, is being organised by NGOs. Through this mechanism it was possible to train 40,000 village poultry vaccinators within a short time. The follow-up of the training through refresher courses and distribution of chicks, vaccines and anthelmintics is also in the hands of NGOs. All inputs are sold to the farmers at cost price. Village vaccinators charge for their services and thus generate some income. There is no similar programme known in Africa. Attempts have been made to introduce village poultry extension workers in North Togo and Zaire. However, they are out-posted government extension workers that depend on their government salary and — most importantly — on supplements paid by the project in cash or in the form of other incentives. Although payment of incentives to government extension workers is neither appreciated by government nor by donor organisations, this is often the only way to achieve the objectives of a project.

Main elements of rural poultry improvement

It is generally known that development of rural poultry production requires improvements in various fields. The most important elements are:

- vaccination
- genetic improvement
- housing and shelter
- feeding
- marketing.
Since it is not possible to include all items simultaneously in an extension package their sequence or prioritisation is discussed here extensively. It is generally agreed that vaccination against the most important disease, namely Newcastle disease (ND), is a prerequisite for any poultry development.

The importance of genetic improvement has been over-estimated in many projects and exotic improved breeds have been introduced into village conditions without adequate improvement of housing and feeding. It seems logical that the introduction of improved breeds or upgrading of local strains through selection and cross-breeding is only justified when feeding and housing enable the animals to express their genetic potential for growth and egg production. If priorities have to be set in introduction the above mentioned elements, genetic improvement should be ranked after vaccination, housing and feeding.

Vaccination

Various reports and epidemiological studies have shown that ND is the most serious problem in rural poultry development (DEMEY, 1990), and vaccination against this disease is necessary to reduce the economic risk for poultry raisers. A review of the importance of different poultry diseases in Africa mentioned ND, fowl pox, Gumboro, Salmonella pullorum and gallinarum, coccidiosis and other non-specified enteroparasites and ectoparasites (BUSSI, 1981). While vaccination against ND has proved economically viable there is virtually no large-scale poultry vaccination scheme in Africa operational without external assistance. This is due to the absence of cold storage and adequate transport facilities for vaccines in rural areas. In many countries vaccination of domestic animals is traditionally provided by government veterinary services and is free of charge. Therefore, farmers are often not prepared to pay for vaccination of the fowl. But even if the farmers were prepared to pay the full cost of vaccination, the government services are not in a position to sustain regular vaccination campaigns. Most of the poultry projects have to arrange for vaccination and supply of drugs through NGOs and self-help groups.

Housing and shelter

Housing conditions are important to protect the birds against diseases and predators. It is therefore necessary to construct chicken houses and shelters in such a way that they can easily be cleaned and controlled. They should be well ventilated and cheap. Special attention has to be paid to the protection of young chicks. It is generally recommended that chicks and mother hens should be kept close to the farmer’s living area in special cages or hen houses. This reduces mortality caused by predators as well as diseases. There is a wide variety of models for chicken houses, based on cheap local material, which may be easily constructed by interested poultry raisers (SMITH, 1990; BRES et al., 1973).
Feeding

Feed resources for poultry are scarce under rural conditions. Nevertheless poultry production can be viable if the birds scavenge for a part of their daily ration and the farmer provides some feed supplements. Studies on feeding habits of scavenging birds have shown that they consume large amounts of invertebrates (SAVORY, 1989). Hence their basic ration is very rich in protein, and any supplements of grain or other energy-rich by-products will result in a better balanced diet and increased production. This type of “strategic” feeding which is based on scavenging and supplementary feeding has various advantages:
- as the basic feed supply is scavenged by the birds, they will survive even if temporarily no feed supplements are available;
- since feed for maintenance of the chickens is free of charge, any supplements which increase production result in high economic returns (BESSEI, 1989, 1990).

It has been demonstrated by various authors that rations which are not optimal by Western standards can be economically viable even though production is low (BRANCKAERT, 1990). More research and information is needed to find adequate feed supplements and to demonstrate their economic efficiency.

Genetic improvement

Genetic improvement of local chicken breeds in Africa was started during the colonial period, and continued after independence through many development projects (SONAIYA, 1990; OLABORO, 1990). The most widespread strategy was the so-called cockerel exchange. Although no quantitative data is available on the effectiveness of the cockerel exchange, the overall impression is that the results were rather discouraging. Theoretical studies show that cockerel exchange was less effective and more expensive compared with the distribution of fertile eggs or chicks of improved breeds (ter HORST, 1987). The general failure of genetic upgrading of local chicks in poultry development projects was caused by various factors:
- high mortality of cockerels which are usually raised intensive-ly and then exposed to the harsh village conditions;
- lack of awareness of the genetic value of the cocks by the village population (many improved cockerels were sacrificed or sold for consumption);
- the maintenance of pure line exotic stocks for continuous supply of improved genetic material was not feasible in rural areas;
- selection of the best animals was not possible at the village level.

Therefore, genetic upgrading of local chickens will continue to depend on regular supply of cockerels, hatching eggs or chicks through government or non-government services. Further attempts for upgrading of local chickens should preferably concentrate on the distribution of hatching eggs and young chicks.

Private poultry breeders may be more efficient in producing and distributing improved genetic material. This was demonstrated in the North-Kivu, Zaire, where a private company sold 20,000 improved chicks annually to remote areas while the attempt of a Technical Assistance Project to launch a cockerel exchange programme in the same region was not successful.
Marketing

Egg and meat from local chickens are highly appreciated in rural and urban areas in Asia and Africa. In many countries they fetch higher market prices than products of improved breeds. The possibility of supplying the large urban markets with local chickens from rural areas is hampered by the high costs of egg collection and transport (SAUER, 1990). The capacity of rural markets to absorb increased quantities of poultry is limited. Therefore, successful poultry development projects usually face marketing problems after 2 or 3 years. Attempts to organise marketing through cooperatives and self-help groups have not been successful so far. There are, however, some examples where considerable quantities of rural poultry are being marketed over long distances on a sustained basis. In Bangladesh chickens and eggs are collected by private hawkers at the farm gate and sold at larger markets (FAO, 1987). There is a traditional system of private traders in Burkina Faso who collect local chickens and export them to the large cities of Côte d’Ivoire. In future rural poultry projects, the potential of traditional marketing channels should be considered as an active element of development.

References


3.3 Research and Development Perspectives

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Abstract

Poultry occupies a unique position in small-scale production systems in developing countries. It is and will continue to form an integral part of the symbiotic relationship between livestock and human beings. Unfortunately, due to several structural constraints this economically sound production system lacks the expertise needed to enhance appropriate indigenous developmental techniques. Special attention should be given to social sentiments and economic considerations. Immediate research and development efforts are required to improve survival, reproductive ability and health through improved housing, management, feeding and breeding. Advancements in specific fields of poultry husbandry should be encouraged through extension-oriented research which would act as a vehicle not only for small-scale animal production but for agricultural development as a whole.

Résumé

La volaille occupe une place unique dans les systèmes de petite production des pays en voie de développement et joue un rôle intégral de relation symbiotique entre le bétail et les êtres humains dans ces systèmes qui continueront également à l'élever dans un avenir proche. Malheureusement, ce système de production, judicieux du point de vue économique, manque d'expertises permettant une approche de développement indigène appropriée, et ce en raison de différentes contraintes structurelles. Il faut mettre un accent particulier sur la valeur des perceptions sociales et sur la sensibilité économique de ce système. Une recherche immédiate et des efforts de développement sont nécessaires en vue d'améliorer la capacité de survie et de reproduction, ainsi que l'état physique, grâce à des interventions dans le logis, la gestion, l'alimentation et la couvaison. Il faudrait s'efforcer de faire des progrès dans les domaines spécifiques à cette production par une recherche orientée sur l'extension du développement qui ferait office de véhicule, non seulement pour la production animale à petite échelle, mais aussi pour le développement de l'agriculture dans son ensemble.
1. INTRODUCTION: The Significance of indigenous poultry production

Poultry occupies a unique position through its contribution to the supply of valuable protein food to families in the small-scale production systems which predominate in developing countries. In these countries, livestock is mainly kept either for marketing, as a capital reserve, or for prestigious reasons. Poultry is practically the only domestic species which fulfils the objectives of subsistence as well as marketing, especially under conditions of smallholders.

The significance of smallholder indigenous poultry production systems is stressed in several reports, especially from Africa. Even nowadays about 75 to 80 per cent of the poultry production is done under small-scale rural conditions as in Cameroon (Ngoupayou, 1990) or in Kenya (Gichoki, 1989). Local poultry stock can, as in the case of Nigeria, represent up to 90 per cent of poultry products, showing how indigenous poultry husbandry systems occupy a paramount position in integrated farming systems in the tropics. Probably no other domestic species is of such universal importance as a food source.

Furthermore, in certain regions products from native fowl, kept in backyard systems, are widely preferred because of their pigmentation, taste, leanness and their suitability for special dishes. Generally, meat and eggs from local stock are sold at even higher prices than the same products from exotic birds from industrial production systems.

In spite of this undoubted role of indigenous poultry production systems, it is almost grotesque that, so far, scientific research on its true performance potential, development efforts, and improvement of management and breeding systems has been neglected.

For the last few years, however, prejudices against small animals have changed, and especially the potential of poultry species in exploiting poultry specific feed and husbandry resources in land and water sites are more and more recognized.

This symposium which is to discuss future perspectives of research and development for small-scale poultry production systems is a clear illustration of these changing attitudes.

2. STRUCTURAL CONSTRAINTS FOR RESEARCH AND DEVELOPMENT

The first bottleneck for development is the fact that backyard poultry production is practiced mainly in uncontrolled extensive systems and in remote areas lacking the necessary infrastructure. Furthermore, little or no market contacts inhibit monetary economic calculations and therefore also prevent developmental considerations or even activities from political a point of view.

Further limitations arise from cost-benefit considerations. Extensive production systems are characterized by low production risks because there are low or no capital inputs. This overshadows any concern over low productivity levels.
Progressive improvements in traditional production systems through different inputs have been compiled by Bessei, 1987 (Table 1).

<table>
<thead>
<tr>
<th>Production system</th>
<th>Eggs/year</th>
<th>Number of 1 year-old chickens</th>
<th>Eggs for consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRADITIONAL - scavenging no regular feed/water poor night shelter</td>
<td>20 - 30</td>
<td>2 - 3</td>
<td>0</td>
</tr>
<tr>
<td>IMPROVED TRADITIONAL - Step 1 regular water/feeding grains household wastes, improved shelter, care in first weeks Newcastle vaccination</td>
<td>40 - 60</td>
<td>4 - 8</td>
<td>10 - 20</td>
</tr>
<tr>
<td>IMPROVED TRADITIONAL - Step 2 as step 1 plus further improvements: treatment for parasites, additional vaccination</td>
<td>100 - 120</td>
<td>10 - 12</td>
<td>30 - 50</td>
</tr>
<tr>
<td>IMPROVED TRADITIONAL - Step 3 semi intensive, as step 2 with improved breeds/complete diet</td>
<td>160 - 180</td>
<td>25 - 30</td>
<td>50 - 60</td>
</tr>
</tbody>
</table>

(Source: Bessei, 1987)

The introduction of improved management such as prophylaxis, feeding, housing and breeding requires interdisciplinary approaches and packages for basic extension, demonstrations and multiplication of technical information.

3. AREAS WHICH REQUIRE IMMEDIATE RESEARCH AND DEVELOPMENT ACTIVITIES

Most of the problems affecting individual performance and survival in the tropics are caused by bacterial and viral diseases, such as Newcastle, Marek's, Pox, Infectious bronchitis, but also tick borne diseases as well as coccidiosis, round worms and insect infestations.

As neither natural nor artificial selection have been effective up to now, only vaccination and treatment can counter these diseases. On the other hand vaccination campaigns for extensively kept fowl are usually expensive and not complete. Therefore, organisation and implementation of vaccination have to be improved and adapted.
Efforts in this respect include the use of

* vaccine supplemented feed additives,
* eyedrop vaccine, packed in charges which are adapted to smallholding dimensions,

and recently the implementation of

* "basic" extension services on a village level (e.g. in Burkina Faso).

There is a wide range of feeding conditions even within small-scale production systems mainly through quality and quantity of feed. The more the natural mobility of the fowl is limited, the more differences in adequate feed (and also water!) supply may arise. A special advantage of backyard production is the free range orientation, allowing the exploitation of abundant "absolute" feed resources. These consist predominantly of high crude fibre proportion and low energy, whereas protein content could be reasonably high because of the higher proportion of invertebrate food in the ration of scavenging chickens.

In general, but also for distinct ecological zones or distinct seasons, the food basis and feed compositions under free range management have not been deeply investigated. An optimisation of food supply or nutrient compensation as well as the exploration of untapped feed resources requires special attention in the future.

Under extensive production conditions little or no management care is taken for housing and flock control. Protection against temperature, radiation, storm or rain as well as against predators is insufficient, ineffective or even missing. Hence, more developmental research must be directed towards appropriate housing and equipment (e.g. for feeding, drinking, laying, resting, etc.). Local design and materials (clay, bamboo, bast, palm material) should be preferred and a combination of traditional and modern equipment-technologies should be tried out.

A special characteristic of small-scale production is the absence of reproductive and breeding control as well as the dependence on brooding hens to secure continuous regeneration and replacement of the flock.

The following diagram (Figure 1) shows a systematic cycling of brooding-, hatching-, rearing- and "separation"-periods which exist under natural reproductive conditions. This phenomenon increases the amount of unproductive days of motherhens and conversely reduces their egg laying performance for hatching and consumption. High rearing losses of up to 80 per cent due to malnutrition, infections, predators and accidents must be added to the low reproductive performance.
Figure 1: DURATION OF LAYING AND BREEDING CYCLE OF NATIVE FOWLS IN THE HUMID TROPICS (INDONESIA)

(= 5 cycles per year)

Therefore, improvement activities have to concentrate on two aspects

* reducing rearing losses and
* improving hatching egg production by changing brooding behaviour and also by introducing appropriate artificial hatching technologies.

Ancient but still working brooding houses in Egypt or the development of equipment operated on biogas or solar energy could be examples for innovative research.

So far small-scale backyard systems are based on indigenous fowl whose degree of absorption of advanced genetic material is unknown. These "non-descript", unimproved birds are characterized worldwide, by small body size, late maturity, low performance in egg numbers, smaller egg size, long laying pause as well as predominant inclination to broodiness.

The adaptability of local chicken to an unfavourable environment is said to be high, but the underlying physiological mechanism for this character has not been identified yet. It is a general assumption that low productivity per se is related to better tolerance to stressful, tropical conditions. However, resistance to prevailing diseases is low which explains the occasionally high mortality rates in the field.

The general performance of local genetic stock suffers from unfavourable environmental conditions. Hence, it does not fully reflect their possible genetic potential. Appropriate breeding improvements are feasible and also necessary to induce a long-term increase in productivity.

Especially in case of smallholder developments, breeding activities adapted to environmental levels and limitations must be encouraged particularly because of two reasons:

* their low cost feasibility through integration of cockerels, pullets, day-old chicks or hatching eggs, and

* the continued self-generation of whatever genetic responses have been achieved in a flock.
Besides the fact that numerous experiments have demonstrated successful integrations of improved exotic genomes into local fowls, it should be noted that fowl belong to the genetically best known livestock species which allows manifold, flexible breeding plans because of its specific nature of reproduction and inheritance.

Furthermore, locally oriented breeding strategies would give a chance to developing countries to establish self-reliant breeding schemes. This is especially so because up to now tropical oriented breeding work is undertaken either by large breeding firms or by research institutions. On the other hand, scientifically accepted models, which stimulate developmental research in the tropics are already available. In the near future, molecular genetic approaches will also be applied to poultry genetics. These methods should be of special interest for developing countries because they enable the transfer of tropically relevant major genes and also facilitate the detection of genetic markers for diseases and adaptability. This is important not only for efficient tropical oriented selection work but also for better evaluation of the potential of local genetic resources.

4. TARGETS FOR DEVELOPMENTAL EXTENSION-ORIENTED RESEARCH (DEXTOR)

The closer human beings and domestic animals live together and the more they depend on each other, the greater importance is attached to social sentiments in the choice of production strategies. This is especially true in traditional smallholder husbandry where these considerations often by-pass rational evaluations.

The most important requirements for identifying actual research concepts in small-scale production systems are:

* interdisciplinary links between socio-economic and basic scientific activities
* integrated research and extension activities.

Hence, scientific operations should be directed towards developmental extension-oriented research (DEXTOR) as a priority. The two branches of research and extension have, for a long time, existed as separate branches and in different institutions. The first concern now should be to bring them together for the success of development and research.

An integrated field survey could be undertaken to

* study actual problems in production and marketing, and
* identify urgent research topics.

The next step would be the development of and research into technical improvements followed by testing for reliability of the innovations. Development and pre-testing are central components of on-station-research (OSR), whereas introduction and test in the field have to be collaborative between research and extension through on-farm-research (OFR).
The main functions of research are the
* creation of ideas and concepts,
* development of appropriate improvement technologies, and
* transfer and adaptation of new research results to field conditions.

This means that beyond developmental orientations, national research must also have a certain niche for more scientifically based projects. It should be borne in mind that the advantage of combining development programme with research is to make use of personal interest and motivation, which are essential guarantees of success and continuity of projects. Research has the same rules and attitudes worldwide and as a result, the outcome and success of research universally determine the researcher’s career. Successful research is not only a means for personal development, but also for international exchange and co-operation, thus creating further stimulation for research and development.

Promotion of adequate research and rational spending of funds (always limited) should not only stimulate activities but also help to avoid too many parallel operations. It is therefore necessary in the field of small-scale poultry production to act on a regional or international basis, through:
* exchange of publications,
* participation in congresses,
* workshops,
* joint research programme, especially directed to the systematic integration of differing ecological locations and socio-economic conditions.

Poultry in general but tropical poultry research in particular can serve as a good model for developing and executing international co-operation. The advantage of the subject of "poultry" can be seen in its
* small animal unit
  which makes it easy to keep in reliable numbers and with low costs,
* biological characteristic of having endogenous nutrient and water supply for the first days
  which makes it practicable to transfer identical test-animals over the whole world,
* short production phases
  which allow immediate judgement on a scientific approach or a co-operating partner.

The fact that this animal species allows to carry out simultaneous research projects with the same animals descending from the same stock and with the same research methods is an additional important advantage to strengthen international partnership and co-operation.
This can be finally substantiated by own long-term experiences, where we were able to build up a kind of network of co-operating researchers and institutions on the basis of a new, appropriate research concept. As seen in the following figure (Fig. 2) in a programme on tropical oriented poultry breeding, now more than 10 countries are co-operating not only in breeding tests but also in the fields of feeding and disease resistance.

Fig. 2: Regional distribution of testing programmes in tropical countries (introduced by Technical University of Berlin (-Dahlem)

5. CONCLUDING REMARKS

It must be stressed again that development and extension-oriented research will be important for the advancement of the specific field of small-scale poultry production. This is all the more important since neither the productive potential nor the developmental perspectives of smallholder systems in poultry have been considered in an adequate manner. Prevailing problems and developmental needs have to be identified under field conditions with close integration of research and extension. Activation of research, in general, has not only implications for further improvements in a specific field but it also stimulates the potential for development of born scientific infrastructure and personal career advancement.

International co-operation will lend support to the creation of efficient research and development capacities. Poultry can again play an important role as a promoter in this aspect.
The fact that improvements introduced to this species result in a visible response within a short time gives it a special position not only in Developmental Extension oriented Research (DEXOR) schemes for small-scale animal production, but also as a vehicle for activities in agricultural development as a whole.

This symposium presents a chance to verify the importance of research and development and to explore more efficient ways for further successful international co-operation. The symposium might take the opportunity to correct a false developmental policy, which has neglected this sector of smallholder production for a very long time.

Finally it is my sincere hope that our joint efforts may stimulate research interests and developmental improvements of this area of crucial importance to the poor.

References


3.4 Development and Funding of Small Poultry Projects in Africa

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Abstract

Traditional methods of poultry keeping evolve slowly into more complex systems (in this paper referred to as the 'high-tech' system). It is best to start modestly and expand the facility as experience and know-how increase. The development and gradual expansion of a Newcastle Disease vaccination scheme for smallholders is described in detail.

Some of the more sophisticated and larger units in Africa have been supported by the International Finance Corporation (IFC) with funds channelled through the Africa Project Development Facility (APDF) with its headquarters in Washington D.C. and field offices in Nairobi, Abidjan and one shortly to be set up in Harare. Five projects in Cameroon, Burundi, Gabon, Ghana and Malawi are described. The broad spectrum of project activities demonstrates that the countries are aware of the latest techniques in poultry development and are willing to use the tools of modern technology.

Résumé

Les méthodes traditionnelles d'élevage de la volaille évoluent lentement vers un système de haute technologie. Le mieux est de débuter modestement et d'élargir les installations lorsque les expériences et le savoir-faire s'accentuent. On trouvera une description détaillée d'un projet de vaccination contre la maladie de Newcastle destiné aux petits éleveurs.

Certaines des installations d'Afrique les plus sophistiquées et les plus importantes ont été soutenues par la International Finance Corporation (IFC), grâce à des fonds canalisés par le Africa Project Development Facility (APDF) dont les quartiers généraux se trouvent à Washington D.C. et les bureaux d'opération à Nairobi, à Abidjan et, d'ici peu, à Harare. On trouvera également une description de cinq projets réalisés au Cameroun, au Burundi, au Gabon, au Ghana et au Malawi. La largeur du spectre des activités de développement montre que les pays ont conscience du retard des techniques dans le développement de la volaille et qu'ils sont disposés à utiliser les outils d'une technologie moderne.
Up to fifty years ago the aim of all countries, even the richest, was to have a chicken in every pot on Sunday. This is because chickens were the most expensive meat as well as the most delicious. Today the development of hybrid chickens which are efficient converters of feed, better understanding of the nutritional requirements of the birds, better lighting, adequate water of good quality, improved vaccines and other disease control measures, better equipment etc. have made chicken meat so cheap that many families of rich and middle income countries can afford to have chicken at every meal if they wish.

Most of the poorer countries have adopted this improved technology in the urban areas. But there are areas which still continue to use the traditional system of rearing native chickens fed on scraps from the kitchen and what they glean from the yard. Two of the reasons for this are that the ‘high-tech’ system requires a great deal of capital: capital to set up a hatchery, capital to establish a feed mill, capital to erect a processing plant, capital to obtain suitable water supplies, capital to install a poultry house and/or provide services for outgrowers, and capital to maintain disease preventive and other sanitation measures. It also requires experienced suitable management. People also feel that birds raised in the backyard taste better (I must say that I share this view). However, I also believe that this system should gradually evolve into the use of the high-tech system because it produces cheaper birds more affordable to consumers and which are equal in nutritional value to the native birds. Chicken meat is generally the cheapest form of protein, and also a healthy food.

As I said above the improved technology is being used in the urban areas of most of the poorer countries. Generally speaking, traditional methods evolve into the high-tech system slowly. Typically the change takes place along the following lines.

In the traditional system the price of chicken meat or eggs is usually high because birds develop slowly and lay few eggs or put on weight slowly. Word gets around that there are new breeds of chicken which grow faster or produce more eggs. Most development starts with egg production, because it requires less capital than meat production. An enterprising person imports a few day-old layer pullets, feeds them scraps and kitchen waste, and soon they start laying, producing more eggs than native chickens. The entrepreneur makes a good profit partly because his new layers are more productive and also partly because of the high price of eggs.

Others copy his example and soon a thriving egg-laying industry develops. Then someone decides to try using commercially-prepared feed. When this proves successful, the setting up of a simple feed mill follows, using local materials and producing a reasonable feed by incorporating some imported ingredients. Because of the relatively small scale of operation, the owner and his family can pay proper attention to the flock, seeing that the birds have enough feed and water and that the sick birds are attended to and removed before they contaminate the others. This helps to make the business successful. Other factors which help are the fact that eggs can keep for a time without refrigeration, and are sold in the open market with little or no packaging or preparation. When the layers have completed their laying cycle they are sold live for meat.
Because several people go into the business, there is competition which results in lowering the price of eggs, and increasing consumption. Egg producers realizing this, try to increase demand further by adopting measures to reduce production cost enabling them to sell at a lower price. The measures include the production of layer chicks. This is sometimes done by the Government, often inefficiently, or by the private sector. Imported layer eggs are hatched in incubators, producing day-old layer chicks at a lower cost than imported ones and also using less foreign exchange. A further step is the establishment of a parent flock to produce layer eggs to produce layer chicks. Careful study however, is needed before taking this step because, even a small parent flock often produces a larger number of commercial layers than the market needs. This frequently results in losses and closure of the parent stock unit.

About 50% of the day-old chicks produced by the hatchery are males which are sold to local farmers who fatten them for meat. The farmers soon realize that the birds eat a lot of food for the meat they produce, and that it is difficult to compete in price and quality with imported frozen broilers. They soon realize that the day-old layers are not as good at converting feed to meat as day-old broilers, and switch to day-old broiler chicks for meat production. Soon, as in the case of layers, broiler hatching eggs are imported and hatched in the same incubator as used for hatching layer eggs, but at different times. It is easier to go to the next stage in broiler production, the parent stock, because more broilers are needed than layers.

In the early stages of the development of a broiler industry, people buy live birds and kill them at home. This is a messy job and householders soon change to using a "pluck" shop, specially set up to kill and pluck live birds for consumers. The final stage of development is the processing plant.

The whole development process must be carefully planned and coordinated. For example, it is no good having a well-designed facility without having adequate working capital to provide good feed or vaccines; or good quality water; or good management. It is best to start modestly and expand and improve the facility as experience and know-how increase.

I have portrayed a typical development programme but there are other ways in which the farmers using the traditional system might be helped. One outstanding example occurred in a West African country.

Efforts to improve traditional poultry operations, including an intensive anti-Newcastle disease campaign, had not been successful so it was decided to rethink and reformulate actions to improve them. A foreign Government’s assistance was sought. It sent a veterinarian and an agricultural economist to the country to study the problem.

The team determined that the main problem inhibiting good performance was the health of the birds. It was therefore decided that an effective disease prevention programme should be implemented.
Newcastle disease (ND) is the most serious poultry disease in the country, as it is in most other poultry producing countries. It was therefore decided to concentrate on this disease, but also to treat other less serious diseases such as Trichomonas and certain parasites.

After a series of tests ITA-New was selected as the most appropriate vaccine to be used in the anti-Newcastle disease campaign.

Selected villagers were trained by veterinarians in the method of applying the vaccine. The training stressed the importance of proper storage of the vaccine to prevent the loss of potency, and to use all the vaccine in a package within a limited time. A manual was prepared to help vaccinators carry out their duties.

The vaccinator was given an aluminum box containing 2 syringes, 4 atomisers and 6 packages of 100 doses each of ND vaccines. The estimated cost of this was FF 6000.

The vaccinator had to keep a register of the names of the villages which received vaccination, the dates of the visits and the quantities of vaccine used.

Diagram 1 shows:

(i) the number of vaccinators trained;
(ii) the number of vaccinators operational;
(iii) the total number of vaccinations; and
(iv) the average number of vaccinations per vaccinator.

Over the period 1979-83, a high percentage of the trainees dropped out. Nevertheless the number of active vaccinators increased from 235 to 350, and the total number of vaccinations from 105,767 to 986,300. The average per vaccinator rose from 450 to 2,320 per year. This represents a fivefold improvement by the vaccinators over the four year period.

The vaccinators were supervised by Government agents, who also paid the vaccinators out-of-pocket expenses. The vaccinators charged the village farmers a fee for carrying out the vaccination.

The estimated cost is summarized below:

<table>
<thead>
<tr>
<th></th>
<th>'000 CFAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>36,000</td>
</tr>
<tr>
<td>Operation</td>
<td>112,760</td>
</tr>
<tr>
<td>Personnel</td>
<td>26,240</td>
</tr>
<tr>
<td>Other</td>
<td>25,000</td>
</tr>
<tr>
<td>Total</td>
<td>200,000</td>
</tr>
</tbody>
</table>

The scheme has been considered a great success, resulting in better health of poultry flocks in the country and a higher production of eggs.
Showing the development of the anti-Newcastle disease vaccination program 1979 to 1983

(1) Number of vaccinators trained
(2) Number of vaccinators working
(3) Total number of vaccinations carried out
(4) Average number of vaccinations per vaccinator

(Agriculture traditionnelle Haute Volta, Synthèse des Connaissances actuelles et Réflexions autour d'une Expérience de Développement 1979 - 84. Vol. II)
I have discussed the traditional system of poultry production, showing how it can be improved, and is improved by adopting parts of the state of the art technology, eventually evolving into sophisticated poultry rearing. I quoted a success story of the implementation of a disease prevention campaign. I believe other countries could benefit from its experience.

The evidence indicates that for countries which have to develop slowly, a programme of disease prevention may be a suitable first step. The cost of this may be funded by Government or a sympathetic foreign agency. For others who are further along the road to development, the evolution process can be funded by small entrepreneurs' resources, probably supported by development banks.

I shall now discuss the more sophisticated system in Africa, using as models, projects in which the International Finance Corporation (IFC) has been involved.

When I spoke to you in 1983, IFC had just set up a unit called the Caribbean Project Development Facility (CPDF) under the auspices of the United Nations Development Programme to deal with small private enterprises in the Caribbean. CPDF was created in 1981 to help entrepreneurs develop and evaluate their proposals for productive investment projects in the Caribbean. In 1989 CPDF expanded its services to include Central America. The Facility now serves twenty seven countries.

If a proposed project appears to be technically and economically sound CPDF will help entrepreneurs find suitable financing. It will assist in structuring the proposal in a form which will be acceptable to financial institutions. It also provides technical assistance, assists in the financing of feasibility studies and helps to identify suitable joint venture partners.

The Facility was established to help small enterprises, whose businesses were too small for IFC's portfolio. The lower limit of the size of enterprise which CPDF dealt with was US $ 500,000 and the upper limit US $ 5 million. Its services have been so successful that they have attracted larger enterprises, and the upper limit has been increased to over US $ 5 million.

The success of CPDF encouraged IFC to set up similar facilities in Africa (1986) and the Pacific (1990). The Africa Project Development Facility (APDF) is headquartered in Washington, but has field offices in Nairobi, Kenya and Abidjan, Ivory Coast, and one shortly to be set up in Harare, Zimbabwe. The Pacific Development Facility has its offices in Sydney, Australia.

APDF's project size is smaller than CPDF's, and since this seminar deals particularly with Africa, I have drawn, with their permission, on this Facility's experience, but also on one project in which IFC was directly involved.

The 5 projects which I will discuss cover a wide area, particularly of West Africa, but also of South East Africa. They also cover a broad spectrum of poultry activities. Two are involved in broiler production, one in egg production, one in broiler and egg production and one in day-old chicks production. The broad coverage demonstrates that countries are aware of the latest techniques in
poultry development, and are willing to use the tools of modern technology.

Table 1 presents a summary of the main aspects of the five projects, which are discussed below.

**Table 1: Basic data on five African poultry projects**

<table>
<thead>
<tr>
<th></th>
<th>CAMEROON</th>
<th>BURUNDI</th>
<th>GABON</th>
<th>GHANA</th>
<th>MALAWI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Project</strong></td>
<td>Broiler</td>
<td>Broiler and Eggs</td>
<td>Eggs and Feed</td>
<td>Eggs and day-old Chicks</td>
<td>Broiler</td>
</tr>
<tr>
<td><strong>Size of Project</strong></td>
<td>1.3 million kg</td>
<td>105,000 broilers</td>
<td>9.5 million eggs</td>
<td>25.6 million (20.3 to 45.9)</td>
<td>125,000 broilers</td>
</tr>
<tr>
<td><strong>Annual Production</strong></td>
<td>meat (2 phases)</td>
<td>1,500,000 eggs</td>
<td>2,500 tonnes feed</td>
<td>11.13 million (1.53 to 2.71)</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Project (US $)</strong></td>
<td>$ 3.0 million</td>
<td>$ 815,000</td>
<td>$ 2.45 million</td>
<td>$ 3.06 million</td>
<td>$ 251,800</td>
</tr>
<tr>
<td><strong>Equity</strong></td>
<td>$ 1.2 million</td>
<td>$ 354,000</td>
<td>$ 1.0 million</td>
<td>$ 1.11 million</td>
<td>$ 66,700</td>
</tr>
<tr>
<td><strong>Debt</strong></td>
<td>$ 1.8 million</td>
<td>$ 461,000</td>
<td>$ 1.45 million</td>
<td>$ 1.94 million</td>
<td>$ 185,100</td>
</tr>
<tr>
<td><strong>Source of Financing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Equity:</strong></td>
<td>Private 73% Government 27%</td>
<td>Local private DPD 40% IFU</td>
<td>Local private</td>
<td>Sponsors</td>
<td>Sponsor</td>
</tr>
<tr>
<td><strong>Loan:</strong></td>
<td>European Govt. Institution</td>
<td>Three local banks</td>
<td>Banque Nationale de Credit FMO</td>
<td>CDC+FMO: $ 1.63m</td>
<td>Local bank: $ 53,333</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>local bank: $ 0.31m</td>
<td>GOM using USAID funds: $ 106,667</td>
</tr>
<tr>
<td><strong>Repayment:</strong></td>
<td>7 yrs incl. 2 yrs grace</td>
<td>10 yrs incl. 1 yr grace</td>
<td>7 yrs incl. 1 yr grace</td>
<td>8 yrs incl. 1 yr grace</td>
<td></td>
</tr>
</tbody>
</table>
Three of the projects are relatively large with capital costs ranging from US $ 2.45 million to US $ 3.06 million; the other two are small with capital costs of US $ 300,000 and US $ 815,000. The sizes are also comparable with the sizes of the countries.

Cameroon. This is a broiler project which was designed to be implemented in three phases, the first two of which were clearly defined. This paper deals with the first two phases. During the first phase the company would construct 10 broiler houses, each capable of housing 10,000 birds and a 600 bird/hour slaughterhouse. These facilities were expected to produce 662,000 kg of broiler meat per year. In the second phase which should start during the second year of operation, the company would encourage and assist outgrowers to produce an equal volume of broilers.

The estimated cost of phases 1 and 2 of the project was US $ 3.0 million. This was expected to be financed by 40% in equity and 60% in long term debt. It was projected that 73% of the equity would be provided by local private investors and 27% by the Government. A European financial institution had expressed interest in funding the loan.

The project was aborted because the promoters were unable to find a suitable local partner. This was apparently partly due to the fact that potential sponsors were unsure of the market because of the availability of cheap sources of other meats e.g. fish was being sold at about US $ 1.30/kg and beef at US $ 3.13 - 5.62/kg, compared with the price of dressed chickens of US $ 5.16 to US $ 5.88/kg.

Burundi. This is a broiler - egg production proposal to produce 105,000 broilers and 1,500,000 eggs per annum. The production was organized in three separate production centres, broiler growing houses, layer houses and a slaughterhouse. The project was expected to cost US $ 815,000 which would be financed by equity of US $ 354,000 and debt of US $ 461,000. 40% of the equity was contributed by the sponsor, 30% by the Danish Project Development Co. (DPD) and 30% by the Danish Industrial Fund for Developing Countries (IFU). The Loan was funded by three local banks, to be repaid in seven years including a 2 year grace period.

Reports suggest that the project is being implemented satisfactorily.

Gabon. This is an egg production proposal to produce 9.5 million eggs per year and 2,500 tonnes feed at an estimated capital cost of US $ 2.45 million. The sponsors would provide equity of US $ 1.0 million and the long term loans of US $ 1.45 million were to be financed by Banque Nationale de Credit and the Dutch Development Bank (FMO). The loans were to be repaid over ten years including two years grace.

The sponsor decided not to take the financing arranged and is proceeding using his own resources though at a much slower rate than originally planned.

Ghana. This is a fairly large project to expand annual production of eggs by 25.6 million (from 20.3 to 45.9 million) and day-old chicks by 1.13 million (from 1.58 to 2.71 million).
This is to be achieved by:

a) Two parent breeding farms, one for broilers and the other for layers;
b) modifying existing layer units to provide housing for 90,000 layers in three units;
c) increasing feed mill capacity to 10 tonnes/hour; and
d) a new hatchery with a capacity of 10 million eggs per year.

The estimated cost was US $ 3.06 million, US $ 1.63 million of which was foreign. The sponsors, the owners of the existing facility, would provide the equity of US $ 1.11 million, and the loan would be financed by:

Commonwealth Development Corporation (CDC) and FMO (US $ 1.63 million), and a local commercial bank (US $ 0.31 million)

The loan would be repaid in 7 years including a one year grace period.

Eventually, the sponsors decided not to accept the arranged loans, but to finance from profits and an export credit facility of US $ 800,000.

Malawi. This project was a privatisation scheme, designed to assist the sponsor to obtain a loan of US $ 160,000 to help purchase a broiler operation from Government. The estimated value of the assets was US $ 251,800, and the balance of US $ 91,800 would be provided as equity by the sponsor.

The facilities include 12 poultry houses each capable of housing 3,000 birds, a feed mill, a vegetable oil extracting plant, a slaughterhouse, a cold room, an office, a manager’s house and staff housing for up to 10 families. Three of the twelve poultry houses will be used for mixing feed and for storage.

Part of the loan will be funded by USAID through a local commercial bank.

The project is apparently being implemented satisfactorily.

**General Comments**

The establishment of up-to-date poultry enterprises is expensive. The entrepreneurs often find it difficult to raise the sum which will be considered adequate as equity by the financial institutions. Often too, some are unwilling to borrow foreign funds as they may be unable to obtain the necessary foreign monies to service their debts.

The evidence suggests that there are a number of foreign development investors who are willing to help fund worthwhile projects. Moreover local development banks stand ready to help in the financing as well.

In addition APDF was set up to help with the establishment of such projects. Its staff is ready and willing to help worthwhile pro-
jects. I therefore recommend that individuals with suitable projects contact the APDF office in their area if they need assistance. The following are the addresses of the APDF field offices and the areas they cover:

(i)  
Abidjan APDF Office  
Immeuble C.C.I.A. - 17th Floor  
01 BP 8669  
Abidjan 01  
Côte d’Ivoire  
Telephone: 32-96-97  
Telex: 22264  
Fax: 32-61-51  

Countries served:  
Cameroon, Côte d’Ivoire, Gabon, Ghana, Guinea, Mali, Nigeria, Senegal  

(ii)  
Nairobi APDF Office  
International House  
P.O. Box 46534  
Nairobi, Kenya  
Telephone: 722200  
Telex: 25303  
Fax: 339121  

Countries covered:  
3.5 COOPERATIVE RESEARCH AND THE DEVELOPMENT OF POULTRY PRODUCTION

T. Viegas,
European Commission DG XII G-4,
Rue de la Loi 200, B-1049 Brussels, BELGIUM

Abstract

Poultry research has had its share in the 2 previous phases (1983-86 and 1987-91) of the EC’s Science and Technology for Development Programme (STD). The award of new research contracts is done in a highly competitive way. Joint proposals are presented direct by scientists in Europe and developing countries according to research priorities established by the commission of the EC.

One of the decisive factors influencing the formulation of a poultry development strategy is that the increase of per capita food production falls short of the population growth rate in most African countries. Therefore poultry will have to compete, for a long time from now, for grain priced for human consumption.

Since insufficient disease control constitutes the main limiting factor for animal productivity the following areas deserve our concentrated efforts:

- the characterization of poultry diseases
- technical alternatives for their control
- an economic appraisal of these alternatives
- the use of disease-resistant strains, provided that market constraints do not exist.

Résumé

La recherche sur la volaille a eu droit à sa part dans les 2 phases précédentes (1983-86 et 1987-91) du Programme STD (Science et Technologie pour le Développement) de la Communauté Européenne. L’attribution de nouveaux contrats de recherche se fait de manière très compétitive. Des propositions collectives sont présentées directement par les scientifiques européens et des pays en voie de développement, conformément aux priorités établies par la commission de la CE en matière de recherche.

L’un des facteurs décisifs qui influence la formulation d’une stratégie de développement en matière de volaille est le fait que l’augmentation de la production alimentaire par tête est inférieure au taux de croissance de la population dans la plupart des pays africains. Par conséquent, la volaille devra rivaliser d’ici longtemps pour le grain vendu pour la consommation humaine.
Etant donné que l’insuffisance du contrôle sanitaire représente le facteur majeur de restriction de la productivité animale, il faudra concentrer nos efforts sur

- la caractérisation des maladies de la volaille,
- les alternatives et
- l’utilisation d’espèces résistant aux maladies, à condition qu’il n’existe pas de contraintes sur le marché.

1. Background

The CTA and the Greek Government should be commended for their decision to hold a seminar on the problem of developing poultry production in African countries. These ubiquitous animals generally referred to as poultry include chickens, ducks, geese, guinea-fowl and other avian species. They share with Man the surroundings of their homesteads and, through a combination of scavenging and the use of leftovers, supply rural families with much needed food, income from sales and social and ceremonial objects. At the other end of the scale, poultry, particularly chickens, has been exploited almost to the limit of its biological potential in vertically integrated intensive systems which are a key source of supply of urban markets with protein at affordable prices.

Is there an intermediate level between the scavenging and the industrialized modes of production? Should transitional systems be considered and are they viable in the economic environments of sub-Saharan Africa? Can strategies be devised to promote change which brings about economic and social benefits to producers and consumers alike? These and other questions will no doubt be addressed by this seminar, where scientists and technicians will try to examine the complementarity of the scientific and development approaches. I myself will try to focus the attention of the seminar’s participants on the problem of the research requirements and priorities for change, particularly in the context of North/South scientific cooperation.

2. North-South scientific cooperation

The European Community’s Scientific Programme STD is about to begin phase 3. Like its 2 previous phases (1983-86 and 1987-91), STD 3 will support cooperative research between scientists in developing countries and in Europe, in the areas of Agriculture and Human Health. Poultry production has had its share of research contracts over the past few years and I am happy to acknowledge the presence in this seminar of several of our contractors who will no doubt contribute significantly with their work to the seminar’s success. The award of research contracts is done in a highly competitive way through strict scientific procedures. Joint proposals are presented directly by scientists and their institutions in Europe and developing countries according to research priorities established by the Commission of the European Communities after wide consultation with research leaders in member states and in developing countries. These research priorities are crystallized around mobilizing themes which reflect for each of the sub-sectors the strategic importance assigned to them. Choosing between a number of possible research
themes constitutes thus a first step in the strategic planning of the STD programme.

3. Factors affecting the formulation of a poultry development strategy

Experience in the intensification of poultry production accumulated over the past 40 years has shown that technology is not a limiting factor provided the major inputs can be obtained on time and at a convenient price. Assuming that this is the case, there is still a need for a sizable investment in infrastructure requiring equity or access to credit. Unfortunately, the supply of a key input (grain-based feed) usually accounting for 80% or more of total production costs, often constitutes a limiting factor in Africa where growth of "per capita" food production has not been able to match high population growth rates. Therefore, until relatively cheap feed energy becomes available it is unlikely that industrially produced chickens will become an everyday consumer item in most agriculturally based economies. An indirect strategy to develop poultry production could then be a concentration of efforts in the production of oilseed. An alternative strategy, perhaps more appropriate in the short to medium term horizon, would explore the potential for higher animal productivity leading to increased "per capita" or family income. The two strategies are not antagonistic, they merely have different time horizons, different requirements in capital and technology and thus require different levels of organization of services - input supply and marketing. More likely than not, they will coexist and exploit different development "niches" in the urban/rural social and economic fabric. Our present comments concern exclusively the increase in animal and labour productivity in the peasant sector, both rural and peri-urban.

4. Elements of a possible strategy

Two key resources are available to village poultry production: animals and labour. Whereas the former will have to be acquired somehow the latter has usually a zero opportunity cost, utilizing slack labour from family members. Well-known limiting factors to higher animal productivity are epidemic diseases causing high and recurrent mortality, and infectious and parasitic diseases depressing productivity in a sub-clinical way. The effective control of these diseases will lead to a risk reduction in the utilization of other inputs such as improved feed and genetics.

Since disease control constitutes the main limiting factor it is essential to concentrate our efforts to increase animal and labour productivity initially on disease prevention. This requires an epidemiological characterization of poultry diseases, an evaluation of the technical alternatives available for its control (including its organizational arrangements) and an economic appraisal of these alternatives. Moreover, the possibility of increasing poultry production through the use of disease-resistant strains or species should be thoroughly evaluated wherever it can be demonstrated that there are no market constraints for certain species.
The second element of the strategy relates to the feasibility of stimulating small producers to invest in disease control and eventually other inputs. It is therefore urgently recommended to undertake research on the socio-economic features of producer units with particular emphasis on sustainability under varying income scenarios, generated by increased poultry productivity. This analysis will provide critical information for the planning of suitable economic and/or technical activities.

5. Research requirements

A research strategy can be elaborated on the basis of the above-mentioned elements. When drafting research proposals based on such a strategy, care should be taken to adhere strictly to its contents and to avoid the temptation to draw up "shopping lists" which by definition constitute the absence of any strategy. I do hope that these comments will assist the seminar in defining a poultry research strategy for the benefit of the developing countries of Africa.
3.6 The Mode of Development of Poultry Production in Greece

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Ministry of Agriculture,
2, Acharnior Street, 10176 Athens, GREECE

Abstract

No other production system in agriculture has changed as rapidly and as extensively as poultry production did. This development was mainly based on scientific and technological achievements in genetics, husbandry, nutrition and hygiene.

Greek poultry production was still on the traditional, rural level in 1945/55 when it was chosen for development by the Greek authorities. Agricultural and veterinary offices, schools and institutes on all levels were engaged in the scheme. Activities included the distribution of bulletins and construction plans, films, imported pure-bred hens, pullets and cockerels. Practical demonstrations were organized and financial aid given. Problems that arose included the selection of suitable farmers, pollution in expanding villages, the insufficient supply of imported improved breeds and overproduction of eggs and broilers at times when too many farmers changed from rural poultry production to industrial forms of poultry farming.

The most successful poultry farmers in this scheme became the owners of some of the largest industrial poultry units in the country today. Simultaneously, an intensive poultry industry developed near urban areas.

Résumé

Aucun autre système de production agricole n'a connu de changements aussi rapides et aussi vastes que la production de volaille. Ce développement s'est principalement basé sur des réalisations scientifiques et technologiques dans les domaines de la génétique, de l'élevage, de la nutrition et de l'hygiène.

La production grecque de volailles en était encore au niveau traditionnel et rural en 1945/55, époque où elle fut sélectionnée par les autorités grecques comme secteur à moderniser. Les services agricoles et vétérinaires, les écoles et les instituts à tous les niveaux furent engagés dans le projet. Les activités de développement comprenaient la distribution de communiqués et de plans de construction, de films, de poules pondeuses d'importation, de poulets et de jeunes coqs. On organisa des démonstrations pratiques et on accorda des aides financières. Les problèmes naquirent au moment de la sélection des fermiers adéquats, de la pollution dans les villages en expansion, de l'insuffisance de l'approvisionnement en
meilleures races d'oiseaux importés et de la surproduction d'oeufs et de poulets à rôtir au moment où trop de fermiers passèrent de la production rurale de volailles à des formes industrielles d'élevage.

Les éleveurs de volailles les plus performants lors de ce projet sont devenus les propriétaires actuels de certaines des unités d'élevage industriel les plus importantes du pays. De plus, une industrie intensive de la volaille s'est développée à proximité des centres urbains.

Introduction

In this first part of my speech, I shall give a brief and concise outline of the development of poultry husbandry up to date. In setting up development programmes for poultry in the developing countries, the experience acquired until now should prove useful.

Specific features of poultry production

When opting for the development of poultry, in preference to other sectors of animal production, as well as when drawing up and implementing development programmes, the specific features of this particular field should be taken into account.

The mode of development of poultry production in Greece

I should mention that the subjects and facts that I will elaborate upon in the first and second parts of my speech are not unknown. However, in order to better serve the purpose of this conference, I have included them in a brief presentation, since their importance and role in the development of poultry husbandry has always been quite decisive. Besides, they have also played an essential part in the development of poultry production in Greece.

Poultry industry and its development

Up until and long into the 19th century, poultry husbandry in the world had been practised in the traditional way, that is in rural areas and on a small scale.

Towards the end of the 19th century, the first incubators and hatcheries were introduced, accompanied by artificial brooders and specific brooding space, thus contributing greatly to the evolution and development of poultry husbandry.

More recently, thanks to scientific achievements and technological progress mainly in genetics, nutrition, control of disease, mechanisation and automation of various tasks, poultry husbandry evolved considerably and became an autonomous and essential sector of agricultural economy.

After 1940, the poultry industry and, especially, chicken production, developed so rapidly and impressively in size and form in the industrialized countries, that it is considered to be one of the most amazing events in the history of agriculture. No other
sector of vegetable or animal production has developed so much so quickly.

The methods and systems of production have changed completely and continue to do so. The new forms of poultry production units were adopted quickly by the developed and other countries. The volume of production has multiplied considerably, while fowl performance continues to improve.

This rapid development of the poultry industry is mainly due to the intrinsic nature of fowl - quick reproduction and ability to adapt to artificial conditions of keeping etc. - and to the application of scientific and technological achievements in the following sectors:

- Genetics
- Conditions of keeping
- Nutrition
- Hygiene, prevention and treatment of diseases.

Genetics has been a decisive factor in the development of poultry husbandry, contributing new hybrid strains. Poultry husbandry has fully exploited the achievements of the technological and genetic revolutions.

The most favourable conditions of keeping - temperature, ventilation, humidity, lighting etc. - have been identified and are monitored by electronic devices, and the use of computers is also widespread.

Modern feed contains all the necessary nourishing elements in the appropriate quantities. Rations are calculated by computers, in terms of quantities, proportions and cost of foodstuffs necessary for their composition. I think that feeding of chickens is the most meticulously studied and attended to of all sorts of animal feeding.

The considerable progress achieved in the prevention and treatment of diseases and, more particularly, the discovery of vaccines have effectively reduced losses, while contributing to the stabilisation of poultry breeders' income. This has made it possible to accumulate large flocks, which has given fresh impetus to poultry husbandry.

The construction and application of new, modern and constantly improving poultry house equipment has led to better living conditions for poultry and to an increased saving of human labour, thus allowing poultry production units to grow to an enormous size.

Today, therefore, intensive poultry raising is practised in large poultry houses, usually equipped with automatic machinery, where one man unit can serve more than 20,000 laying hens or 50,000 broiler chickens. The eggs and poultry meat produced are of excellent nutritious and dietetic quality, while, in comparison to other animal products, they cost much less to produce, something that greatly contributes to improved human nutrition.
Whereas, in the past, eggs and poultry used to be among the most expensive foodstuffs, reserved, consequently, for the rich and powerful, or for ailing people, today there is ample supply, in the developed countries, at least.

Specific features of poultry production

Poultry production is characterized by certain specific features which give it a comparative advantage over other sectors of animal production. They can be divided into animal husbandry, structural and economic marketing features.

Animal husbandry characteristics

Hens, like all domestic birds, have a much faster rate of reproduction than any other domestic animal. As a result, it is possible to breed large flocks where all birds are of the same age, thus having the same nutritional requirements and demanding the same environmental conditions.

Today, hen performances are in the order of 250 eggs or 15 kilos as a yearly average, that is to say, a hen can produce, within one year, eggs equaling 6 or 7 times its weight, requiring an average amount of 3.5 kilos of feed for 1 kilo of eggs. When it comes to meat, a hen can produce, within one year and with its direct offspring, more than 75 times its own weight, requiring 2 kilos or even less of feed for 1 kilo of meat (live weight). The comparative figures for rabbits are 15 times, for pigs 10 times, for cows and sheep 1 time, while their feeding requirements are much higher. A hen, therefore, is a highly specialised biological machine that transforms its feed into animal products, eggs and meat with a performance capability much greater than any other domestic animal, with the exception, maybe, of milk cows. Intensive poultry farming, however, demands a high degree of expertise, technical know-how and scientific knowledge.

Structural characteristics

As hens adapt easily to artificial conditions of keeping and are fed with concentrated feeds, the poultry industry can develop without being organically dependent on land and other sectors of agricultural production in general, which is the case with cattle, sheep and goat husbandry. Consequently, the poultry industry is not greatly affected by adversities, such as small agricultural holdings and land distribution in numerous small lots, thus offering the advantage of large production units that do not require much acreage.

Thanks to the animal husbandry characteristics and the systems of keeping of hens, there are increased possibilities for the establishment and operation of sizeable mass-production poultry units that meet the requirements for high productivity, low production costs and strong market competitiveness.
Economic marketing characteristics

In poultry husbandry, the fixed costs, as against variable costs, are relatively low, while there is also considerable mobility of the circulating production capital.

Poultry husbandry exhibits a high degree of adaptability to changing market conditions, due to the relatively short period required for generating output, in comparison to other sectors of animal production.

The mode of development of poultry production in Greece

In the aftermath of the 2nd World War, the Greek economy laid in ruins. A large part of the rural population, especially in the mountainous, semi-mountainous and disadvantaged regions, in general, subsisted on minimal income and faced food shortages. Being a sector of animal husbandry that develops at a quick pace and supplies food products for human consumption at a lower cost than other sectors of animal production, poultry husbandry attracted the interest of the Ministry of Agriculture and was selected, together with other agricultural sectors, for promotion and development, in order to improve the food and income situation of the rural population.

Poultry husbandry in the years 1945/55

The situation of poultry husbandry in Greece in the years following the 2nd World War can be summarized as follows:

Almost exclusively, poultry husbandry took the form of traditional or rural poultry keeping, with very small hen flocks which, in most cases, numbered no more than 10 hens per rural household. It was only natural, then, that poultry husbandry was considered a side-branch of agriculture.

In most cases, there were no proper housing installations for poultry and the few existing poultry houses were inappropriate. Hens were kept together with other animals. To sum up, housing conditions for poultry were extremely bad.

The hen population, local, not belonging to specific breeds but resulting from cross breeding, had, admittedly, low feeding requirements and resistance to unfavourable keeping conditions. Its performance, however, was very low. Hen feeding was inadequate. Hygiene measures, prevention and treatment of diseases were practically non-existent.

Eggs and poultry meat were normally sold to earn money for the family, so that financial needs could be met, or were reserved for the sick members of the family. Seldom were they used for the family’s regular food needs.
Development goals of rural poultry keeping

With the aim of improving the rural population’s food and income conditions, poultry husbandry was selected for development, as already mentioned above, starting off with rural poultry keeping. The priority targets were:

- Improved food situation and increased income for rural families.
- Acquisition of expertise and technical know-how that would be used for the growth of rural poultry production units and, at a second stage, for the establishment of intensive poultry units.

To achieve those goals, activities centered on:

- improvement of housing conditions for hens
- genetic upgrading of the local hen population
- improvement of hen feeding
- improvement of hen care and poultry management
- hygiene measures, prevention and treatment of diseases.

The development programme for rural poultry keeping

The services and departments involved in the implementation of the programme were:

- The Department of Animal Production of the Ministry of Agriculture, which was responsible for the coordination and the implementation of the programme at national level.
- The regional services of the Ministry of Agriculture and their agricultural engineers expert on poultry, responsible for coordination and programme supervision at regional level.
- Local Directorates of Agriculture and their agricultural engineers for animal production, responsible for programme implementation in their respective prefectures.
- Institutes for Agricultural Research and animal production stations, the task of which was keeping and reproduction of improved hen populations and production of pullets and cockerels approximately 50 days old, for marketing purposes, as well as the organisation of seminars on poultry husbandry for agriculturalists and farmers.
- The Agricultural Centres for vocational training, responsible for the training of farmers.
- Extension service agriculturalists and experts in rural home economics, responsible for on-the-spot programme implementation.
- Finally, the veterinary services of the Ministry of Agriculture, involved in the prevention and treatment of poultry diseases and in the organisation of veterinary seminars.

The measures and means used were:

- Bulletins and leaflets on poultry distributed to the farmers concerned.
- Construction plans for rural poultry houses with capacities of 20, 25, 40, 50 and 100 hens, as well as for semi-intensive poultry houses with a capacity of 500 hens.
- Short films on rural poultry keeping, shown at village meetings.
- Improved pure breeds of hens, such as the New Hampshire Red, the Leghorn, the Rhode Island Red etc., imported from abroad, kept and reproduced in agricultural research institutes and animal production stations for the production of chickens.
- Pullets and cockerels, no younger than 5 weeks, reared and produced by the agricultural research institutes and the poultry production stations, that were supplied to farmers so that the latter could improve their poultry flocks.
- Demonstrations of practical procedures and lectures, performed by agriculturalists or rural home economics experts at village meetings.
- Financial aid or subsidies for the construction of poultry houses, the purchase of poultry house equipment and chickens that covered up to 50% of expenditures.
- Loans from the Agricultural Bank of Greece.

Results of the programme

The development programme for rural poultry keeping was implemented over a period of approximately 15 years (1955-1970). Several centres for the development of rural poultry keeping were established in the countryside, eventually becoming the pilot projects for further expansion, as well as the initial step for many pioneering poultry farmers as poultry production units evolved gradually into intensive poultry production units. Simultaneously, intensive poultry industry developed near to urban areas.

Problems in the implementation of the programme

Some problems of minor importance, though, arose due mainly to:

- difficulties in selecting the suitable farmers for the programme
- public health problems in those villages that expanded, later, into bigger communities
- insufficient numbers of improved breeds
- the over-production of eggs and poultry meat, that coincided, mostly, with the periods during which many poultry farmers abandoned rural poultry keeping and engaged in intensive poultry farming
- the fact that no efforts were made to maintain indigenous breeds and their genetic potential. Cross-breeding with imported breeds led to their extinction.

Poultry production in Greece today

Over the past 30 years, the Greek poultry industry has developed and evolved considerably more than any other sector of plant and animal production, both in terms of production volume and rational structure and exploitation of production units. By 1989 production of eggs and poultry meat had grown by, respectively, 145% and 750%, compared with 1960 levels.
TABLE

Production of eggs and poultry meat

<table>
<thead>
<tr>
<th>Year</th>
<th>Tonnnes</th>
<th>Tonnnes</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Eggs</td>
<td>Poultry meat</td>
</tr>
<tr>
<td>1938</td>
<td>28.000</td>
<td>13.000</td>
</tr>
<tr>
<td>1950</td>
<td>22.000</td>
<td>9.000</td>
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<tr>
<td>1960</td>
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<td>18.000</td>
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<tr>
<td>1970</td>
<td>101.000</td>
<td>67.000</td>
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<tr>
<td>1980</td>
<td>120.000</td>
<td>144.000</td>
</tr>
<tr>
<td>1989</td>
<td>130.000</td>
<td>153.000</td>
</tr>
</tbody>
</table>

Today, approximately 65% and 87% of the respective total production of eggs and poultry meat come from intensive poultry industry and the remaining quantities from rural poultry farming. The current production almost meets consumption needs; imports are mainly of products not yet produced in Greece, such as parent stock chickens, egg products (ovalbumins etc.) as well as small quantities of turkey meat and frozen chickens. The latter two categories are imported when there are favourable purchase conditions in the international market. As a result, domestic production either decreases accordingly or accumulates surpluses.

The existing capacity of poultry houses more than suffices to cover consumption needs in eggs and poultry meat. Several poultry houses, however, need to be further modernised. The Greek poultry industry has now overcome the problem of increasing production to meet demand; the existing problems are rather "qualitative" than "quantitative", such as:

- Modernisation of poultry houses
- Improved product quality
- Export growth for eggs and poultry meat
- Coordinated action of competent bodies
- Production of processed eggs and poultry meat
- Increased consumption of poultry meat, the aim being substitution for other meats, the domestic production of which does not cover demand
- Coordinated production of eggs and poultry meat, to avoid seasonal surpluses.

To conclude, I would venture to say that the development of poultry production in the developing countries is expected to follow a similar course to that in Greece.
3.7 LE ROLE DES VOLAILLES NON CONVENTIONELLES
DANS L'AVICULTURE AFRICAINE

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AGA FAO, Via delle Terme di Caracalla,
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Abstract

Traditional poultry keeping is usually taken to mean the production of eggs and chickens from gallinaceous birds.

However, depending on the specific region and food habits, other sub-classes and orders of fowl are also highly valued. We should like to mention in particular guinea-fowl, ducks, turkeys, geese, pigeons and to a lesser extent ostriches and quails, of which the geographical distribution and above all the impact at smallholding level are more restricted.

This paper attempts to identify the importance at regional level of these various fields of poultry specialisation, to outline the interest and to forecast their evolution within the smallholder sector which traditionally goes in for rearing one or the other of these species: the domestic duck has been known in China for at least 3000 years, the guinea fowl has been domesticated in the Sahel zone of Africa for centuries, as has the turkey in Mexico.

At present the development of this "non-conventional" poultry is fairly limited on the African continent, at any rate in the tropical regions. The principle zones of semi-industrial poultry management appear to be Mediterranean Africa for the turkey (Egypt - Tunisia), the quail and the pigeon (Egypt).

However, a number of countries have developed small units covering the various species mentioned, including Côte d'Ivoire, Kenya and Nigeria. Some of these have even developed small processing units, achieving a profitable added value in the finished product. For instance Madagascar fattens ducks and geese to produce foie gras. In South Africa large farms are given over to extensive rearing of ostriches in order to produce feathers, skin, meat and carcase meal, which are marketed both locally and abroad.

Thus although there is a semi-industrial poultry sector as a potential supplier of foreign exchange, most of the non-conventional types of fowl are to be found in traditional smallholdings of limited size in a semi-domesticated state. Sometimes a class of small poultry keepers has specialised in one or the other of these species. This is the case with guinea fowl rearers in the Sahel and Sudan regions. This sector is fairly typical in Burkina
Faso and some of the emigrants from this country have developed this type of poultry rearing in their new countries, such as the Ivory Coast, where the eggs and meat of the guinea fowl are highly prized.

After having set out the classification of the various species under consideration and specified a certain number of performance features, this paper endeavours to locate and quantify their importance and their evolution on the African continent. A brief review of the pathology is also provided.

Interest in family rearing of this type of poultry is analysed before recommendations are put forward for development and improvement.

Résumé

L'aviculture traditionnelle couvre habituellement la production d'œufs et de poulets à partir de gallinacés.

Toutefois, suivant les régions et les habitudes alimentaires, d'autres sous-classes et ordres de volatiles sont également très appréciés. Nous citerons tout particulièrement la pintade, le canard, le dindon, l'oise, le pigeon, et dans une moindre mesure l'autruche et la caille, dont la répartition géographique et surtout l'impact au niveau du petit exploitant agricole sont plus restreints.

La présente communication tente d'identifier l'importance au niveau régional de ces diverses spéculations avicoles, d'en cerner l'intérêt et de prévoir leur évolution au sein de la petite exploitation agricole qui, traditionnellement, s'adonne depuis fort longtemps à l'élevage de telle ou telle espèce: le canard domestique est connu en Chine depuis au moins 3000 ans, la pintade a été domestiquée en Afrique saharienne depuis des siècles, tout comme le dindon au Mexique.

Actuellement, le développement de ces volailles "non conventionnelles" reste assez limité sur le continent africain, du moins dans les régions tropicales. Les principales zones d'élevage semi-industriel semblent être l'Afrique méditerranéenne pour le dindon (Égypte - Tunisie), la caille et le pigeon (Égypte).

De nombreux pays ont cependant développé de petites unités: Côte d'Ivoire, Kenya, Nigeria ... couvrant les diverses espèces considérées. Certains d'entre eux ont même développé de Petites unités de transformation procurant une plus-value intéressante au produit fini. Ainsi Madagascar engraisse canards et oies pour fabriquer du foie gras. En Afrique Australe, de grandes exploitations s'adonnent à l'élevage extensif de l'autruche, afin de produire plumes, peau, viande, et farine de carcasses, commercialisées sur le marché local ou exportées.

S'il existe donc un secteur semi-industrialisé pourvoyeur éventuel de devises, la plupart des volatiles non conventionnels se retrouvent cependant dans les petites exploitations traditionnelles en effectifs limités évoluant à l'état semi-domestique. Quelques fois une classe de petits aviculteurs s'est spécialisée dans l'une ou l'autre de ces espèces. Tel est le cas des éleveurs de pintades dans les régions sahariennes et soudanennes. Ce secteur est assez représentatif dans le Burkina-Faso et certains Burkinabés ont développé ce type d'élevage dans les pays où ils ont émigré, Côte d'Ivoire par exemple, où œuf et chair de pintade sont fortement prisés.
La présente communication, après avoir exposé la classification des diverses espèces considérées et précisé un certain nombre de caractères de performances, s'efforce de localiser et de chiffrer leur importance et leur évolution sur le continent africain. Une revue sommaire de la pathologie est également esquissée.

L'intérêt de l'élevage familial de ce type de volailles est analysé, avant de proposer des recommandations pour son développement et son amélioration.

LE ROLE DES VOLAILLES NON CONVENTIONNELLES
DANS L'AVICULTURE AFRICAINE

1. Classification et origines
   1.1. Classe aves
   1.2. Origines

2. Performances spécifiques
   2.1. L'Autruche
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   2.3. La Pintade
   2.4. Le Dindon
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3. Localisation, importance et évolution de ces différents types d'élevage
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6. Conclusions

Bibliographie
1. Classification et origines

1.1. Classe aves

Sous-Classe: NEORNITHA
Super-Ordre: PALAEOGNATHA
Ordre: Struthioniformes
Famille: Struthionidae

AUTRUCHE (Struthio camelus)
Super-Ordre: NEOGNATHA
Ordre: Anseriformes
Famille: Anatidae

CANARDS
2 espèces: - Anas Platirynchos: canard commun (Pékin, Kaki, Rouen ...)
   (Ducks.
   - Chairina moshata (Canard de Barbarie)
Muscovy

OIES: Plusieurs espèces - Geese
Ordre: Galliformes
Famille: Numididae

PINTADES (Numida, plusieurs espèces)
Guinea fowls
Famille: Phasianidae

DINDONS (Meleagris) Turkey

CAILLES (Coturnix) Quail
Ordre: Columbiformes
Famille: Columbidae

PIGEON (Colomba), nombreuses espèces et
nombreux genres connus.

1.2. Origines


*) Communication Personnelle de L. TAVERNE, Université Libre de Bruxelles, Belgique
L'Oise apparaît en Europe au Miocène et s'y développe pendant tout le tertiaire supérieur et le quaternaire. Ce n'est qu'au Pléistocène (début du quaternaire) qu'elle atteint l'Amérique du Nord et l'Asie.


Le dendon a été découvert en Amérique du Nord au 16ème siècle par les premiers explorateurs européens qui l'ont ramené en Europe. Il est acclimaté partout à l'heure actuelle.

La caille est un oiseau d'apparition assez récente. Quelques restes fossiles sont connus dès le Pléistocène en Europe et en Asie ainsi qu'en Nouvelle-Zélande où l'oiseau vit toujours actuellement, et d'où il a été introduit en Australie.

Quant à la famille des Phasianidae à laquelle appartiennent le dendon et la caille, elle est originaire d'Europe où on la retrouve dès l'Éocène (début du tertiaire). Genre Palaeortyx en France. Elle atteint l'Amérique du Nord à l'Oligocène (début du tertiaire supérieur) et l'Asie au Pliocène (fin du tertiaire).

2. Performances spécifiques

2.1. L'Autoruche

L'éleveage de l'autruche n'est véritablement pratiqué qu'en Afrique Australe. Il a joué un rôle important dans l'économie sud-africaine au début du siècle, où la plume d'autruche représentait en 1913 le 4ème produit d'exportation, après l'or, le diamant et la laine.

Toutefois d'autres produits sont intéressants à commercialiser: la viande, fraîche ou séchée (biltong) - considérée comme impure dans la religion juive - la peau qui fournit un cuir de qualité particulièrement recherché dans la sellerie de haut de gamme.

L'autruche est également utilisée comme animal de sport: les courses sont populaires en Afrique du Sud.

C'est un oiseau bien adapté aux climats secs, mais qui ne se prête guère à l'élevage en petites exploitations, étant donné les besoins en espace (5 à 10 ha/animal adulte). Le troupeau domestique d'Afrique du Sud, d'environ 100,000 têtes actuellement (8 fois moins qu'en 1910) se répartit entre quelques centaines d'exploitations (400), regroupées dans une grande coopérative: le Klein Karoo Landbou Kooperasie (K.K.L.K.), installée à Outshoorn depuis 1947. L'éleveage sud-africain engrange environ 10 millions de dollars US annuellement, dont le tiers à partir des plumes.

L'autruche présente un grand nombre de particularités morphophysiologiques, décrites dans les articles spécialisés.
2.2. Les Palmipèdes

Les volatiles palmipèdes extériorisent des performances exceptionnelles à partir d'une alimentation en grande partie fibreuse. Ils sont également capables de s'associer ou de s'intégrer dans des systèmes de production agricole, communs en régions semi-humides et humides, où ils peuvent apporter une plus-value intéressante. Il y a d'ailleurs bien longtemps que ces performances ont été identifiées et sélectionnées dans le Sud-Est asiatique.

Trois spéculations sont envisageables dans l'élevage du canard: la ponte, la chair et le foie gras. En utilisant des souches appropriées, on s'aperçoit que la productivité du canard est supérieure à celle des gallinacés (Tableau 1).

**Tableau N° 1: Performances comparées entre canes/canards et poules/poulets (Burundi)**

<table>
<thead>
<tr>
<th></th>
<th>Poule Warren</th>
<th>Poulet Arbor/Acre</th>
<th>Cane Pékin</th>
<th>Canard Pékin</th>
<th>Canard Barbarie Local</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pourcentage ponte</strong></td>
<td>60-65</td>
<td></td>
<td>55-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Poids moyen</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>œufs (gr.)</strong></td>
<td>60</td>
<td></td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Solidité Coquille</strong></td>
<td>+/-</td>
<td></td>
<td>+ +</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Indice consommation</strong></td>
<td>4-5</td>
<td></td>
<td>5-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>(gr.aliment/gr.œuf)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prix revient œuf (F.BU.)</strong></td>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Poids réforme (Kgs)</strong></td>
<td>2,2</td>
<td></td>
<td>2,8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Poids 8 semaines</strong></td>
<td>1,8</td>
<td></td>
<td>2,4</td>
<td>2,-</td>
<td></td>
</tr>
<tr>
<td><strong>(Kgs)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Indice consommation</strong></td>
<td>3,-</td>
<td></td>
<td>3,5</td>
<td>3,5</td>
<td></td>
</tr>
<tr>
<td><strong>(Kg/aliment/kg.P.V.)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rendement %</strong></td>
<td>70</td>
<td></td>
<td>73</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td><strong>Prix revient Kg.P.V.</strong></td>
<td>120</td>
<td></td>
<td>70</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td><strong>(F.BU.)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Les races pondeuses les plus réputées sont le Coureur Indien (Indian Runner) et le Kaki Campbell, issu d'un croisement entre le précédent et le Rouen. Il s'agit de deux races légères qui peuvent produire 300 œufs de 60-65 gr./an, à partir de 18 à 20 semaines.
Parmi les canards à rôtir, le Pékin originaire de Chine possède les meilleures aptitudes. La cane présente des performances honorables pour la ponte: 120 œufs de 75 gr.

Le cane de Barbarie est mauvaise pondeuse. Toutefois, la sélection a permis ces dernières années d’améliorer notablement ce caractère, jusqu’à 150 œufs/42 semaines.

La production de foie gras s’effectue à partir de canard et d’oie. Elle est basée sur le gavage naturel ou artificiel de ces palmipèdes pendant 2 à 3 semaines et aboutit à un produit de luxe dont la demande est en croissance sur le marché mondial. Tant pour les canards que pour les oies, il existe des races spécialisées: Barbarie ou Mulard (croisement Barbarie/Pékin ou Barbarie/Rouen) chez le canard, oies de Toulouse et des Landes chez l’oie.

Etant donné que le gavage requiert une main d’œuvre faiblement spécialisée importante, il est certain que cette technique est intéressante à promouvoir dans les pays où l’on peut disposer d’une main-d’œuvre bon marché. Depuis plusieurs dizaines d’années, le gavage est pratiqué à Madagascar avec des résultats très prometteurs.

On retiendra que les canards et oisins gavés procurent également des morceaux à rôtir (magrets et cuisses) de haute qualité.

Les avantages comparés des palmipèdes et des gallinacés sont repris dans le tableau n° 2.

Tableau n° 2: Avantages comparés palmipèdes/gallinacés

<table>
<thead>
<tr>
<th>Pathologie</th>
<th>Gallinacés</th>
<th>Palmipèdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maladies rencontrées</td>
<td>+ + +</td>
<td>+</td>
</tr>
<tr>
<td>Vaccinations imposées</td>
<td>2 à 6 suivant régions</td>
<td>0 à 1</td>
</tr>
<tr>
<td>Risques de Prédation</td>
<td>+ +</td>
<td>+ + +</td>
</tr>
<tr>
<td>Durée chauffage sous l’éleveuse</td>
<td>2 à 3 semaines</td>
<td>1 semaine</td>
</tr>
<tr>
<td>Alimentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrés</td>
<td>+ + +</td>
<td>+</td>
</tr>
<tr>
<td>Sous-produits/déchets</td>
<td>+ +</td>
<td>+ + +</td>
</tr>
<tr>
<td>Fourrages</td>
<td>+/-</td>
<td>+ + +</td>
</tr>
</tbody>
</table>

5. Performances

| Ponte                              | + +        | + + +      |
| Poids carcase                       | + +        | + + + +    |
| Indice consommation                | + + +      | +          |
On retiendra essentiellement que les performances de ponte et de chair sont meilleures chez les palmipèdes, que le prix de revient du produit fini est plus économique du fait de la valorisation par les palmipèdes de produits en grande partie fibreux peu utilisables par les gallinacés, que les contraintes pathologiques sont réduites.

Toutefois, les pertes essentielles se produisent pendant les premiers jours, pendant lesquels canetons et oisins, très peureux et très frieurs sont excessivement sensibles aux aléas climatiques et aux prédateurs. Une des règles d’or de la réussite de ce type d’élevage est de maintenir obligatoirement enclaustration les jeunes de moins de 2 semaines.

Un des avantages essentiels de l’élevage du canard est son intégration aisée et rentable aux systèmes de production agricole rencontrés en région humides et sub-humides, particulièrement à la riziculture. Dans le même ordre d’idées, le canard s’associe facilement à d’autres élevages, particulièrement à ceux du porc et du poisson (Figure 1).

Figure n° 1
(de: DEVENDRA, Pig Production in the Tropics)
Quant à l’oie, outre son rôle dans la production de foie gras, on retiendra également sa production importante en viande: un couple d’oies, disposant de fourrage et d’eau en toutes saisons, peut fournir annuellement à une famille 40 à 60 Kgs de viande pendant 20 ans. Leur période reproductrice est plus longue que celle de tout autre volatile domestique et leur alimentation peut être composée principalement de fourrages frais. Elles sont également utiles dans l’entretien des plantations de café, bananiers, ananas, sisal, palmiers, ... Leur rôle de sentinelle n’est pas à négliger dans les régions où les volis domestiques ont tendance à s’amplifier.

Enfin, la production d’un fumier de qualité est particulièrement importante dans ces espèces.

2.3. La Pintade

Originaire d’Afrique, la pintade s’y rencontre en grands effectifs, principalement dans les régions sèches des savanes sahéli-soudaniennes, où elle vit en bandes soit à l’état sauvage, soit en semi-domestication, c’est-à-dire en liberté autour des habitations, les oiseaux couchant sur les arbres et cherchant la presque totalité de leur nourriture dans les champs. Il est toutefois possible d’élever des pintades en climat humide. On remarquera d’ailleurs qu’en Afrique tropicale, la ponte n’a lieu qu’en saison pluvieuse.

La chair de la pintade a une saveur rappelant celle du gibier à plume: ce goût de "sauvage" plait aux consommateurs, blasés du poulet de chair à saveur fade. Cet engouement très perceptible dans les pays industrialisés, ne fera que s’amplifier dans les pays africains déjà amateurs séculaires de ce type de produit.

L’élevage de la pintade est probablement promis à un bel avenir, à condition d’en maîtriser les contraintes.

L’élevage en liberté ou semi-liberté pose problème sur le plan de la pathologie, mais aussi sur celui de la reproduction: en effet, les pintades pondent où bon leur semble et la collecte des œufs s’avère difficile.

L’élevage en claustrofie s’opère de préférence dans des locaux obscurs, pour éviter les accidents dus aux paniques. La densité au m² tourne autour de 10.

À l’heure actuelle, les résultats rencontrés dans l’amélioration de l’élevage des pintades en Afrique Tropicale se sont révélés assez décevants. Tel est, par exemple, le cas du Burkina Faso, dont le plan ambitieux de développement de cet élevage au sein du Projet de Développement de l’Aviculture Villageoise s’est heurté depuis 1988 à un ensemble de causes multifactorielles, entraînant une mortalité importante des pintadeaux.

On notera également que le pintadeau présente des performances (*) moins élevées que le poulet: poids d’abattage de 1,2 kg, atteint à 12 semaines, indice de consommation de 3,5 à 4, que la pintade a une ponte saisonnière relativement faible: 90 œufs pour 180 jours de ponte, que le taux d’éclosion tourne autour de 60 à 70 %.

(*) Performances enregistrées chez des souches améliorées. Ces dernières années toutefois, la sélection et l’insémination artificielle ont permis d’effectuer des progrès spectaculaires:
- Œufs pondus: 165-185 en 9-10 mois
- Poids moyen à 12 semaines: 1,480 kg
- I.C. = 2,7 - 3,2 (chiffres communiqués par la Société GALOR)
Ces diverses caractéristiques expliquent que le prix de revient du produit fini est relativement élevé et qu’en conséquence, le pintadeau représente un aliment de luxe, tout comme le pigeon ou la caille.

2.4. Le Dindon

Cette réserve n’est plus applicable à l’élevage du dindon. Auparavant, ce dernier représentait un plat de luxe traditionnel à certaines fêtes religieuses (Noël dans les pays chrétiens) ou civiles (Thanksgiving Day aux U.S.A.). Les progrès accomplis sur les plans de l’amélioration génétique, de l’efficacité alimentaire et de la prophylaxie sanitaire, ont permis dans de nombreux pays - eient autres en Afrique du Nord - de développer des unités rentables de production et de transformation.

La dinde représente à l’heure actuelle la source de viande la plus économique. Par rapport au poulet, le dindon conserve son taux d’efficacité alimentaire beaucoup plus tard, jusqu’à 24 semaines. Autre avantage, le rendement s’améliore avec l’âge, et les pertes dues à la préparation peuvent diminuer jusqu’à 15 % à partir de 18 semaines, alors qu’elles s’élèvent à 30 % chez le poulet de 8 semaines.

Compte tenu de cette constance dans le taux d’efficacité alimentaire, le dindon peut être abattu à différents âges et à différents poids en fonction de la demande du marché local. Il peut également être conduit à un poids relativement élevé et vendu à des entreprises de transformation qui le conditionneront, sous forme de viande fraîche : escalopes, pilons, saucisses, ... ou de produits charcutiers. A cet égard, les pays religieusement hostiles à la consommation de viande de porc (juifs, musulmans, coptes) peuvent avantageusement remplacer celle-ci par la viande de dinde. L’exemple d’Israël est significatif à cet égard : en 1975, la consommation de dinde représentait 12 % de la viande totale, alors qu’elle ne représentait que 2 % de la consommation anglaise.

A part l’Afrique du Nord et du Sud, l’élevage de la dinde n’est cependant guère développé dans les autres régions du continent, particulièrement en zones intertropicales.

D’une part, le marché n’est réellement intéressant qu’aux fêtes de fin d’année, chez certaines classes de la population citadine, d’autre part le manque de technicité se heurte à une pathologie qui reste meurtrière, particulièrement du fait de l’histomonose.

La promotion de ce type de production animale ne pourra donc s’effectuer qu’à la suite d’un apprentissage de goût du consommateur africain, favorisé par la disponibilité d’un produit à coût modéré.

Le choix du site est important dans l’élevage de la dinde. En régions sèches, sur sols sableux, le dindon s’engraisse facilement en semi-liberté. Sur des sols lourds, en régions humides, l’élevage en claustration sur des litières bien sèches est recommandable.
2.5. Le Pigeon

Le pigeon est peu répandu en Afrique Tropicale. Sa consommation est commune par contre en Afrique du Nord. Il représente une viande de luxe pouvant générer un revenu très satisfaisant à partir d’investissements mini- mes, tant sur le plan des infrastructures que du logement. Ce dernier est indispensable pour mettre les pigeonneaux à l’abri des prédateurs. Quelques résultats enregistrés au Soudan et au Rwanda font état de 8 couvées et d’une production de 10 à 15 pigeonneaux par an et par couple. Les carcasses vides pesent en moyenne 200 gr. Un couple peut ainsi produire 2 à 3 kg de carcasse par an, ce qui, pour un petit exploitant, peut représenter un complément de revenu intéressant.

La consommation alimentaire d’un couple de pigeons, ayant élevé 14 pigeon- neaux, se situe entre 35 et 50 kg de grains par an suivant le format, ce qui représente le prix de vente de 2 à 4 pigeonneaux. En Afrique Tropicale, maïs et arachides, accompagnés d’un complément vitaminique et minéral, peuvent aisément constituer la base de la ration.

Les races utilisables sont nombreuses. En général, les croisements mâles, Mondain sur femelle Carneau (très prolifique) donnent les meilleurs résultats: pigeonneaux de 400 grs à un mois.

Toutefois, il est de plus en plus commun d’utiliser des races autosexables, telles les King et les Texans car le sexage visuel est très difficile, le mâle ne présentant aucun caractère sexuel secondaire, facilement identifiable.

2.6. La caille

Enfin, l’élevage des cailles, fréquemment pratiqué en Afrique du Nord, est quasiment inconnu en Afrique Tropicale. Comme la pintade, il s’agit également d’un type de gibier d’élevage. La caille domestique provient du Japon où, pendant six cents ans, elle a été sélectionnée pour son chant.

Ce n’est qu’au début de ce siècle que la sélection a porté sur la ponte et la chair. Au Japon et en Chine, c’est la viande qui est recherchée par les consommateurs qui la paient au prix fort dans les autres parties du Monde.

La caille présente un ensemble de caractéristiques qui en font l’oiseau domestique le plus productif :

- rapidité du développement embryonnaire: 16 jours sont nécessaires pour l’éclosion,
- précocité sexuelle atteinte dès la 6ème semaine,
- prolificité: la caille pond 200 à 250 œufs de 5 à 10 grs/ch, avec un taux d’éclosion de 70 %,
- une croissance rapide: 150-180 grs. à 7 semaines.

Une caille peut donc produire 21 à 31 kg de viande par an, ce qui représente 130 à 180 fois son poids vif adulte (150-170 grs) (Tableau 3).

L’élevage intensif de la caille suppose toutefois une bonne technicité, jointe à l’utilisation d’infrastructures et de matériel coûteux (batteries).

De tels investissements ne sont justifiables que grâce à l’existence d’un marché local intéressant. Tel est le cas de certaines régions touristiques.
d’Afrique du Nord, ou de certaines grandes métropoles où une clientèle de citadins aisés pourrait justifier l’implantation de quelques exploitations de moyennes dimensions.

**Tableau 3: Productivité annuelle comparée des volailles (souches améliorées)**

<table>
<thead>
<tr>
<th></th>
<th>Nb Oeufs</th>
<th>% éclosion</th>
<th>Taux mortalité</th>
<th>Nb sujets abattus</th>
<th>P.V. abattage (kg)</th>
<th>P.V. Total (kg)</th>
<th>P.V. Reprod. (kg)</th>
<th>Rapp. P.V. abattu Pds Repro.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poule</td>
<td>180</td>
<td>80</td>
<td>10</td>
<td>130</td>
<td>1,8</td>
<td>233</td>
<td>3</td>
<td>77</td>
</tr>
<tr>
<td>Cane Pékin</td>
<td>150</td>
<td>50</td>
<td>10</td>
<td>68</td>
<td>2,3</td>
<td>156</td>
<td>3,5</td>
<td>45</td>
</tr>
<tr>
<td>Barbarie</td>
<td>50</td>
<td>50</td>
<td>10</td>
<td>23</td>
<td>2,8</td>
<td>64</td>
<td>3,8</td>
<td>17</td>
</tr>
<tr>
<td>Oie</td>
<td>80</td>
<td>50</td>
<td>15</td>
<td>34</td>
<td>5</td>
<td>170</td>
<td>7,0</td>
<td>24</td>
</tr>
<tr>
<td>Pintade</td>
<td>90</td>
<td>70</td>
<td>15</td>
<td>54</td>
<td>1,2</td>
<td>65</td>
<td>2,7</td>
<td>24</td>
</tr>
<tr>
<td>Dinde</td>
<td>70</td>
<td>80</td>
<td>20</td>
<td>45</td>
<td>5</td>
<td>225</td>
<td>6,5</td>
<td>35</td>
</tr>
<tr>
<td>Pigeon</td>
<td>16</td>
<td>90</td>
<td>20</td>
<td>14</td>
<td>0,4</td>
<td>5,6</td>
<td>1,6</td>
<td>3,5</td>
</tr>
<tr>
<td>Caille</td>
<td>225</td>
<td>70</td>
<td>10</td>
<td>142</td>
<td>0,17</td>
<td>24</td>
<td>0,23</td>
<td>104</td>
</tr>
</tbody>
</table>

(*) Sont pris en compte les sex. ratio suivantes:

- Poule, Dinde : 1/10
- Canard, Oie, Pintade : 1/5
- Caille : 1/3
- Pigeon : 1/1

3. **Localisation, importance et évolution de ces différents types d’élevage**

3.1. **Effectifs**

Très peu d’informations sont disponibles. D’après la FAO (1), il y aurait 16 millions de canards en Afrique et 6 millions de dindons. Les effectifs les plus nombreux sont recensés en Egypte (50 % des canards, 33 % des dindons) et à Madagascar (33 % des canards, 66 % des dindons). Il ne s’agit, en fait, que d’estimations en l’absence de toute statistique fiable.

Il est intéressant de comparer ces effectifs avec ceux d’autres continents, ou d’autres pays situés en régions intertropicales. L’Asie, le Bangladesh et la Thaïlande possèdent 20 millions de canards, l’Indonésie 27, et le Viêt-Nam 30.
Les pays en voie de développement comptent 116 millions de canards, dont les 2/3 en Extrême Orient.

Quant au dindon, le troupeau le plus important se trouve en Amérique du Nord: 83 millions, dont 67 aux U.S.A. et 10 au Mexique. En Europe, sur un total de 60 millions, les 2/3 se répartissent entre la France (18 millions) et l'Italie (22 millions). L'U.R.S.S. compte également un effectif important de 65 millions de têtes (2).

La majeure partie du Troupeau des P.V.D. se trouve en Amérique Latine (2) mais représente moins de 10 % de l'effectif mondial. La part de l'Afrique est négligeable. 

Il n'existe malheureusement pas de statistiques sur les autres espèces de volailles.

Toutefois, compte tenu de leur origine et de la prédilection de certaines populations pour leur élevage, il est permis de supposer que les effectifs de pintades sont élevés, particulièrement en régions semi-arides et à l'état semi-domestique.

3.2. Evolution

Contrairement aux gallinacés, les statistiques officielles ne montrent que peu de changements dans les effectifs de canards et de dindons au cours de la décennie 80.

Cependant, pour peu que l'on parcoure le continent africain, il apparaît que de nombreux efforts ont été tentés dans les diverses régions pour intéresser les exploitants à diversifier leurs volailles. Souvent, ces projets ont été partiellement couronnés de succès. Il n'en reste pas moins vrai que très peu d'informations sont disponibles et que les tentatives en ce domaine sont dispersées et très mal connues. La plupart des projets dépendent:

- soit d'initiatives privées: il s'agit alors d'exploitations d'une certaine importance, installées après une bonne étude de marché, ayant abouti à la passation de contrats, et à une quasi-intégration avale entre l'exploitation et les acheteurs potentiels (surfaces commerciales, chaînes d'hôtels/restaurants)

- soit d'organisations non gouvernementales: dans ce cas, les projets pechent par le manque de continuité. Bien souvent en effet, les techniciens sont de jeunes volontaires, sans expérience préalable, qui ne demeurent en poste qu'un an ou deux.

Quoi qu'il en soit, ni les privés ni les ONG n'ont pour habitude de rédiger des documents (rapports, compte-rendus) collationnant et analysant leurs observations et leurs résultats.


(2) Le CIDEF fait état de 244 millions en Italie, 22 millions en URSS, 19 au Canada, 10 au Brésil, 8 en Argentine et au Mexique.
Il pourrait ainsi être recommandé une mission de consultation, chargée de faire l'état des essais entrepris et des résultats obtenus dans ce type d'élevage à travers les diverses régions d'Afrique Tropicale.

Toutefois, cette mission devrait succéder à une vaste enquête préliminaire précisant tout d'abord l'impact de l'aviculture traditionnelle et l'importance des différentes espèces identifiées et recensées au sein de celle-ci.

4. Problèmes pathologiques


Aucune de ces deux maladies n'a été officiellement signalée en Afrique. La pathologie du dindon et de la pintade n'a pas été systématiquement identifiée. Toutefois, un certain nombre de maladies ont été signalées au hasard des publications ou d'informations personnelles. Tout d'abord, il existe un certain nombre de maladies communes aux diverses espèces de volailles.

4.1. Maladies infectieuses

Pullorose et autres Salmonelloses (Paratyphose) frappent aussi bien poussins que canetons, dindonneaux, oisins, pigeonneaux et pintadeaux. Des mesures de prophylaxie rigoureuses seront donc prises lorsque la maladie est signalée. Dans le cas des élevages familiaux, où les diverses espèces cohabitent, il peut être utile de vacciner toutes les espèces de volailles (sauf pigeon).

L'incorporation de furazolidone (0,04 %) dans l'aliment peut être conseillée pendant les deux à trois premières semaines comme traitement préventif.

Le choléra (pasteurellose) peut frapper le caneton après 4 semaines. Traitement aux antibiotiques (tetracyclines).

La variolo-diphthérie se rencontrent chez les canards, dindons et pigeons. Il n'est pas habituel de procéder à la vaccination, sauf chez le pigeon. Chez le canard et le dindon, on s'efforcera d'éliminer les animaux atteints.

4.2. Maladies parasitaires

La coccidiose est due à des Eimeria spécifiques: meleagridis chez le dindonneau où la maladie présente une évolution comparable à celle des poussins. Prophylaxie et traitement identiques. Par contre, Eimeria Truncata du canard et de l'oie se localise au niveau des reins (nodules blanchâtres, évolution chronique peu symptomatique).

L'ascaridiose est habituelle chez le pigeon où il convient de traiter systématiquement (vermifugeage trimestriel).

L'hétéraïkidoose se rencontre chez le canard, le dindon et l'oie au niveau des coeca. Chez le dindon, l'infestation se complique généralement d'histomonose ou "maladie du rouge". L'histomonose est une affection intestinale et hépatique, particulièrement grave chez le dindon; elle se rencontre également chez le poulet et la pintade. L'agent étiologique est Histomonas meleagridis
et son vecteur est représenté par les œufs d’Heterakis gallinorum courant chez les gallinacés. D’où le danger de la promiscuité entre les deux espèces de volailles. Il ne semble pas que l’âge influe sur la résistance du dindon.

Le contrôle de la maladie n’est guère possible par élimination de Heterakis, surtout si les dindons sont élevés à l’extérieur où ce Nématode survit très longtemps dans le sol en s’enkystant sous forme de larves.

L’histomonose est probablement la maladie la plus redoutable dans l’élevage du dindon, particulièrement en conditions d’humidité favorable à la survie des parasites et de leur vecteur.

En conséquence, il convient de réserver plutôt ce type d’élevage aux régions à climat sec, ou de traiter préventivement les animaux, par incorporation dans l’aliment de dimitridazole, épronidazole et ronidazole.

D’autres parasites digestifs sont également rencontrés chez les volailles en divagation. Leur fréquence est variable:

- Capillaria chez toutes les espèces dans le jabot et l’intestin.
- Amidostomum dans le gésier du canard et de l’oie.
- Railetina chez le dindon et la pintade.

Trichomonas gallinae, due à un protozoaire flagellé: Trichomonas gallinæ est fréquente chez le pigeon. Elle se prévient et se traite par les mêmes produits que l’histomonose. Lésions localisées dans le jabot et pouvant gagner les régions voisines.

4.3. Maladies fongiques

L’aspergillose se rencontre plus fréquemment chez le canard et l’oie évoluant en milieu semi-aquatique, et sur des litières chaudes et humides où la moisissure responsable se développe sous forme d’un mycelium se propageant dans les sacs aériens.

La candidose est fréquente chez la pintade qui y est très sensible. Elle est due à une levure, normalement saprophyte: candida albicans. Les lésions intéressent essentiellement le jabot dont la muqueuse est revêtue d’un enduit blanchâtre.

Dans ces deux cas, le respect des règles d’hygiène est essentiel pour limiter le développement des levures et moisissures.

4.4. L’aflatoxicose

L’aflatoxicose peut être rapprochée des maladies fongiques puisque la production d’aflatoxine est le fait d’une moisissure très répandue en conditions chaudes et humides: Aspergillus flavus. Précédemment identifiée sur l’arachide et ses sous-produits, on la retrouve sur de nombreuses céréales: maïs, riz, ... et leurs sous-produits agro-industriels: sons, farines basses, ... Aussi faut-il être particulièrement attentif lors de l’utilisation de ceux-ci dans l’alimentation des volailles, parmi lesquelles le caneton se révèle très sensible à l’aflatoxine, et représente d’ailleurs un instrument de diagnostic pour l’évaluation de la toxicité de ce poison.
4.5. Parasites externes

Tiques (Argas, Dermaysses), Poux et Puces des oiseaux sont abondants en régions tropicales. Ils s’attaquent préférentiellement aux gallinacés et aux pigeons. Chez ces derniers, un excellent moyen préventif est de disposer des déchets de tabac dans les nids. La nicotine a un effet répulsif sur les ectoparases.

5. Intérêt de l’élevage familial des volailles non conventionnelles

Cet intérêt peut se concevoir sous trois aspects:

1°) Auto-consommation
2°) Revenu monétaire
3°) Intégration au sein de certains systèmes agricoles spécifiques

5.1. Auto-consommation

L’auto-consommation suppose l’évolution du goût du consommateur rural africain, ainsi que l’élimination de certains tabous. L’acceptation ou le rejet de certaines viandes varie avec la tradition locale ou la religion. L’éducation et/ou la présence de certaines carences nutritionnelles peuvent représenter des catalyseurs dans l’acceptation de certains aliments.

Actuellement, parmi les espèces considérées, seule la pintade est unanimement appréciée. Les autres espèces sont peu ou pas consommées.

5.2. Revenu monétaire

La production d’un revenu monétaire complémentaire et d’une épargne facilement mobilisable représente partout en Afrique l’objectif principal du petit élevage.

Les volailles non conventionnelles n’échappent pas à la règle. Toutefois, la présence d’un marché intéressant est impérative. Or, si ce dernier existe par exemple à proximité de certaines villes - son importance est peu connue et, de tout manière, le petit exploitant n’en est pas informé. S’il fallait développer certaines productions, des enquêtes préliminaires s’imposeraient pour:

- quantifier le marché potentiel,
- déterminer les périodes favorables,
- organiser la production en conséquence.

Exemples:

* si un marché existe pour la dinde en fin d’année, il convient que les dindeins soient disponibles en juillet/août pour les exploitants.

* un hôtel/restaurant peut passer un contrat avec de petits exploitants pour une production régulière de pintades, canards ou pigeons.

Il est certain que de telles possibilités existent et que, dans certains pays, elles sont exploitées non par de petits fermiers, mais plutôt par des producteurs de moyenne importance.
Le regroupement des petits exploitants s'avère donc utile pour faciliter la commercialisation, ainsi que dans la fourniture des intrants nécessaires.

5.3. Intégration au sein du système agricole

Il semble cependant que l'intérêt majeur de certaines volailles soit leur facilité d'élevage et d'intégration au sein de certains systèmes agricoles. A cet égard, le développement de la riziculture joint à la facilité d'élevage du canard en milieu semi-humide représente un cas de figure intéressant.

Il semble d'ailleurs que cet élevage soit en progression, tout en étant facilement améliorable:

- par l'utilisation de souches performantes; en effet, le canard le plus commun est le Barbarie, à taux de ponte faible et dont les performances de croit sont basses, par rapport à leurs congénères des régions tempérées.

- par la protection des jeunes caneton pendant les premières semaines

- par une complémentation alimentaire peu coûteuse (son de riz) avec généralisation de la culture d'Azolla dans les rizières.

Ces diverses propositions ne sont pas originales et sont vulgarisées depuis bien longtemps dans les rizières, canaux et étangs d'Extrême Orient.

Un problème essentiel réside dans l'augmentation de la consommation du canard et/ou des œufs de can par la population africaine.

L'élevage de la pintade est, pour sa part, traditionnel dans les zones sèches. Il est très apprécié des populations locales et son développement ne devrait guère rencontrer de difficultés sur le plan psychologique. Toutefois, les essais menés ces dernières années se heurtent essentiellement à l'amélioration de la technicité de l'exploitant. Il conviendra de persévérer dans ces tentatives en faisant appel à des spécialistes qualifiés afin de vulgariser:

- des modèles de gestion adaptés aux petites exploitations,
- des souches rustiques et performantes,
- des plans de prophylaxie et d'alimentation rationnels et économiques.

Quant aux autres volatiles, ils semblent difficilement vulgarisables chez le petit exploitant:

- le caractère très saisonnier du marché de la dinde ou la nécessité de conditionner celle-ci dans des ateliers de transformation, supposent une organisation rationnelle de la production, envisageable dans de grandes unités. Tout au plus pourrait-on envisager l'installation de coopératives de petits éleveurs, se chargeant de la fourniture des intrants, de la commercialisation, de l'abattage et de la transformation des produits.

- la technicité que requiert l'élevage de la caille jointe à la nécessité de l'existence d'un marché de "luxe" restreint ce type d'élevage à des exploitations spécialisées.

- le gavage des oies et canards rencontre un succès certain à Madagascar. Il pourrait être étendu à d'autres pays, disposant d'une main-d'œuvre économique.
Cependant, si l'on étudie les tableaux représentant la production totale malgache de 1988, on s'aperçoit que 68 % des canards et foie gras sont produits par 10 exploitants, soit 2,4 du total des gueurs, les 32 % restants étant fournis par 383 petits (353) et moyens (30) gueurs.

Tableau n° 4: Madagascar effectif des gueurs (1990)

<table>
<thead>
<tr>
<th>Type de gueurs</th>
<th>canards/semaines</th>
<th>effectifs Nombre/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>petits</td>
<td>1 à 5</td>
<td>203</td>
</tr>
<tr>
<td></td>
<td>5 à 10</td>
<td>150</td>
</tr>
<tr>
<td>moyens</td>
<td>10 à 20</td>
<td>30</td>
</tr>
<tr>
<td>gros</td>
<td>&gt; 20</td>
<td>10</td>
</tr>
</tbody>
</table>

Tableau n° 5: production totale (1990)

<table>
<thead>
<tr>
<th></th>
<th>gros gueurs</th>
<th>autre gueurs</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>canards (Nbre)</td>
<td>12.000</td>
<td>5.600</td>
<td>17.600</td>
</tr>
<tr>
<td>foie gras (kgs)</td>
<td>4.200</td>
<td>1.960</td>
<td>6.160</td>
</tr>
<tr>
<td>carcasse (kgs)</td>
<td>54.000</td>
<td>11.760</td>
<td>65.760</td>
</tr>
</tbody>
</table>

Il est donc permis de se demander à nouveau s'il s'agit d'une spéculation à encourager chez le petit exploitant ou l'entreprise spécialisée.

- La diffusion systématique d'un couple d'oies pourrait se révéler intéressante, à condition:
  1°) que les produits soient effectivement auto-consommés,
  2°) que les précautions soient systématiquement prises pour éviter que ces oies ne causent des dégâts aux cultures.

- Enfin, l'installation de petits pigeonniers pourrait apporter un complément de revenu intéressant à condition que les pigeonneaux soient à l'abri des multiples prédateurs, que les couples soient correctement alimentés et régulièrement déparasités.

En ce cas, la faible productivité apparente du pigeon (Tableau n° 3) est compensée par le prix élevé du pigeonneau de consommation. A titre d'exemple, la production de 5 couples de pigeons équivaut au Burundi au Produit National Brut par habitant.
6. Conclusions

À l’heure actuelle, le marché des volailles non conventionnelles reste encore très limité sur le continent africain, particulièrement au Sud du Sahara.

Seule exception : l’engouement pour la pintade dans les régions sèches. Toutefois, cet élevage semi-dématique se heurte à de nombreux obstacles, lorsqu’on veut l’améliorer. De plus, ses caractéristiques spécifiques en font un élevage peu productif, orienté plutôt vers une clientèle de luxe.

L’élevage du canard semble extrêmement prometteur dans les régions humides, à condition d’utiliser des souches plus productives que le canard de Barbarie local, dont les caractéristiques de ponte et de croît sont faibles, et des systèmes de production permettant de limiter les pertes élevées dans le jeune âge.

Par ailleurs, la consommation des produits du canard : œufs et viande, se heurte à une réticence traditionnelle qui devrait s’estomper avec une bonne politique d’information et de vulgarisation.

Les autres espèces de volailles demandent une technicité plus élaborée, ainsi que l’existence d’un marché qui demeure actuellement très modeste, saisonnier, et restreint à une clientèle relativement aisée. Certaines productions requièrent des installations d’abattage et de transformation onéreuses. Elles ne peuvent donc se concevoir au niveau de la petite exploitation familiale, à moins d’une intégration de cette dernière au sein de regroupements plus importants.

Quoi qu’il en soit, les informations de base font défaut pour décrire la situation exacte de ces types d’élevage à travers les différentes régions, identifier leur impact et leur intérêt, et programmer éventuellement leur développement en fonction des éventuelles demandes des consommateurs potentiels.

Une enquête préliminaire s’avère donc indispensable pour déterminer ces différents paramètres et proposer des stratégies adaptées aux diverses situations rencontrées. Cette enquête pourra aisément s’inclure dans une étude générale des systèmes avicoles familiaux en prenant toutefois en considération les caractéristiques spécifiques de certains volailles : adaptabilité à l’écosystème, intérêt du paysan, existence et importance d’un marché local.
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3.8 The Integration of Rural Production into the Family Food Supply System

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Abstract

Over 6000 million poultry are kept in developing countries, almost two for each human in these parts of the world. They provide a preferred form of animal protein for the majority of the population in developing countries because there are few taboos affecting their consumption. This is not the case with other forms of animal protein such as that derived from pigs and from cattle.

The greater part of these poultry is kept under scavenging conditions and therefore does not compete for those foodstuffs that humans could eat directly such as maize and groundnuts. This advantage is partially outweighed by the fact that such birds are very unproductive. The likely offtake from a scavenging flock is probably between 20 and 40 % (2 to 4 carcasses provided each year from a breeding flock of 10 birds). This compares with a 10.000 % output (1000 carcasses produced from a breeding flock of 10 birds) from intensively reared broiler breeders. Thus a scavenging flock of 10 birds will provide three to six kg of meat a year. This is about 10 % of the animal protein requirement of a family of five persons (50 kg a year).

If it is assumed that the 6,000 million poultry found in developing countries produce at the above rate they will provide approximately 5,850 tonnes of meat for 3,900,000 persons, or only 1.5 kg per person per year. Clearly at these levels of production poultry are making only a minor contribution overall to human nutrition in the poorer sector of the third world. However, those families with 10 chickens or more clearly receive a useful addition to their protein supply. If the production of these chickens were improved by even a modest amount these birds could meet a family's needs for animal protein.

Résumé

Les pays en voie de développement comptent plus de 6000 millions de volailles, ce qui représente presque deux oiseaux par habitant dans cette partie du globe. Elles fournissent une forme préférentielle de protéines animales à la majorité de la population des pays en voie de développement, car il existe peu de tabous concer-
nant leur consommation, ce qui n’est pas le cas pour d’autres formes de protéines animales comme celles dérivées du porc et du bétail. La plupart de ces volailles se nourrissent en fouillant dans les ordures et ne représentent donc aucune concurrence pour les aliments que les êtres humains pourraient manger directement, à savoir le maïs et les arachides par exemple. Cet avantage est considérablement réduit par le fait que de tels oiseaux sont très improductifs. La mortalité dans une colonie d’oiseaux se nourrissant de déchets se situe probablement entre 20 et 40 % (2 à 4 carcasses produites par une colonie de 10 oiseaux pondeurs), en comparaison avec un output de 10.000 % (1000 carcasses produites par une colonie d’oiseaux pondeurs) de poules reproductrices élevées de manière intensive. Ainsi, une colonie de 10 oiseaux se nourrissant de déchets fournira trois à six kg de viande par an, ce qui représente environ 10 % des besoins en protéines animales d’une famille de cinq personnes (50 kg par an).

Si l’on suppose que les 6.000.000.000 de volailles qui se trouvent dans les pays en voie de développement ont un taux de production égal à celui mentionné plus haut, elles fourniront approximativement 5.850 tonnes de viande pour 3.900.000 personnes, ce qui représente 1.5 kg de viande par personne et par an seulement. Il est clair qu’à ce niveau de production, la volaille ne représente qu’une part mineure dans l’alimentation des hommes dans le secteur le plus pauvre du tiers monde. Néanmoins, les familles qui possèdent 10 poulets ou plus en tirent un supplément précieux pour leur approvisionnement en protéines. Si l’on pouvait améliorer, voire même faiblement, la production de ces poulets, ces oiseaux pourraient couvrir les besoins d’une famille en protéines animales.

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Why poultry are used as a source of animal protein for humans

Poultry in one form or another are kept in most areas of the world. There are fewer religious or social taboos associated with them than there are with pigs and cattle. Products produced by or from poultry provide an acceptable form of animal protein to most people throughout the world, with the exception of strict vegetarians and vegans. Some Hindu vegetarians are willing to consume eggs produced by intensively kept poultry because these eggs have not been fertilized and are therefore not perceived as potentially living creatures. On the other hand they are unwilling to
consume the eggs produced by scavenging poultry because these will almost certainly be fertile.
The actual number of poultry in the world is twice the human population. Chickens are by far the most important species (Table 1). These data should be treated with caution because many of the figures are based on estimates.

Table 1: World Population of Poultry and Humans in Selected Areas and Countries (millions) (FAO 1988)

<table>
<thead>
<tr>
<th></th>
<th>Chicken</th>
<th>Ducks</th>
<th>Turkeys</th>
<th>Turkeys</th>
<th>Total Human Population</th>
<th>Poultry per Human in Agric.</th>
<th>Poultry Per Human in Agric.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>1.280</td>
<td>29</td>
<td>64</td>
<td>46</td>
<td>497</td>
<td>29.8</td>
<td>2.76</td>
</tr>
<tr>
<td>South America</td>
<td>879</td>
<td>9</td>
<td>8</td>
<td>70</td>
<td>285</td>
<td>12.8</td>
<td>3.14</td>
</tr>
<tr>
<td>Asia</td>
<td>4.019</td>
<td>433</td>
<td>11</td>
<td>1.755</td>
<td>2.994</td>
<td>2.6</td>
<td>1.50</td>
</tr>
<tr>
<td>Africa</td>
<td>828</td>
<td>13</td>
<td>5</td>
<td>375</td>
<td>610</td>
<td>2.3</td>
<td>1.30</td>
</tr>
<tr>
<td>Developed countries</td>
<td>4.515</td>
<td>37</td>
<td>203</td>
<td>110</td>
<td>1.235</td>
<td>43.2</td>
<td>3.85</td>
</tr>
<tr>
<td>Developing countries</td>
<td>5.700</td>
<td>482</td>
<td>30</td>
<td>2.240</td>
<td>3.879</td>
<td>2.8</td>
<td>1.60</td>
</tr>
<tr>
<td>World</td>
<td>10.215</td>
<td>519</td>
<td>233</td>
<td>2.348</td>
<td>5.114</td>
<td>4.7</td>
<td>2.14</td>
</tr>
</tbody>
</table>

More than half of these poultry are in developing countries where the majority are kept under scavenging conditions and consequently unproductive. It can be argued that this situation could be radically changed and the supply of poultry products in poorer countries could be rapidly expanded to meet the needs for animal protein. That this is technically possible is certainly true because poultry are able to adapt to most areas of the world, have a low individual economic value, short generation time and a potentially high rate of productivity. A poultry enterprise can be producing meat within eight weeks and have the first egg produced within 18 weeks of the first chicken being hatched. All the necessary technology and stock can rapidly be deployed from wherever it is available. As a consequence many governments in developing countries have either encouraged or organised the development of large scale modern poultry enterprises within their countries. However these systems are not appropriate for small-holders in developing countries who normally still use systems that were practised in western countries 50 years ago.
The Consumption of Vegetable and Animal Protein in Developed and Developing Countries

People in developed countries consume far more protein and especially animal protein than do those in developing countries (Table 2).

Table 2: Daily Consumption of Vegetable and Animal Protein by Humans in Various Regions of the World (g.) (FAO, 1988)

<table>
<thead>
<tr>
<th></th>
<th>Vegetable Protein</th>
<th>Animal Protein</th>
<th>Total Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>46.1</td>
<td>42.7</td>
<td>42.9</td>
</tr>
<tr>
<td>South Africa</td>
<td>37.3</td>
<td>37.6</td>
<td>26.9</td>
</tr>
<tr>
<td>Asia</td>
<td>41.5</td>
<td>48.5</td>
<td>6.9</td>
</tr>
<tr>
<td>Africa</td>
<td>42.3</td>
<td>44.8</td>
<td>11.2</td>
</tr>
<tr>
<td>Developed</td>
<td>46.4</td>
<td>43.1</td>
<td>44.6</td>
</tr>
<tr>
<td>Countries</td>
<td>41.1</td>
<td>47.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Developing</td>
<td>42.8</td>
<td>46.2</td>
<td>19.8</td>
</tr>
<tr>
<td>World</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The increase in demand for animal protein with increasing affluence does not reflect a change in nutritional requirements with growing wealth but a desire for foodstuffs which are perceived to be "better"! Thus the demand for more animal protein reflects a want rather than a need and should be viewed alongside other "wants" associated with increased wealth such as TV sets and motor cars. According to the FAO figures an average adult human needs about 65 grammes of protein a day of which only 10% needs to be of animal origin. Thus it can be seen by comparing the figures in Table 2 with those in Table 3 that the over-supply in western countries is extreme and may in fact lead to health problems. In developing countries the mean supply of both animal and total protein is sufficient for minimum human requirements. However because of a maldistribution of the available resources some poorer members of society will receive insufficient amounts. Although certain members of the population such as lactating women and young children (Table 3) may need a greater proportion of animal protein than the rest of the population, in fact in most countries where animal protein is short it is often the case that most goes to those who need it least, the rich and the adult males.
Table 3: Recommended Daily Intake (RDI) of Protein (g) by Humans

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>35**</td>
<td>35**</td>
</tr>
<tr>
<td>5-6</td>
<td>45*</td>
<td>45*</td>
</tr>
<tr>
<td>9-11</td>
<td>57</td>
<td>51</td>
</tr>
<tr>
<td>15-17</td>
<td>75</td>
<td>58</td>
</tr>
<tr>
<td>18-34</td>
<td>68-90</td>
<td>55-63</td>
</tr>
<tr>
<td>35-64</td>
<td>65-90</td>
<td>51</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>-</td>
<td>60*</td>
</tr>
<tr>
<td>Lactating women</td>
<td>-</td>
<td>68**</td>
</tr>
</tbody>
</table>

* Groups with a high priority for animal protein  
** Groups with a very high priority for animal protein

Could more of the Animal Protein Needs of People in Developing Countries be provided from intensive Poultry Production

During the last 20 years, and particularly in the last ten, many countries have adopted intensive poultry production as a means of bridging the protein "gap". Intensive poultry have been seen as a way of rapidly increasing animal protein supplies for rapidly growing urban populations. However, what seems often to be forgotten is that the building of a broiler house or a laying house together with a food factory and the necessary processing plants are the easy parts of the operation. The major problem arises when scarce foreign exchange has to be used to import food and to a lesser extent, vaccines and drugs. To produce one kilogramme of broiler carcase requires 2.5 to 3 kg of a balanced diet and to feed a laying bird throughout the year requires up to 50 kg of a similar diet. Birds and animals are food converters rather than food producers (Tables 4 and 5).
Table 4: The Efficiency of Food Energy Conversion of High and Low Producing Domestic Farm Animals

<table>
<thead>
<tr>
<th></th>
<th>Mean Daily ME* Intake in Mj</th>
<th>Mean Daily Yield of Energy Metabolisable by Humans (Mj)</th>
<th>% of food ME* Recovered for Human Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laying hen (250 eggs per annum)</td>
<td>1.10</td>
<td>0.27</td>
<td>24.5</td>
</tr>
<tr>
<td>Laying hens (50 eggs per annum)</td>
<td>0.71</td>
<td>0.075</td>
<td>10.6</td>
</tr>
<tr>
<td>Growing chicken 2kg killed at 7 weeks</td>
<td>1.06</td>
<td>0.31</td>
<td>29.0</td>
</tr>
<tr>
<td>Growing chicken 2kg killed at 20 weeks</td>
<td>0.91</td>
<td>0.11</td>
<td>10.1</td>
</tr>
<tr>
<td>Beef animal (Gaining at 1.5 kg/day)</td>
<td>110</td>
<td>18.6</td>
<td>16.9</td>
</tr>
<tr>
<td>Beef Steer (Gaining at 0.25 kg/day)</td>
<td>51</td>
<td>6.1</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Table 5: Efficiency of Protein Utilisation by Various Classes of Farm Livestock at two levels of Output

<table>
<thead>
<tr>
<th></th>
<th>Mean Daily CP** Intake in g</th>
<th>Mean Daily Yield of Crude Protein - usable by Humans</th>
<th>% of food CP** Recovered for Human Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laying hen (250 eggs per annum)</td>
<td>18</td>
<td>1.71</td>
<td>26.0</td>
</tr>
<tr>
<td>Laying hens (50 eggs per annum)</td>
<td>13.9</td>
<td>0.34</td>
<td>6.7</td>
</tr>
<tr>
<td>Growing chicken 2kg killed at 7 weeks</td>
<td>16.3</td>
<td>6.1</td>
<td>37.5</td>
</tr>
<tr>
<td>Growing chicken 2kg killed at 20 weeks</td>
<td>11.3</td>
<td>2.1</td>
<td>18.1</td>
</tr>
<tr>
<td>Beef animal (Gaining at 1.5 kg/day)</td>
<td>252</td>
<td>33.0</td>
<td>13.0</td>
</tr>
<tr>
<td>Beef Steer (Gaining at 0.25 kg/day)</td>
<td>124</td>
<td>5.5</td>
<td>4.4</td>
</tr>
</tbody>
</table>

*) ME = metabolic energy  
**) CP = crude protein
The foodstuffs used for poultry food are often of a quality that could be fed directly to humans, so if food is short the effect of intensive poultry keeping is the turning of food that poor men can afford into a much smaller quantity of food that only rich men can afford, but almost certainly do not need. Political considerations apart it makes sense for countries to adopt intensive poultry production when one or more of the following conditions prevail:

1. The country produces a large surplus of plant foodstuffs such as cereals over and above the needs of the human population.

2. The country has a large manufacturing base which brings it sufficient foreign exchange to purchase animal feed stuffs.

3. The country has an exportable commodity (such as oil) which it can exchange for animal foodstuffs.

If none of these conditions prevail the intensive poultry industry will become a liability rather than an asset and the government would be better advised to pursue a policy of encouraging scavenger poultry production. If this policy is followed could scavenger poultry production meet the needs of less privileged groups for animal protein in developing countries?

The Requirements of the Family for Energy and Animal and Vegetable Protein

The food value of both eggs and poultry meat must be primarily considered in terms of the protein (essential amino acids) that it provides, and secondly as a source of mineral and vitamins. The main source of energy in human nutrition will be from vegetable sources such as maize. Within most populations there are differences in the requirements between individuals (Table 6). Hence the recommendations for the population of the UK (DHSS 1978) are defined as follows:

"The average amount of the nutrients which should be provided per head in a group of people if the needs of practically all the members of the group are to be met". If this approach is followed the recommended daily intake (RDI) is based on the assessed requirement, to which a safety factor is added to take account of individual variation and also maldistribution of the foods available. The amount of protein required by an individual is influenced by age and sex of the individual (Table 6).
Table 6: Daily Requirements of Protein, Minerals and Vitamins for Vulnerable Groups. (Source MAFF, 1975)

<table>
<thead>
<tr>
<th></th>
<th>Protein/Day (g)</th>
<th>Animal Protein per Day (g)</th>
<th>Calcium/Day (mg)</th>
<th>Iron/Day (mg)</th>
<th>Vitamin A /Day unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant Women</td>
<td>60</td>
<td>6.0</td>
<td>1200</td>
<td>15</td>
<td>750</td>
</tr>
<tr>
<td>Lactating Women</td>
<td>68</td>
<td>6.8</td>
<td>1200</td>
<td>15</td>
<td>1200</td>
</tr>
<tr>
<td>Infants under one year</td>
<td>15</td>
<td>1.5</td>
<td>600</td>
<td>6</td>
<td>450</td>
</tr>
<tr>
<td>Infants 1-2 years old</td>
<td>19</td>
<td>1.9</td>
<td>500</td>
<td>7</td>
<td>300</td>
</tr>
<tr>
<td>Adult Male Sedentary</td>
<td>43</td>
<td>4.3</td>
<td>500</td>
<td>10</td>
<td>750</td>
</tr>
</tbody>
</table>

It is possible to achieve adequate intake of essential amino acids from vegetable protein sources alone but this may result in excessive consumption of total nitrogen and of some amino acids (Shrimpton, 1985). Both eggs and poultry meat provide protein which is well balanced for human needs. Therefore the addition of either to the human diet will improve the quality of the diet. This could be particularly important in improving the diet of young children and help to overcome the diarrhoea - marasmus complex which is responsible for the deaths of approximately 15 million young children each year (McLaren, 1985).

The foods that provide predominantly energy are usually those most important the diet of most people in the rural sector of villages in the tropics. Some of these staple foods such as maize, sorghum or rice have a fairly high protein content, others such as cassava and plantains have a much lower one. Families that depend on the latter types of diet are the one most likely to suffer from protein deficiency, especially the younger members of the family. The energy requirement is affected by age, sex and activity of the individual concerned (Table 7). Large individuals, more active individuals and men will need and normally consume more energy than small, less active individuals and women. Consequently they will also consume more protein each day because most so called energy foods such as maize and rice also contain a considerable amount of protein.
Table 7: Recommended Daily Intake of Energy (Mj/day) (MAFF, 1975)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td>5-6</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>9-11</td>
<td>10.5</td>
<td>9.6</td>
</tr>
<tr>
<td>15-17</td>
<td>12.6</td>
<td>9.6</td>
</tr>
<tr>
<td>18-34</td>
<td>11.3-15.1*</td>
<td>9.2-10.5*</td>
</tr>
<tr>
<td>35-64</td>
<td>10.9-15.1*</td>
<td>9.2-10.5*</td>
</tr>
</tbody>
</table>

*) indicates active individuals

The daily energy needs of a 9-11 year old female child (9.6 Mj, Table 7) could be provided by 655 g of maize (Table 8). This quantity of maize would provide 52 g of protein. This is enough protein to meet her basic protein needs. Protein of animal origin needed to supply sufficient essential amino acids could be provided by one egg or 40 g of poultry meat (Table 8). An adult male consuming 15 Mj a day of diet based on maize will consume about 1000 g of this grain which will provide 80 g of protein, nearly double his requirements. Therefore even allowing for amino acid imbalance in the cereal it is unlikely that this person will require an animal protein supplement.

If the diet was based on cassava rather than maize then the protein imbalance for the female child would be considerable. The 640 g of cassava needed to provide the energy requirements of a nine year old girl would provide only 6.5 g of protein and virtually no lysine or methionine. So, in this case it would be necessary to provide additional vegetable protein such as groundnuts as well as a source of animal protein such as eggs in order to provide a balanced diet. It is not surprising that cases of protein deficiency are common in societies where cassava is the staple diet.

Table 8: The amounts of Nutrients Provided by given amounts of Selected Plant and Animal products (Source MAFF, 1975)

<table>
<thead>
<tr>
<th></th>
<th>Protein (g)</th>
<th>Animal Protein (g)</th>
<th>Calcium (mg)</th>
<th>Iron (mg)</th>
<th>Vitamin A (integrated Units)</th>
<th>Energy (MJ/ME)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One 50 g Egg</td>
<td>6.1</td>
<td>6.1</td>
<td>27</td>
<td>1.1</td>
<td>70</td>
<td>0.31</td>
</tr>
<tr>
<td>100 g of Poultry Meat</td>
<td>25.0</td>
<td>25.0</td>
<td>9</td>
<td>0.8</td>
<td>0</td>
<td>0.6</td>
</tr>
<tr>
<td>100 g of Yellow Maize Grain</td>
<td>8.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>440</td>
<td>1.4</td>
</tr>
<tr>
<td>100 g of Rice grain</td>
<td>6.5</td>
<td>0.0</td>
<td>4</td>
<td>0.4</td>
<td>0</td>
<td>1.5</td>
</tr>
<tr>
<td>100 g of dry Cassava</td>
<td>1.9</td>
<td>0.0</td>
<td>1.4</td>
<td>0.0</td>
<td>0</td>
<td>1.2</td>
</tr>
</tbody>
</table>
However even the modest provision of one egg per person per day would necessitate a production of 365 eggs per individual per year. If a similar amount of protein was provided from adult chickens a yearly supply of 10 birds would be needed. If these calculations are extended to the nuclear family a true picture of number of poultry required to meet minimum needs are obtained.

In this example it is assumed that a nuclear family consists of one lactating mother and three children aged 1, 5 and 9. The total animal protein requirements per day would be as follows (Table 9).

**Table 9: Animal Protein g per day required by a family of five persons**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Father</td>
<td>4.3</td>
</tr>
<tr>
<td>Lactating wife</td>
<td>6.8</td>
</tr>
<tr>
<td>Three children</td>
<td></td>
</tr>
<tr>
<td>1 yr.</td>
<td>1.9</td>
</tr>
<tr>
<td>5 yrs.</td>
<td>4.5</td>
</tr>
<tr>
<td>9 yrs.</td>
<td>5.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23.2</strong></td>
</tr>
</tbody>
</table>

This total requirement could be obtained from five 50 grammes eggs a day or one 3 kg chicken consumed each week. Could this amount of animal protein be provided by a scavenging poultry flock, and if so, what size of flock would be required? This will become clear when the productivity of flocks is discussed later in this paper.

**How Should the Eggs and Meat be Used in the Diet of Families**

Eggs are an excellent, well balanced addition to the diet, especially for pregnant and lactating women, small children and the elderly. They can be cooked in many ways, depending on how many eggs are available for use. It should be borne in mind that eggs should be well cooked in order to avoid illness from Salmonella infection, especially in scavenging hens.

If only a few eggs are available per family, say 1 to 3, it is probably best to incorporate them in foodstuffs for the whole family, for example, pancakes or maize cakes. These can be cooked on a griddle over an open fire. Egg custards can be made in a saucepan. If more sophisticated cooking facilities are available they can be made into baked egg custards, bread and butter puddings and savoury quiches.

If families can afford more eggs and have ready access to a more adequate supply it would be sensible to feed them to small children, probably in the form of scrambled eggs, one egg per child, and also to older people and pregnant women. They can be simply boiled and added to vegetable curries as a main meal for the whole family, with the addition of whatever cereals are eaten. Spanish omelette is an easy way to cook eggs for the family, or
they could be incorporated into maize porridge to make a type of gnocchi.

Meeting the Animal Protein Need of the Family from the Output of Scavenging Poultry

There is a limited amount of information on the productivity of laying birds under scavenging conditions. Bessei (1987) quoted by Horst (1989) gives an indication of the levels that can be expected under various types of production (Table 10).

Table 10: Characteristics of Traditional Poultry Production Systems (modified from Bessei, 1987)

<table>
<thead>
<tr>
<th>Production System</th>
<th>Eggs/Year</th>
<th>Number of Year Old Chickens</th>
<th>Eggs available for consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRADITIONAL - Scavenging no regular food/water inadequate night shelter</td>
<td>20-30</td>
<td>2-3</td>
<td>0</td>
</tr>
<tr>
<td>IMPROVED TRADITIONAL - Regular provision water and grains &amp; household wastes, improved night shelter, care in first weeks. Newcastle vaccination</td>
<td>40-60</td>
<td>4-8</td>
<td>10-20</td>
</tr>
<tr>
<td>IMPROVED TRADITIONAL 2 - The same as above plus additional vaccination, parasite control, improved feeding, cockerel exchange</td>
<td>100-120</td>
<td>10-12</td>
<td>30-50</td>
</tr>
<tr>
<td>SEMI INTENSIVE - As above improved birds, complete diet</td>
<td>160-180</td>
<td>25-30</td>
<td>50-60</td>
</tr>
</tbody>
</table>

It is possible to work out the expected levels of production by analysing the reproductive cycle. Under scavenging conditions the reproductive cycle is comprised of three phases.

a) Laying phase (10 days)
b) Incubation phase (21 days)
c) Brooding phase (about 56 days)

Thus the maximum number of clutches per year is 4.2 per hen; about 2-3 is nearer the mark in practice. This means that each bird will produce 20-30 eggs per annum.

A basic analysis of the production of poultry in the middle belt of Nigeria was undertaken by Matthewman (1977) which confirmed these levels of production. Under the system of management found in this part of Nigeria chickens are raised near the houses and
wander in the bush in search of food. No special housing is provided for them. Some families use baskets to take chickens into the bush during the day and bring them home each night. Some additional food is given. Under these conditions Matthewman found that most of the eggs are left to hatch, but most of the chickens hatched die (Figure 1).

Figure 1: Estimated Chick Mortality Curve
(from R. Matthewman, 1977)

Consequently the overall production from a flock of 209 hens is only about 70 birds per annum in this example (Figure 2).

Figure 2: Productivity and offtake of a village poultry flock in Nigeria (Jago village)
The ratio of hens to cocks in this region is 1:3 (more cocks eaten). Although a considerable number of eggs are laid mortality rates can be very high (Figure 2).

Similar levels of production have been recorded both in the Sudan and Mali. In the former country (Darfur region) 35 eggs per bird per year was recorded in village flocks and a similar number in the latter. This level of production will only make a limited contribution to a family diet.

If it is assumed that one chicken is needed each week to meet the animal protein needs of a family of five this means a total requirement of 50 birds supplied by a flock of 250. This is clearly a much larger flock than is kept by most families. If, however, the level of production can be increased (Smith, 1990) by moderate inputs so that both eggs and poultry meat were made available, then it would be possible to obtain the necessary poultry meat from a much smaller poultry flock, maybe one as small as 50 adult birds in total.

Alternatively it might be possible to obtain the necessary 50 kg of protein from poultry of another type. A pair of geese with access to good quality grazing and water can produce goslings that will provide 45 to 75 kg of meat a year for 20 years or more. They can be kept in crops such as coffee, bananas, pineapple and other cultivated crops which grow tall enough to avoid the problem of the geese consuming the crop along with the weeds.

The above examples show that poultry in one form or another do make a considerable contribution to the animal protein needs of rural families. However there is considerable scope for increasing this contribution particularly to poorer families. Other papers presented at this seminar will show how this can be achieved.

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3.9 DISEASE PREVENTION IN SMALLHOLDER VILLAGE POULTRY PRODUCTION IN AFRICA

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Abstract

Many constraints of smallholder poultry production in Africa are linked with the physical environment, but most of them with economic and sociological patterns.

In order to protect or improve animal health chemoprevention or vaccination seem to be the only practical possibilities. The necessary products must be readily available to the farmers, they must be cheap and easy to use if any effect is to be expected of them.

The highest priority should be accorded to vaccinations which are usually effective, relatively inexpensive and which do not require repeated application. The greatest recorded demand is for the vaccination against Newcastle disease, a major killer of African poultry, followed by Fowlpox and Pasteurellosis. The other infectious diseases against which birds are vaccinated in modern industrial farms do not appear to be that acutely important in smallholder poultry production in Africa.

For the small-scale poultry farmer specific low cost-low input improvements must be identified. The achievements and lessons from various smallholder village poultry projects are analysed and the prospects for vaccine improvement are discussed.

Résumé

De nombreuses contraintes dans la petite production de volatile en Afrique sont liées à l'environnement physique, mais la plupart d'entre elles sont dues à des modèles économiques et sociologiques.

Il semble que la chemoprévention ou la vaccination soient les seules propositions praticables permettant de protéger ou d'améliorer la santé des animaux. Il faut que les fermiers puissent accéder facilement aux produits préventifs qui doivent être bon marché et d'emploi facile si l'on veut obtenir quelque effet que ce soit.

L'intérêt principal réside dans les vaccinations qui sont normalement efficaces, relativement bon marché et qui ne demandent pas de multiples interventions. La plus grande demande enregistrée concerne la vaccination contre la maladie de
What are the constraints caused by the physical and socio-economic environment?

Smallholder poultry production systems are described and analysed in detail by other speakers at this seminar. The available data most often indicate that disease is the most important single cause of losses for farmers. These systems differ greatly from suburban industrial or semi-industrial systems particularly by the absence of control over several major constraints of importance regarding disease prevention.

These constraints are primarily those linked with the physical environment. Birds are generally set free to scavenge around human dwellings during the day. As a result they are directly exposed to climatic and meteorological factors. The scarcity of feed limits the bird density at all geographical levels. Their dispersion in the natural environment increases the probability of contact with the avian fauna and the possibility of contamination from wild birds by germs and parasites. Malnutrition and the exposure to adverse weather conditions increase the susceptibility to diseases.

The resulting disease patterns of smallholder poultry differ rather markedly from those of birds under more modern and intensive conditions of husbandry. The data are not very numerous but the relative importance of diseases in village flocks is set out below (see Table 1).

These fragmentary data are not very homogeneous but all indicate that the major recognized killer of village poultry is Newcastle disease. This contrasts with modern flocks in which Coccidiosis, Marek’s disease and Gumboro seem to prevail in Africa.

The most detailed analyses in Burkina Faso and Niger also indicate seasonal fluctuations with outbreaks of ND occurring during the cold dry season with very high rates of mortality (up to 98%). Young birds born during the previous rainy season account for most of the losses.

Not all poultry species are equally susceptible to ND and in Burkina Faso where guinea fowl are reared together with chicken, they seem to have better resistance to ND but have their own scourge which is Trichomoniasis to which chicken appear immune.
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<td>Guinea</td>
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<td>Niger</td>
<td>Niger</td>
<td>Mauritania</td>
<td>Malawi</td>
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<tr>
<td>Husbandry System</td>
<td>Small-holder</td>
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<td>Rank 1</td>
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<td>Rank 3</td>
<td>Fowlpox</td>
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<td>5 and further</td>
<td>Pasteurellosis Int.paras. Ext.paras.</td>
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¹) Newcastle disease  
²) Trichomoniasis  
³) Coccidiosis  
⁴) Cronic Respiratory Disease  
⁵) Salmonellosis
The relative importance of the various diseases both infectious and parasitic is thus different in smallholder village poultry from that in modern farms.

Appropriate control measures become even more different when human factors are taken into account. These relate to the socio-economic aspects of village poultry production. The in-depth study in Burkina Faso and Niger shows that, at the present time, the production from small-holder village flocks is low and more or less equally used for family consumption, gifts and market. Total sales do not exceed 2 or 3 birds per year per family as an average. The income derived remains modest, but often benefits women and children for whom they are a major source of cash. As a result, marketable bird populations are scarce, scattered, and of low absolute value although their relative value to their owners may be great. These socio-economic patterns explain in great part why government institutions have shown until recently rather limited interest in disease control for smallholder village poultry.

What control measures are there which could be implemented?

In general and for all species there are two main types of disease control measures:

- Quarantine based on organizational and statutory principles. In modern poultry production systems, quarantine is routinely a part of flock management with such practices as batch rearing of chicken, isolation of age groups from one another, systematic disinfection of premises between batches etc. Control of the environment is easy to practise under conditions of total isolation. Nothing should be less true for village poultry where there is a constant mixture of species, birds from different households, generations in each family flock etc. The various surveys quoted here above mention that outbreaks of disease most often result from the introduction of birds from other places. The building materials used for poultry shelters are inadequate for effective disinfection and pest control.

- The other type of control measures are medical. These include chemoprevention or systematic treatment and vaccination. Once again the rules governing the implementation of systematic treatment and vaccination calendars in modern poultry flocks are well established. The Veterinary Bulletin announces on average one congress on the subject each year. Within the last decade at least 7 books have been published on the subject (Bozotnikov, I., 1982; Baidlevyakotov, A.B., 1987; IABS, 1991; Meszaros, J.F., 1983; Perry, R.A., 1983; Skutar I.G., 1980; Copland J.W., 1987) plus numerous shorter papers; practical recommendations for African farmers have been given in various poultry manuals including the Manuel d’aviculture tropicale translated into English by CTA. Commercial information on the subject is easily accessible.
How does it happen then that smallholder village poultry production remains subject to such heavy losses from disease?

As seen here above, quarantine measures appear largely unpractical and the control of poultry diseases, in African smallholder systems depends essentially upon the use of medical measures.

According to the priorities identified so far Newcastle disease is the major threat. We must analyze first the constraints to the improvement of the control of this disease.

These constraints have been very clearly identified by both P.B. Spradbrow and J.L. Samuel at the international congress organized by ACIAR in Malaysia in 1987.

The vaccines available at the present time are of two types: live avirulent or hypovirulent vaccine-viruses, or killed adjuvant viruses.

The former are fragile and have very precise rules of use. They require a cold chain almost up to the bird side. Their effectiveness is reduced if there are residual antibodies in the chicken. The low level of pathogenicity ensures that no other diseases will develop. Collective vaccination through drinking water or aerosol is possible. Some of these live virus vaccines are passed more or less regularly from bird to bird, thus amplifying the effect of vaccination. Much hope has arisen from the Malaysian research on the V4 strain which is more heat resistant than those identified so far and can be administered in pelleted food with satisfactory results.

The latter (killed vaccines) are most frequently used in Africa particularly for smallholder village poultry. They do not require such a rigid cold chain as live vaccines and as a consequence have a longer shelf life and can be used farther away from the big cities. The killed vaccines appear to be most effective in birds that have already some degree of immunity from of vaccination with a living vaccine. The chickens must be injected individually. Killed vaccines are usually cheaper than live vaccines because the inactivation process ensures that the product is more durable. The virus killing chemical also acts against all possible pollutant living agents and particularly against unwanted pathogenic viruses or bacteria.

The low cost of these vaccines is a reality only in large flocks and documents from Burkina Faso and Niger indicate a high rate of wastage of vaccine due to the fact that unit trials contain generally 100 individual doses, while village vaccinators only manage to vaccinate a few dozen birds a day at best. Much of the advantage gained in efficient manufacturing, packaging and dispatching is thus lost at this final stage.
Catching the birds to give them injections or to deposit live vaccine in the eye or the nostrils is a cumbersome task which cannot be avoided with the techniques available at present.

Strain V4 is already being tested in several African countries and has shown promising results in overcoming the major constraints associated with ND prevention: this vaccine has been shown to stand up well to tropical environmental factors. It can be effectively administered orally and is transmitted from bird to bird. Yet, the problem remains of its application at family flock or village level under scavenging husbandry systems in which feed distribution is not usual.

However, the story of strain V4 gives us some ideas of what to look for in vaccine improvement for smallholder village poultry in Africa. Effective disease prevention may be expected from the use of thermostable and self-propagating vaccines.

The second feature implies that the germs should be alive and stable, and ideally several germs could be associated in a single mixed vaccine to protect the birds against the most common diseases.

What is the African experience in these various subjects?

Regarding self-propagating avirulent or hypovirulent african strains of Newcastle disease virus several surveys indicate the existence of village chicken possessing antibodies against ND without having been vaccinated. This is the case in Burkina Faso, Niger and Nigeria; a worthwhile research to isolate and study the virus strain has been undertaken in Nigeria. A progress report on the subject may be given at the present meeting.

In the early 1960’s various combined vaccines were developed by African laboratories in an attempt to try and prevent the then prevalent diseases of village poultry. One such vaccine was Polavia, from the Farcha laboratory, in Chad, in which antigens for Newcastle disease, Fowlpox and Avian Salmonellosis were combined in a freeze dried vaccine which was injected intramuscularly to enhance antibody production. Despite its requirement for cold chain and handling of the birds, this vaccine rapidly almost entirely replaced the monovalent products which were until then available in the central African customer countries of the Farcha laboratory (Chad, CAR, Cameroon).

Dr. Alain Provost, co-developer of this vaccine suggests that, taking into account the recent achievements in microbiology, new combined vaccines could be developed, with improved technological features, and possibly with a potential to be administered orally, or even self transmitted from bird to bird by the fecal-oral route. New research
could be started on the basis of the orally transmissible Poulxpop virus identified by MAY R and the R 95 Salmonella strain which was already recommended by IBAR more than 20 years ago.

Possibilities for new research orientations focused on smallholder village poultry are thus opened up, since modern industrial production systems have developed and continue to develop protection programmes of their own.

Regarding protozoal diseases, if we rely on the available information, Coccidiosis remains a secondary concern under village husbandry conditions. I was recently visiting Vietnam were scientists had undertaken experiments on the prevention of this disease with radiation attenuated parasites. Satisfactory protection was reported. But if we refer to the sustainability requirements of the village production systems, we must admit that such means of Coccidiosis protection do not meet our expectations and might cost more than these farmers would accept.

Chemoprevention of parasitic diseases is difficult to envisage, as most remedies are essentially curative. The smallholder village poultry project in Burkina Faso has developed, in cooperation with a private pharmaceutical firm, a mixture of anthelmintics and antimicrobial drugs. In suckable tablet form these can be sold at a low unit price for individual systematic administration to the birds to reduce parasitic loads at critical periods of the animals' lives. Such packages do not alleviate the cumbersome necessity of catching and handling the chickens, but field results, which will be reported at this meeting indicate that the procedure was quite successful.

Although new research projects may offer new hope for more practical, effective and cheap disease prevention in smallholder village poultry systems of production, much of the efficiency will depend upon the persistence and quality of extension services.

Recent data, particularly those gathered during this meeting indicate that smallholder poultry have more economic, social and technical importance than previously assessed. This makes new research worthwhile.

I would like to acknowledge the kind assistance of Dr. Alain Provost in discussing and reviewing this paper and supplying information.

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3.10 STRATEGIES FOR THE CONTROL OF NEWCASTLE DISEASE IN VILLAGE POULTRY FLOCKS IN AFRICA

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Abstract

Newcastle disease (ND) is enzootic throughout Africa and is by far the most significant threat to poultry causing mortality rates of over 90%.

Of the four general approaches - hygiene, vaccination, slaughter of infected flocks and selection for resistance - vaccination in combination with hygienic measures is most promising in combating the disease.

The use of a recombinant vaccine with an Avipox virus is favoured because of its heat resistance, its efficacy and the fact that serological monitoring for the presence of wild-type virus would be possible at the same time as vaccination. This could lead to eventually eradicating the virus.

Amongst the recommendations for research are
- serological and virological surveys for the presence of NDV,
- trials to test the capacity of the recombinant vaccine and
- the development of specific ELISAs for antibodies against the HN protein (wild-type) and F protein (vaccinal) and their long term serological monitoring.

Résumé

La maladie de Newcastle (ND) est répandue à travers toute l'Afrique et représente de loin la menace majeure pour la volaille, provoquant des taux de mortalité de plus de 90%.

Parmi les quatre approches générales - l'hygiène, la vaccination, l'abattage des bandes contaminées et la sélection pour la résistance - la vaccination, à laquelle viennent s'ajouter des mesures d'hygiène, est la plus prometteuse pour la lutte contre la maladie.

L'utilisation d'un vaccin recombinant avec un virus Avipox obtient la préférence en raison de sa résistance à la chaleur, de son efficacité et parce que le monitoring sérologique permettant de détecter la présence d'un virus de type sauvage serait possible au moment même de la vaccination. Cela pourrait permettre d'éliminer éventuellement le virus.
Parmi les recommandations faites en matière de recherche, on trouve:
- des études sérologiques et virologiques sur la présence du NDV,
- des expériences permettant de tester la capacité du vaccin recombinant et
- l’élaboration d’ELISAs spécifiques pour les anticorps contre la protéine HN (type sauvage) et la protéine F (vaccin) et leur monitoring sérologique à long terme.

Introduction

Newcastle disease is enzootic throughout Africa. Where the viruses responsible have been studied these have been velogenic (5). Mortality in village poultry flocks is very high, reaching over 90%. This does not only affect the village poultry flocks, but also serves as a reservoir of virulent virus threatening industrial poultry production (5). Other pathogens are present in village poultry flocks (4,7), but in the face of the high mortality caused by Newcastle disease they are much less significant. In addition, the non-intensive rearing conditions in village poultry means that their effects are less marked than they would be in intensive farms.

Possible strategies

Four general approaches can be used to control Newcastle disease: hygiene, vaccination, slaughter of infected flocks, and selection for resistance to the disease or for a better immunological response. While hygienic measures are of limited use in the case of very small flocks that are free to roam around, they become increasingly important as soon as semi-intensive farming is undertaken. In this case all the measures that are applied to industrial farms such as cleaning and disinfection between flocks, isolation of farms, limited access to birds and personal hygiene become necessary. The slaughter of infected flocks is a measure which has been successfully employed in regions that are essentially free of the disease, such as the United States, but it is clearly inapplicable in Africa, where the disease is widespread. Genetic selection may be of value in the long term, and this question will be dealt with by another contributor. Newcastle disease virus (NDV) is of a single serotype and vaccination is clearly effective in reducing the mortality caused by it, in combination with appropriate hygienic measures.

Four different types of vaccine can be considered. Firstly, the conventional live vaccine such as Hitchner B. While this cannot effectively be given in drinking water to village flocks, the eye-drop method can be used and has the advantage that each bird receives its dose individually. This has been successfully used in Morocco where it led to a considerable reduction in mortality (2). However, it does require refrigeration and this could be a problem in hotter areas with limited refrigeration facilities.

Inactivated vaccine produces a good immunity, but requires priming by a live vaccine for the best results, unless a natural infection can serve this purpose. It has been successfully used in Burkina Faso (16). Its disadvantage is that it requires some
training to apply. Both this and the live vaccine applied by eye-drop require the birds to be caught.

The live V4 vaccine has been successfully used to control Newcastle disease in village chicken flocks in Malawi (14). A relatively heat-resistant derivative of the V4 vaccine applied to feed has been used successfully in South-East Asia (6). It does not require individual application and can spread at least to some extent between birds.

The fourth possibility is a recombinant vaccine using a virus from the Avipox genus. NDV expresses two proteins on the surface of its virion, the haemagglutinin-neuraminidase (HN) collaborators (11) showed that antibodies against the F protein are able to protect chickens against viral challenge better than anti-HN antibodies. They subsequently constructed a recombinant vaccine using a vaccinia virus vector expressing NDV F protein (12). The vaccine protected chickens against live virus challenge. While vaccinia virus could not be used as a poultry vaccine owing to potential human health hazards a recombinant vaccine could equally be constructed using a virus from the Avipox genus. This work is now in progress (12) and the vaccine is likely to be ready for field trials within the next year or so (13).

Use of such a recombinant vaccine for the control of Newcastle disease in village poultry flocks in Africa would have a number of advantages:

- Since the virus is stable and heat-resistant, it could easily be applied to food like the V4 vaccine tried in Asia.

- The vaccine would be very immunogenic and spread easily. The efficacy of poxvirus vaccines has been well demonstrated by the worldwide elimination of smallpox from the human population by such a vaccine (10).

- Most importantly, serological monitoring for the presence of wild-type virus would be possible at the same time as vaccination. This is possible since the vaccine would only induce antibodies against the F protein and not against the HN protein. Thus the presence of anti-HN antibodies would be uniquely indicative of infection by wild-type virus. These antibodies are detected by the haemagglutination-inhibition (HI) test, which does not detect anti-F antibodies. Anti-F antibodies could be detected by ELISA in order to assess the efficacy of vaccination.

A standard ELISA for anti-NDV antibodies has been developed in collaboration with the FAO/IAEA joint animal health division (3). This is especially designed for easy transport in kit form and is adapted for conditions in tropical countries. A further improvement in the differential detection of wild-type and vaccinal antibodies could be made by the development of ELISAs specific for HN and F proteins, by using purified proteins as antigen instead of crude virus. A precedent for this exists in an ELISA using purified membrane proteins from Salmonella (6), which suggest that such an assay could be quickly developed. The advan-
tage of using an ELISA for detecting anti-HN antibodies would be its potential for producing univorm results in different laboratories. A survey of the HI test carried out in 17 different laboratories in the same country showed very wide variations in the results (1).

Discussion

It is clear from the results of trials already carried out that any well-organized vaccination programme would be of value in controlling Newcastle disease in village poultry flocks in Africa, and each type of vaccine has its merit. However, the most promising possibility appears to be the recombinant vaccine. By permitting serological monitoring for wild-type virus in the presence of vaccination it could lead to sustainable control of Newcastle disease by eventually permitting the eradication of virus. Once the majority of birds in a given region were free of virus, infected birds could be detected and eradicated without compromising the short term control of the disease by stopping vaccination. The additional investment in the new vaccine and the cost of additional trials comparing it with others would be worthwhile if the work were to be well coordinated over the whole of Africa.

The FAO/IAEA joint animal health division has distributed ELISA readers and computers in animal health laboratories throughout Africa in support of the Pan African Rinderpest campaign (9). If the ELISAs mentioned above were developed, advantage could be taken of this existing infrastructure to quantitatively monitor the progress of Newcastle disease control uniformly throughout Africa. The aim would be to maintain a high level of anti-F antibodies while monitoring a diminution of anti-HN antibodies due to decreasing presence of the wild type virus.

Recommendations

In light of the preceding discussion, the following specific research projects are suggested for consideration:

- Serological and virological surveys for the presence of NDV in countries where this has not already been done. This would provide a baseline from which to assess the efficacy of vaccination.

- Trials to test the capacity of the recombinant vaccine to protect against wild-type challenge when administered with feed under laboratory conditions. Comparison of its efficacy and ability to spread easily with the Asian food-pellet vaccine.

- Depending on the results of the previous trials, widespread trials under village conditions in different countries of either the recombinant vaccine or the Asian food-pellet vaccine or both.

- If the recombinant vaccine is chosen, development of specific ELISAs for antibodies against the HN protein and F protein.
Long term serological monitoring for antibodies against wild-type and vaccinal viruses using the above-mentioned ELISAs and computational analysis of the results.

While there are clear advantages to uniform approach for the whole of Africa, experience with other vaccination campaigns has shown that it is also important that strategies be adaptable to suit the needs of individual countries (10).

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3.11 FEEDING AND FEED RESOURCES

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Abstract

The major feedstuffs available for feeding poultry under small scale conditions in Africa are described. The description covers energy, protein feed ingredients, as well as mineral resources. An account of alternative feed resources is given which aims to reduce competition between humans and poultry for foodstuffs. Antinutritional factors associated with some of these ingredients are discussed and recent research findings to reduce their undesirable effects on performance of poultry are presented. Finally, a research proposal to determine the nutritive value of unconventional feeds and to compile existing information on feeding of poultry in various parts of Africa is suggested.

Résumé

On trouvera une description des ressources alimentaires essentielles dont disposent les petits producteurs d'Afrique pour nourrir la volaille. La description comprend l'énergie, les ingrédients alimentaires à base de protéines ainsi que les ressources minérales. On trouvera également un état des alternatives en matière de ressources alimentaires qui visent à réduire la compétition que se livrent êtres humains et volaille au niveau des produits alimentaires. Il y a une discussion des facteurs antinutritionnels associés à certains de ces ingrédients, ainsi qu'un exposé des derniers résultats de la recherche permettant de réduire leurs effets indésirables sur le rendement de la volaille. On trouvera en dernier lieu une proposition de recherche visant à déterminer la valeur nutritive des produits alimentaires non conventionnels et à rassembler les informations déjà existantes sur l'alimentation de la volaille dans différentes régions d'Afrique.


Introduction

In rural areas of Africa, chickens live by scavenging and, when rainfall is adequate, by eating green leaves and insects. Under these conditions, it is not surprising that growth rate is slow, egg production is low and mortality rate is high. Veterinary care is lacking and occasional outbreaks of epidemic diseases like Newcastle disease cause heavy mortality, particularly among very young chicks. Other endemic diseases include parasitic infestation, coccidiosis and salmonellosis. Signs of nutritional deficiencies are commonly seen in the young chicks.

In the case of small and medium scale production in rural areas, additional feed is offered depending on availability. In places near urban centres, all mash poultry ration is occasionally bought and given to the birds. Sometimes feed mixing at home may be done. Despite this supplementary feed, egg production is low, rarely exceeding 100 eggs/hen/year, because of insufficient feeding and inadequate supply of essential nutrients.

Great efforts are needed to design and implement applied research and realistic development programmes to improve the productivity of poultry in rural areas of Africa. This would supply protein of high quality to the rural people, and provide an extra cash source through selling of poultry products in nearby urban centres. From a nutritional point of view, local feed ingredients must be used in ration formulation so as to keep the cost of feed down. To do this, there is a need to identify local feedstuffs and to assess their nutritive value in nutritional laboratories and through feeding trials under experimental and practical conditions.

In this paper, the major feedstuffs available for feeding poultry in Africa are described. The descriptions will cover energy and protein feed ingredients, as well as mineral resources. An account of alternative feed resources will be given, which is aimed at reducing competition between humans and poultry for feed ingredients. Antinutritional factors associated with some of these feedstuffs are discussed, and recent research findings for their identification will be mentioned. Finally, a research proposal to determine the nutritive value of feedstuffs is presented. A practical approach to formulate and test diets under African conditions is also suggested.

Energy feedstuffs

Energy sources in African poultry rations are derived mainly from cereal grains. Fat as a source of energy is not commonly used since the meat industry does not exist on a large scale. Cereal grains used are maize and sorghum. Occasionally, millet, wheat, wheat bran, rice bran, cassava and local brewer's grains are used in small proportions, depending on availability. Variable nutrient values may be obtained for different batches of cereal grains due to differences in cultivars, soil, agronomical practices and climatic conditions. In addition, the amount of fibre and effect of storage conditions on the growth of moulds may reduce the nutritive value of grains.

The following account for the nutritive value of cereal grins and their by-products covers the information found in the internatio-
nal literature. Undoubtedly, information on the feeding value of local feedstuffs is scattered all over African research centres, universities and government extension agencies. Compiling these data is pre-requisite for any serious effort to start applied research to improve poultry production through better understanding of the feeding value of these feed resources (Table 1a).

Table 1a. Composition of cereals and cereal by-products used for poultry (as fed basis).

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<thead>
<tr>
<th>Feed Ingredient</th>
<th>DM %</th>
<th>ME Kcal/kg</th>
<th>Protein %</th>
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<td>3340</td>
<td>9.0</td>
<td>5.3</td>
<td>2.2</td>
</tr>
<tr>
<td>Sorghum</td>
<td>88</td>
<td>3270</td>
<td>10.1</td>
<td>3.1</td>
<td>2.5</td>
</tr>
<tr>
<td>Wheat</td>
<td>88</td>
<td>3020</td>
<td>13.5</td>
<td>2.2</td>
<td>2.5</td>
</tr>
<tr>
<td>Rice</td>
<td>90</td>
<td>2980</td>
<td>7.6</td>
<td>0.8</td>
<td>8.9</td>
</tr>
<tr>
<td>Wheat Bran</td>
<td>89</td>
<td>1300</td>
<td>15.4</td>
<td>2.9</td>
<td>9.6</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>91</td>
<td>2100</td>
<td>12.5</td>
<td>3.0</td>
<td>13.1</td>
</tr>
</tbody>
</table>

Department of Animal Science, University of Gezira, Wad Medani, Sudan.

Table 1b. Amino acid and mineral composition of cereals and cereal by-products used for poultry (as fed basis).

<table>
<thead>
<tr>
<th>Feed Ingredient</th>
<th>Calcium %</th>
<th>Total Phosphorus</th>
<th>Met %</th>
<th>Lys. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>0.02</td>
<td>0.26</td>
<td>0.21</td>
<td>0.20</td>
</tr>
<tr>
<td>Sorghum</td>
<td>0.04</td>
<td>0.31</td>
<td>0.16</td>
<td>0.30</td>
</tr>
<tr>
<td>Wheat</td>
<td>0.05</td>
<td>0.40</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>Rice</td>
<td>0.07</td>
<td>0.31</td>
<td>0.12</td>
<td>0.22</td>
</tr>
<tr>
<td>Wheat Bran</td>
<td>0.15</td>
<td>1.27</td>
<td>0.13</td>
<td>0.50</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>0.08</td>
<td>1.36</td>
<td>0.14</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Department of Animal Science, University of Gezira, Wad Medani, Sudan.

1. Maize.
Maize is considered to be the best cereal grain to supply energy for poultry. It contains higher amounts of metabolizable energy (ME) than sorghum due to its relatively high fat content. Yellow maize contains xanthophyll, a pigment that imparts a yellow colour to the skin, shank and beaks of broilers, and gives an orange-red colour to the yolk (Scott et al., 1982). Maize is
usually used alone to supply the main portion of energy in the poultry diet.

2. Sorghum.
Sorghum is widely grown in the dry tropical parts of Africa. Many varieties of sorghum exists, and an average value for their nutrient composition is given in Table 1. Some cultivars of sorghum contain tannin, an antinutritional factor known to lower digestibility of feeds. The level of sorghum used in poultry diets as the principal energy source is limited by the tannin content. The ME content of 12 varieties of hybrid sorghum grain varies from 3108 to 3956, with an average value of 3625 kcal ME/kg on a dry matter basis. Both ME and amino acid availability increase as tannin content of the sorghum grain decreases (Nelson et al., 1975).

3. Wheat.
The use of wheat in African poultry rations depends on the presence of surpluses over human needs or when broken wheat is plentiful; in both cases, price will be the deciding factor. Otherwise, wheat supplements maize and sorghum as an additional source of feed energy. Wheat has a considerably higher protein content than maize. It contains very little carotene and has a lower ME than maize. The incorporation of soft wheat in all mash feed is usually limited to 30% to avoid the risk of paste formation in the beak.

4. Rice.
Rice in the husk or paddy is not widely used in feeding poultry because of price and availability. Its nutritional value is low compared to other cereal grains because of low energy and high fibre content. It is recommended for use at less than 40% of the diet at the end of the growing period and during laying (IEMVT, 1987).

5. Millet.
Bulrush millet (Pennisetum tyhoideum) is used at the rate of 20% of the layer diet (Oluyemi and Roberts, 1979). It contains 8.28% crude protein, 5.6% ether extract, 1.5% cellulose, 1.49% ash and 83.57% nitrogen-free extract (NFE) on a dry matter basis (Owusu-Dompfeh et al., 1970). However, wider use of this grain in poultry feeding is unexpected, since it constitutes the staple food for humans in many African communities.


a.) Wheat bran. Among wheat screenings in flour-mills, wheat bran is the common fraction used in poultry feeding. The average composition is given in Table 1. The maximum inclusion rate of wheat bran in a layer diet is 40%.

b.) Rice bran. Rice bran is a by-product of rice milling. It consists of the seed coat and germ which are removed from the rice grain. Its nutritional value is comparable to wheat bran. It is not commonly used in poultry feeding.
c.) Brewer’s grains. This is a by-product of brewing beer. Its availability is limited to non-Muslim communities. It consists of starch, cellulose and protein. The protein content ranges from 16-24 %, and cellulose from 9-20 % on a dry matter basis. Maximum inclusion rate of brewer’s grains in a grower diet is 20 %, whereas in laying rations up to 30 % is recommended (IEMVT, 1987).

Protein supplements.

There are two types of protein supplements available for feeding poultry is affected by many factors. Among these factors are amino acid composition, presence of antinutritional factors and effects of processing.

A. Plant protein supplements.

The nutritive value of plant protein supplements for poultry is affected by many factors. Among these factors are amino acid composition, presence of antinutritional factors and effects of processing.

1. Groundnut meal. Groundnut meal is used extensively in many parts of Africa. The production of meal is mostly through mechanical extraction rather than solvent extraction. As a result, levels of residual oil are rather high in the meal. Two forms of meal are present: meal with hulls or without. Meal containing hulls (undecorticated) is lower in protein and higher in crude fibre. The average composition of groundnut meal (GNM) is given in Table 2. The problems of using GNM in poultry feeding are:

- Quality in relation to the presence of aflatoxin - an antinutritional factor produced by mould-infested groundnuts. Proper harvesting and storage is required to avoid infection with mould. Aflatoxin produced by the mould Aspergillus flavus is known to depress growth of chickens. Only meal free from aflatoxin or containing very little (< 1.25 mg/kg) is recommended for use (IEMVT, 1987). Published quantities of GNM used for chicks may reach 36 % of the diet (Oluyemi et al., 1976), if it is free from aflatoxin.

- Amino acid composition. GNM is deficient in lysine, methionine and threonine (Balloun, 1980). Under large commercial systems of production, synthetic amino acids are added to diets containing GNM to correct for these deficiencies.

2. Cottonseed meal. The use of cottonseed meal (CSM) in poultry feeding in Africa is limited because of the following reasons:

- The presence of the toxic compound, gossypol, which reduces growth rate in chicks and causes bluish-green discoloration of youlk, along with severe mottling (Scott et al., 1982).

- The presence of cyclopropenoid fatty acid which causes pink colour formation of albumen.
CSM is known to contain low levels of lysine and methionine in relation to poultry requirements (Balloun, 1980).

Only CSM that is free from these toxic compounds is desirable for use in poultry diets. Again, addition of synthetic amino acids is recommended to supplement CSM used in commercial operations.

3. Sesame seed meal. Sesame seed meal (SM) is the plant protein supplement richest in sulphur-containing amino acids (Table 2). However, it is low in lysine. There is no antinutritional factor in SM. The main nutritional problem of SM is low calcium availability. Studies with laying hens indicate that calcium availability in SM is only about 40%. (Cuca and Sunde, 1967). This is an insignificant problem since cheap sources of calcium are available, e.g. limestone.

4. Soyabean meal. Commercial production of soyabean meal (SBM) is largely unknown in Africa. Large scale poultry operations import SBM to supplement local feedstuffs. It is a protein supplement of high quality and is particularly rich in lysine. It contains no antinutritional factors since heat treatment after oil extraction destroys all antinutritional factors present.

### Table 2. Nutrient composition (%) of protein supplements (as fed basis).

<table>
<thead>
<tr>
<th>Protein Supplement</th>
<th>Protein</th>
<th>Ether Extr.</th>
<th>Fibre</th>
<th>Ca.</th>
<th>Total Phos.</th>
<th>Lys</th>
<th>Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut Meal</td>
<td>42</td>
<td>9.0</td>
<td>12.0</td>
<td>0.15</td>
<td>0.53</td>
<td>1.31</td>
<td>0.48</td>
</tr>
<tr>
<td>Cottonseed Meal</td>
<td>39</td>
<td>4.8</td>
<td>13.0</td>
<td>0.18</td>
<td>1.12</td>
<td>1.59</td>
<td>0.71</td>
</tr>
<tr>
<td>Sesame Meal</td>
<td>44</td>
<td>9.1</td>
<td>10.1</td>
<td>1.96</td>
<td>1.35</td>
<td>1.31</td>
<td>1.22</td>
</tr>
<tr>
<td>Soyabean Meal</td>
<td>44</td>
<td>7.3</td>
<td>5.6</td>
<td>0.26</td>
<td>0.60</td>
<td>2.64</td>
<td>0.61</td>
</tr>
<tr>
<td>Sunflower Seed Meal</td>
<td>31</td>
<td>3.0</td>
<td>20.1</td>
<td>0.37</td>
<td>1.35</td>
<td>1.13</td>
<td>0.63</td>
</tr>
<tr>
<td>Fish Meal</td>
<td>58</td>
<td>9.9</td>
<td>0.2</td>
<td>7.83</td>
<td>4.01</td>
<td>5.34</td>
<td>1.75</td>
</tr>
<tr>
<td>Meat and Bone Meal</td>
<td>50</td>
<td>7.8</td>
<td>2.3</td>
<td>10.6</td>
<td>4.20</td>
<td>2.66</td>
<td>0.71</td>
</tr>
<tr>
<td>Blood Meal</td>
<td>88</td>
<td>1.1</td>
<td>1.0</td>
<td>0.05</td>
<td>0.08</td>
<td>8.85</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Department of Animal Science, University of Gezira, Wad Medani, Sudan.
5. **Sunflower seed meal.** Sunflower seed meal (SFM) may offer an alternative protein supplement in ration formulation for poultry, especially when supplies of good quality protein sources are inadequate. Recently, Sudan started growing sunflower plants on a large scale, and the meal is now available for commercial use. SFM has low lysine and methionine content and is relatively high in fibre (Table 2). Antinutritional factors of SFM are unknown. However, the physical nature of ground SFM poses a problem to the chickens by building up around the beak. Pelleting seems to overcome this problem (Waldroup et al., 1976).

B. **Animal protein supplements.**

Commercial production of standard animal protein supplements in Africa does not exist since the meat industry is still in its developmental stage. Some small rendering plants, attached to the major livestock slaughter houses, and the poultry dressing industry supply the poultry feed industry with limited quantities of animal protein supplements. The nutritive quality of these animal by-products is not constant and varies from one country to another. Smallholder units in rural areas have no access to these protein supplements. The major animal protein supplements present in Africa are fish meal, meat meal, blood meal, skim milk and poultry by-products.

1. **Fish meal.** Commercial grade meals are available in certain countries. Oil is removed from fish by a solvent extraction process. Other fish meals are prepared from residues of smoked fish available for sale in the open market in large cities (Fetuga et al., 1973). Another type of fish meal is prepared by salting whole fish, followed by sun-drying. Some locally prepared fish meal consists of heads, tails and offal obtained from fish restaurants, which are then boiled and left to dry in the open under the sun. As it can be seen, the quality of these meals will show great variation. However good quality fish meal is known to be rich in lysine. Fish meal is normally added to the diet at the rate of 5%. Diets containing fish meal support satisfactory growth performance and egg production.

2. **Meat meal.** This is a by-product of the meat packing industry and meat rendering plants attached to slaughter houses. Another source is dead-animal rendering facilities in some countries, meat meal and meat and bone meal are produced separately. Meat meal has a higher crude protein and better amino acid content than meat and bone meal. The latter has a higher mineral content. Meat and bone meal consists of unusable animal tissues, including bone, which are cooked in a steam-jacketed kettle in its own fat. Both types of meat meal are usually added in commercial feed at 5% of the diet.

3. **Blood meal.** Blood meal is produced as a by-product in slaughter houses. It consists of coagulated blood which is dried and then ground into a meal. It contains 80% crude protein, although of poorer digestibility than most of the other animal protein supplements. Blood meal is characterized by having very low palatability, and it is normally added at 1 - 2% of the diet.
4. Skim milk powder. Skim milk powder is produced by some creameries after separation of butterfat. The residual milk is condensed and dried by air at about 340°F. Following drying, the powder is cooled and packed. Fetuga et al (1973) analyzed skim milk powder, and the results are shown in Table 5. It is used in grower diets at the rate of 2 – 8%.

**Table 3. Composition of some dehydrated tuber meals.**

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>DM %</th>
<th>Crude Protein</th>
<th>Ether Extr.</th>
<th>Crude Fibre</th>
<th>Ash</th>
<th>NFE</th>
<th>Ca</th>
<th>Phos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassava</td>
<td>93.50</td>
<td>2.20</td>
<td>0.54</td>
<td>2.24</td>
<td>2.70</td>
<td>92.32</td>
<td>0.58</td>
<td>0.17</td>
</tr>
<tr>
<td>White Yam</td>
<td>93.50</td>
<td>3.14</td>
<td>0.16</td>
<td>2.04</td>
<td>4.18</td>
<td>90.48</td>
<td>0.38</td>
<td>0.16</td>
</tr>
<tr>
<td>Plantain</td>
<td>94.63</td>
<td>4.63</td>
<td>1.53</td>
<td>1.87</td>
<td>5.38</td>
<td>86.59</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Sweet Potato</td>
<td>94.25</td>
<td>2.76</td>
<td>1.87</td>
<td>1.20</td>
<td>3.49</td>
<td>90.68</td>
<td>0.60</td>
<td>0.15</td>
</tr>
<tr>
<td>Cocoyam</td>
<td>89.50</td>
<td>3.13</td>
<td>0.72</td>
<td>2.43</td>
<td>2.20</td>
<td>91.52</td>
<td>0.48</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Fetuga and Oluyemi (1976).

**Table 4. Metabolizable energy value of some tropical tuber meals and productive efficiency*) of chicks on diets in which the tubers replaced 40% of glucose in a basal diet.**

<table>
<thead>
<tr>
<th>Diet</th>
<th>Weight Gain</th>
<th>Feed Conversion</th>
<th>Energy value of substituted material (Kcal/g dry matter) ME</th>
<th>MEn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>295b</td>
<td>1.70a</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cassava</td>
<td>204c</td>
<td>2.43b</td>
<td>3.88a</td>
<td>3.78a</td>
</tr>
<tr>
<td>Yam</td>
<td>154d</td>
<td>3.03c</td>
<td>3.24b</td>
<td>3.19b</td>
</tr>
<tr>
<td>Plantain</td>
<td>213c</td>
<td>2.33b</td>
<td>3.16b</td>
<td>3.04bc</td>
</tr>
<tr>
<td>Sweet Potato</td>
<td>345a</td>
<td>1.97a</td>
<td>3.94a</td>
<td>3.73a</td>
</tr>
<tr>
<td>Cocoyam</td>
<td>113e</td>
<td>3.57d</td>
<td>2.88c</td>
<td>2.82c</td>
</tr>
</tbody>
</table>

Adapted from Fetuga and Oluyemi (1976).

*) The body weight gain (g) and feed conversion data represent observations on chicks over a 14-day period when test diets were fed. Means followed by the same letters are not significantly different ((P < 0.05).
Table 5. Proximate composition of potential protein concentrates (% dry matter).

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Crude Protein</th>
<th>Ether Extr.</th>
<th>Crude Fibre</th>
<th>Ash</th>
<th>NFF</th>
<th>Ca</th>
<th>Phos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm kernel meal</td>
<td>18.70</td>
<td>6.74</td>
<td>10.3</td>
<td>4.22</td>
<td>49.61</td>
<td>0.28</td>
<td>0.74</td>
</tr>
<tr>
<td>Cashew nut (unextracted)</td>
<td>21.18</td>
<td>48.09</td>
<td>0.68</td>
<td>3.30</td>
<td>22.20</td>
<td>0.03</td>
<td>0.88</td>
</tr>
<tr>
<td>Cashew nut (ether extract)</td>
<td>36.04</td>
<td>7.44</td>
<td>1.23</td>
<td>5.10</td>
<td>42.19</td>
<td>0.06</td>
<td>1.64</td>
</tr>
<tr>
<td>Skim milk powder</td>
<td>36.40</td>
<td>0.32</td>
<td>0.02</td>
<td>7.92</td>
<td>49.84</td>
<td>1.28</td>
<td>1.03</td>
</tr>
<tr>
<td>African locust bean (seed)</td>
<td>30.03</td>
<td>19.55</td>
<td>12.10</td>
<td>5.38</td>
<td>25.87</td>
<td>0.37</td>
<td>0.28</td>
</tr>
<tr>
<td>African locust bean (seed/pulp)</td>
<td>22.68</td>
<td>11.81</td>
<td>18.99</td>
<td>5.86</td>
<td>43.57</td>
<td>0.40</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Fetuga et al. (1973).

**Mineral and vitamin resources.**

Mineral resources available in Africa are limestone, oyster shell, bone meal and sodium chloride. Dicalcium phosphate and micro-minerals are imported. Vitamins are supplied in synthetic form in large poultry units. In rural areas, birds depend on natural vitamins present in feedstuffs. Signs of vitamin deficiencies are sometimes encountered in very young chicks. Green leaves contain xanthophyll which supplies the skin and yolk with yellow colour. According to Oluymi and Roberts (1979) the green feeds commonly used in the tropics include papaya leaf meal, kikyu grass meal (Pennisetum clandestinum), napier grass meal (Pennisetum purpureum), koa-kaole leaf meal (Leucaena glauca), banana leaves and bamboo leaves (Bambusa vulgaris).

**Unconventional foodstuffs.**

A major argument against expansion of the poultry industry in Africa is the competition between man and poultry for cereal grains, particularly when these are in short supply. In many parts of the continent, production of cereals like maize and sorghum has not kept pace with the demand for human consumption due to drought and other constraints. As a result, prices of cereals soared and many poultry enterprises were forced out of the market. This has aroused considerable interest in the use of alternative energy sources which are locally available in the form of starchy roots and tubers. Some work was also done on alternative sources of protein which are locally available. A summary of these efforts is presented here.
a.) Potential energy resources.

The ME of some tropical meals for young chicks were determined by Fetuga and Oluwemii (1976). These include dehydrated cassava (Manihot utilissima), cocoyam (Colocasia esculenta), white yam (Dioscorea rotundata), plantain (Musa sapientum), and sweet potato (Ipomea batatas). All values were determined from the meal form. The nutrient composition of these energy resources is given in Table 3. The ME values, along with results of chicken growth with feeding of diets in which the tubers replaced 40% of glucose in a basal diet is presented in Table 4. The results show that cassava and sweet potato are as efficient as maize as an energy source for chickens. The authors recommend cassava and sweet potato for use on a large scale since they are available in excess for livestock and poultry feeding. The remaining tubers are in high demand in human diets. Currently, cassava is used as a supplementary energy source in African poultry rations (Ames and Ngemba, 1985).

The report of Mbugua (1989) summarizes the progress made over the last ten years on alternative energy sources for feeding poultry in Kenya. Finger millet (Eleusine coracana) and bulrush millet (Penisetum typhoides) replaced maize successfully as an energy source. Cocoyam in broiler diets depressed growth rate due to its low nutrient content and the presence of calcium oxalate. The nutritive value and other properties of these alternative energy sources await further applied studies before they can be used on a large scale.

b.) Potential protein resources.

Most of the data available in scientific journals on nutrient composition of potential protein resources pertain to Nigeria (Fetuga and Oluwemii, 1976). When compared with data from other countries, some differences are noted (Owusu-Domfeh et al., 1970). These differences may be caused by local processing conditions, storage conditions and cultural practices prior to harvesting and processing. Table 5 shows proximate analysis of some of these protein resources. Palm kernel meal and skim milk powder are now in use as protein supplements in certain parts of Africa. In some countries, poultry by-products are also utilized commercially as a protein source. In Sudan, starch production from sorghum provided a new protein source in the form of sorghum gluten feed. Preliminary studies indicate that it can be used up to 8% of the diet in layer feeds (Saleh and Musharaf, 1990).

Great interest was shown recently in many tropical countries for the possibility of using pulse seeds as new protein sources for feeding poultry. Research undertaken in Kenya shows that pigeon peas (Cajanus cajans) can be included in poultry diets up to a level of 15%. Raw lupin (Lupinus albus) has been shown to depress growth rate if it is added at 19% of the diet (Mbugua, 1989). Grimaud and Chabeuf (1989) report that pigeon peas and lupin support satisfactory growth of broilers when fed at 25% and 10% of the diet. Diet poultry waste was satisfactorily included up to 20% in a broiler diet (Mbugua, 1989). In addition to these several other alternative feedstuffs have been identified at the laboratory level in many African countries and await testing under practical conditions.
Under rural conditions a valuable high-protein product can be obtained from slaughtered animals in abattoirs. Mann (1984) described a simple method to collect blood and ruminal contents from the abattoir and dry them with a solar drier. The mixture is suggested to have moisture content not exceeding 10 - 12 %. Best results are obtained when a ratio of 4 parts ruminal content to 1 part of blood is used. This mixture of protein can be added at the rate of 20 % in a poultry diet. Proximate analysis, gross energy content, minerals and amino acid content in a sample of ruminal content and blood are shown in Table 7. Since ruminal contents would vary according to the type of ration consumed by the ruminant, this analysis is expected to reflect this variation. The solar drier is designed to be constructed from local materials. The only imported material is polyethylene film, which is stretched over and under a wooden frame.

Table 6. Proximate composition of some grain legumes and non-conventional protein concentrates (% dry matter).

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Crude Protein</th>
<th>Ether Extr.</th>
<th>Crude Fibre</th>
<th>Ash</th>
<th>NFE</th>
<th>Ca</th>
<th>Phos</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grain Legumes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lima bean</td>
<td>23.43</td>
<td>0.75</td>
<td>4.88</td>
<td>4.66</td>
<td>64.73</td>
<td>0.57</td>
<td>0.50</td>
</tr>
<tr>
<td>Acacia seed</td>
<td>20.68</td>
<td>1.24</td>
<td>10.12</td>
<td>5.38</td>
<td>62.58</td>
<td>0.64</td>
<td>0.26</td>
</tr>
<tr>
<td>Cow pea</td>
<td>25.62</td>
<td>2.54</td>
<td>2.46</td>
<td>5.68</td>
<td>63.70</td>
<td>0.14</td>
<td>0.46</td>
</tr>
<tr>
<td>Bambara nut</td>
<td>22.83</td>
<td>6.11</td>
<td>4.47</td>
<td>4.80</td>
<td>61.79</td>
<td>0.39</td>
<td>0.49</td>
</tr>
<tr>
<td><strong>Protein Concentrates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole rubber seed meal</td>
<td>22.54</td>
<td>49.49</td>
<td>3.80</td>
<td>3.47</td>
<td>20.70</td>
<td>0.93</td>
<td>0.65</td>
</tr>
<tr>
<td>Defatted rubber seed meal</td>
<td>36.40</td>
<td>8.54</td>
<td>4.40</td>
<td>5.33</td>
<td>45.33</td>
<td>1.44</td>
<td>0.82</td>
</tr>
<tr>
<td>Coconut meal</td>
<td>26.82</td>
<td>8.45</td>
<td>17.48</td>
<td>6.87</td>
<td>40.36</td>
<td>0.15</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Ouyemi et al. (1976).

Table 7a. Proximate analysis and gross energy of ruminal content and blood meal mixture (% of dry matter).

<p>| | | | | | | | |</p>
<table>
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<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>37.53</td>
<td>Ash</td>
<td>14.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>3.36</td>
<td>NFE</td>
<td>24.80</td>
<td></td>
<td></td>
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<tr>
<td>Fibre</td>
<td>19.42</td>
<td>Water</td>
<td>4.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross energy (kcal/g)</td>
<td>4.467</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7b. Calcium, phosphorus and amino acid composition of ruminal content and blood meal mixture.

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Amino Acids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Ala 2.91</td>
</tr>
<tr>
<td>Total P</td>
<td>His 2.04</td>
</tr>
<tr>
<td>Avail. P</td>
<td>Leu 4.54</td>
</tr>
<tr>
<td></td>
<td>Met 0.51</td>
</tr>
<tr>
<td></td>
<td>Thr 1.78</td>
</tr>
<tr>
<td></td>
<td>Lys 3.02</td>
</tr>
</tbody>
</table>


Antinutritional Factors in African Poultry Feedstuffs and Their Detoxification.

The nutritive value of some poultry feedstuffs is limited by the natural antinutritional factors found in them. The majority of these factors are present in plant protein supplements. Some of the antinutritional factors affect only digestibility, absorption and nutrient utilization Others contain toxic compounds that may even endanger the health of the birds.

The antinutritional factors present in oil-bearing seeds are protein in nature and heat treatment during the oil extraction process is adequate to eliminate their antinutritional properties. Another method of controlling these factors is to develop, through plant breeding, new varieties of oil-bearing seeds with low levels of toxicity. A second type of antinutritional factor is produced by certain species of fungi, which, under certain conditions of high temperature and humidity, contaminate feedstuffs and produce toxic materials, e.g. aflatoxin. The main antinutritional factors present in African poultry feedstuffs are tannin, aflatoxin, gossypol and glucosides.

1. Tannin

Tannins are complex phenolic compounds distributed widely in nature. Their presence in some varieties of cereal grains is of concern to poultry nutritionists, especially in areas where sorghum is the primary cereal grain. Tannin is also found in dehydrated alfalfa and some legumes. Feeding sorghum grains with high tannin content results in reduced feed consumption, growth depression, poor nitrogen retention, low efficiency of feed utilisation (Vohra et al., 1966) and leg abnormalities (Elkin et al., 1978).

Tannin toxicity can be avoided by using low-tannin varieties. Since tannin is present in the seed coat, physical dehulling will remove it (Chibber et al., 1978). A chemical method is used to remove tannin through soaking of the grains in alkali, e.g. sodium hydroxide (Blessin et al., 1974). Recent research indicates that soaking sorghum grains in wood ash extracts or water overnight can reduce tannin content by 80% and 40%, respectively (Mohammed and ali, 1988). Germination of sorghum grains at room temperature for six days also reduces tannin markedly (Okah et al., 1989).
2. Aflatoxin
Many moulds, when grown under optimum conditions of temperature and humidity, will produce secondary metabolites known as mycotoxins. Aflatoxin is a mycotoxin produced by Aspergillus und other genera. They frequently contaminate groundnuts, sorghum, rice and other grains under conditions of high humidity and temperature (Goldblatt, 1969). Temperatures between 30 - 38 °C, with 80 - 98 % moisture in the air and moisture of the substratum above 15 % will produce optimum conditions for mould growth (Cavalheiro, 1981). For this reason, aflatoxin is a serious problem in the humid tropical areas. Ingestion of diets contaminated with mould by laying hens causes a drop in egg production, decreased egg weight and fatty liver syndrome (Howarth and Wyatt, 1976). During early growth, aflatoxicosis causes reduced growth rate, poor feed conversion, high mortality and pathological changes in the liver and other internal organs (Musharaf, 1989). To control aflatoxicosis, attention must be paid to prevent the development and growth of moulds in feed ingredients and mixed feeds. Humidity in grain stores must be maintained below 13 %, and all efforts must be directed to keep the litter in poultry houses dry, since moulds can grow easily on wet litter.

3. Gossypol
Gossypol is a yellow, poly-phenolic pigment found in most varieties of cotton seeds. It exists in a free state in the pigment glands of the unprocessed seed. During oil extraction from the seed, some gossypol that must be considered in poultry diets, because it can be toxic if fed in large amounts. The highest amount of free gossypol in CNM is usually associated with direct solvent processing. Growth rate of broiler chickens and turkeys is retarded when they are fed excessive free gossypol. Laying hens are the most sensitive to free gossypol in the ration. Gossypol forms an iron-gossypol complex which causes bluish-green discoloration of the yolk and severe mottling (Scott et al., 1982). The undesirable effects of free gossypol can be prevented by addition of iron salts, usually ferrous sulphate, to the poultry rations. Ferrous sulphate is used at the rate of 1 - 2 ppm for each 1 ppm of free gossypol in broiler diets, while in laying rations, a ratio of 4 to 1 is generally recommended (Waldroup, 1981). A second method of control is to use glandless cotton seeds devoid of gossypol for production of meal. The presence of cyclopropenoid fatty acids in residual oil in cottenseed meal causes pink coloration of the egg white. To control this, solvent extraction of oil from cottonseed is recommended because of the low residual oil content of the meal.

4. Glucosides
Cassava contains a glucoside, which when acted upon by an enzyme liberates the highly poisonous prussic acid. The peel is richer in prussic acid in 1 kg of fresh roots is between 10 and 370 mg in peeled roots, and may reach 560 mg in unpeeled roots (Vogt, 1966). The level of toxicity is influenced by genetic and environmental factors. Detoxification can take place by peeling and cooking, roasting, or by simply drying cassava under the tropical
sun. This process also destroys cyanogenic glucosides present in cassava and linseed meal.

Heat treatment of raw beans like soya, cowpeas, bambara and certain pulses destroys protease inhibitors known to reduce digestibility and protein utilization. The possibility of simple roasting of raw beans and pulses in a canister over a wood fire deserves investigation as a means of detoxification in rural areas.

**Future Research strategy for the improvement of poultry feeding in rural areas.**

In order to promote smallholder rural poultry production in Africa, a multi-disciplinary approach is needed in which poultry scientists, agronomists, extension workers and rural administrators work together to bring about the desired change. Women, who normally take care of the chickens in the rural areas, are the target group for this project, and effort must be organized to address them directly.

With regards to poultry nutrition, future research strategy for improvement of poultry feeding in rural areas should aim to:

1. Assess the nutritional value of local feed ingredients. This includes determination of the chemical composition, conducting feeding trials and providing recommendations of the level of inclusion of the ingredient in poultry diets.

2. Evaluate potential methods to reduce the level of antinutrients in locally grown feedstuffs. Recent research indicates that soaking sorghum grains in wood ash extracts or water can reduce tannin content by 80% and 40%, respectively. In addition, simple heat treatment of beans by roasting in a barrel over a wood fire inactivates protease inhibitors and haemagglutinins.

3. Evaluate the feeding value of non-conventional feed resources like pulses, leaf protein and fermented foods. In some areas, an abundance of low-grade, agro-industrial by-products are available, and their merit in poultry diets should be examined.

4. Continue research efforts to evaluate the mineral profile of local mineral resources.

This research is proposed to be carried out in two phases:

**Phase 1.** Creation of a permanent poultry production committee to collect the existing knowledge on tropical poultry feeding, and to formulate easy-to-mix diets, which would be composed of three ingredients at a maximum, for different age groups of poultry. The committee may suggest the use of appropriate measuring and mixing proportions for these diets in rural areas by the use of small canisters or available containers. Brochures published in English, French or Arabic of the various diet compositions could be distributed to extension workers, schools and other relevant groups.
Phase 2. The identification and nutrient determination of potential feed resources in Africa by region. The plan should include determination of chemical composition, followed by feeding trials to assess the nutritional value of the feed resource. Chemical analyses can be done in European poultry research stations, such as Celle (Germany), Nouzilly (France) or Spelderholt (Holland). Feeding trials should be conducted in Africa. Alternative places for testing the diets would be Barneveld College (Holland) or Lincolnshire College (UK). This portion of the research could be funded through World Bank, EEC and other international donors. The experience of the FAO in rural poultry development worldwide is greatly needed in this project.

References


3.12 TRAINING AND EXTENSION IN RURAL SMALLHOLDER POULTRY PRODUCTION

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3779 AB Barneveld, THE NETHERLANDS

Abstract

Knowledge-transfer is essential in developing poultry production. Nowadays it is clear that knowledge development and dissemination are matters in which many partners are involved. The government could stimulate production by creating a knowledge-system in which at least six functions can be distinguished: 1. research, 2. training and education, 3. extension, 4. linkages, 5. local organizations and 6. government policy. The research should make suitable knowledge available to the farmers. This knowledge should then be disseminated by training, education and extension. Training should preferably be done in a practical way; learning by doing. Extension agents are mostly generalists, and need specific poultry training, and support of poultry specialists. Linkage between different actors in the system such as industry, banks, church organizations, etc., determine the result of system and policy. Local organizations can be of great help in reaching the farmers. Poultry centres can be very effective in bringing together applied research, training and education and extension in the field of poultry production, and this may serve as linkage function as well. Barneveld College has founded and supported such centres over the world. The results and the way these centres work are discussed.

Résumé

Il est essentiel qu'un transfert des connaissances se fasse en vue de développer la production avicole. Il est clair aujourd'hui que le développement et la propagation des connaissances sont des problèmes qui mettent en cause de nombreux partenaires. Le gouvernement pourrait stimuler la production en créant un système des connaissances au sein duquel on pourrait distinguer au moins six fonctions: 1. la recherche, 2. la formation et l'instruction, 3. la vulgarisation, 4. les connexions, 5. les organisations locales et 6. la politique gouvernementale. Il serait souhaitable que la recherche mette les informations appropriées à la disposition des fermiers. Ces connaissances devraient ensuite être propagées par le biais de la formation, de l'instruction et de la vulgarisation. Il serait préférable que la formation se fasse de manière pratique; apprendre sur le terrain. Les agents de vulgarisation sont pour la plupart des généralistes et ont besoin d'une formation spécifique à la volaille ainsi que de l'aide des spécialistes avicoles. Les liens entre les différents protagonistes du système, tels les industries, les banques, les organisations ecclésiastiques etc.,
During this symposium many technical papers referring to research are presented. In this paper, I would like to inform you about dissemination of the knowledge obtained from research into the farming practice, especially in developing countries. One may ask how it is possible, that although solutions for almost all technical problems are available, the farmers have not yet increased their poultry production? One has to realize that the way to distribute the knowledge obtained from research to the farming community is an important job, with its own problems and challenges. It is obvious that the task of disseminating knowledge to farmers needs well qualified people, and moreover the technical means to get the message across to the farmers. Another important aspect of the extension service is the feedback of information from the farmers to the research workers. They will then be able to formulate their research programme in line with the problems occurring in practice.

In this paper, we first will deal with the situation of the rural farmer, facing many constraints in poultry production.

Second, a description is given of a knowledge-system, responsible for an efficient flow of information to and from the various "actors" in the system. Due attention will also be given to the role of the government.

Third, and finally proposals are made for setting up poultry centres in developing countries for training and extension. This will be visually illustrated by material from projects in developing countries cooperating with Barneveld College, in the Netherlands.

INTRODUCTION

Before analysing training and extension in rural poultry production, it is important to be aware of the aim of this production, and the constraints in rural areas. In this way, programmes can be adjusted to fit these aims, and become more effective. Rural households in less developed countries - the target group - can be characterised as follows (BESSET, 1989):

- widely spread in areas where transportation is difficult;
- low education level;
- restricted means of transport;
- low capital and little access to credits;
- migration mainly of men to the cities.
Animals play an important role in rural society. Among subsistence farmers poultry keeping is very common. 5 to 20 birds per farm are kept extensively, with very little finance and labour inputs. Revenues are very limited as well, egg production is low and partly needed for reproduction, mortality is high.

In developing countries the poultry products eggs and meat can and do form a substantial contribution to the human food package. Poultry production also forms an income support for people in rural areas. Apart from this poultry can also contribute to manure production, working capital, status, and creation of "rural jobs", to reduce migration to cities. Poultry production, compared with cattle farming has some special advantages:

- efficient low budget production;
- more involvement of women;
- a more direct support to purchasing power spent on nutrition and family care;
- less risks because of lower capital investment;
- easier integration in a farming system.

Therefore, the rural poultry farmer deserves support through professional training and extension.

The important role of the poultry industry in the industrialized countries in the world as a supplier of animal protein for a well-balanced and valuable human nutrition is generally understood. The "International Egg Commission" predicts a strong increase in poultry production in developing countries up to the year 2000, while in developed countries the industry is expected to stabilize. (D.I.S. Richardson, 1988).

The achievement of the predicted growth in developing countries, in numbers and productivity, depends however on a stimulating package, such as presence of a good infrastructure for supply and marketing of products, a good market and price policy, quality of livestock, feeding, housing and veterinary care, and as a key factor the knowledge and skill of the farmers. The latter was especially underlined by McNamara in his address to the conference on Africa held in Maastricht, the Netherlands, in July this year. He said:

"Development must be a human-centred process. People are both the ends and means of development. Therefore achievement of food security, and assurance of universal access to health, education and employment opportunities must be the objectives of the whole process".

The role of the Government. Growth possibilities for poultry production depend to a certain extent of stimulation by the government, as an essential factor in creating an environment suitable for economic production. The government itself is likely to have interests and wishes, such as:

- good and cheap food for all inhabitants;
- export of poultry products;
- rural jobs and income.
With these interests in mind, and within the framework of possibilities and constraints, the government will set a national policy with regard to large- and/or small-scale poultry production.

If the priority is to increase production dramatically in a short time then the introduction of large-scale production is preferable, where economies of scale will be achieved. The number of specialist workers can be limited. However, the required level of specialism is often underestimated. Higher investment, risks such as diseases and dependence on import of feed, vaccines, livestock etc. will hamper these projects. Furthermore, the income generated this way rarely reaches the "rural poor". It even takes away peoples’ last source of income, by competition.

Small-scale development takes more time for production improvement and increase, but results in a more independent, stable situation by making use of locally available resources. Its location is not restricted to big consumer markets near big cities, as is the case with big projects. The products also reach the rural population. Generation of income in rural areas will be greater, especially for women. However, transfer of knowledge, from poultry specialists to rural farmers, is more complicated because of the diffuse and larger target group.

Governments will have to form a two-way policy, aiming at increasing food production and income, while dealing with the problem of accessibility of the rural areas. The technology package must be made suitable for the chosen policy.

KNOWLEDGE-SYSTEM

The level of agricultural know-how in many countries is considerably lower than it should be. If this know-how is present, it is often not accessible, coordinated or appropriate for the target groups. Extension of knowledge can be explained with the help of some aspects of the Dutch agricultural information system as an example. Dutch agricultural development has been quite successful because of a good relationship between Research, Extension and Education. The Government has strongly supported these factors. Major growth has taken place in the last 30 years, and the most prosperous farmers of today are found in the marginal sectors of the earlier days, such as horticulture, and small farmers who have specialized in intensive animal production on poor sandy soils.

Nowadays, it is clear that knowledge development and dissemination are matters in which many partners are involved. This is more effective than activities by the government alone. Recently, the system has changed its appearance, and evolved into a new knowledge-system in which other actors work as well, such as private companies, farmers organizations etc. A Dutch farmer has many ways in which he can obtain information: weekly or monthly magazines on general farming and specialized areas, a daily newspaper for agriculture, periodicals of farmers'
organizations, and cooperatives and private companies provide him with information about the latest developments in technology, markets and agricultural policies.

Short refresher courses on technical and managerial subjects are organized by agricultural schools, with the assistance of extension workers and various farmers' organizations. The government extension agents were the first, but nowadays certainly not the only source of information.

Private enterprises and cooperatives in the area of supplies, marketing and farm mechanization employ agents who provide the farmers with advice, including monitoring of production on a regular basis.

However, the government officers play a strategic role in the knowledge system through their links with research, education and policy.

It is essential that the required functions are carried out promptly. It is less important which organization is involved. There are basic functions which must be fulfilled, but in each case the combination of participating bodies may vary.

These essential functions include:

- research,
- training,
- extension,
- local organization,
- policy,
- linkage.

Research. A distinction can be made between fundamental and applied research. Transfer of knowledge assumes that suitable knowledge is available, but unfortunately this is not always the case. Fundamental research is an international affair. Since this fundamental research is costly, highly specialized and relatively easy accessible through symposia, international congresses and scientific journals, it seems wise that developing countries follow results, rather than to do fundamental research themselves. The national research programme should be practically oriented, taking into account the local resources and possibilities, such as nutrients, breeds, health care, disease prevention, farming systems and so on. On experimental farms, innovations should be tested, not only for technical viability, but also for economic feasibility. Results of national research should be directly applicable to farmers, and aimed at solving farmers' problems. In practice, limited poultry research is carried out. A priority should be the formulation of a complete research programme.

The linkage function between research and farmers is so important that it cannot be left to researchers alone to disseminate the results. This function should be carried out in practice through training and extension officers.

Training and education. Results or research should be implemented in the educational programme, which is based on a practical training with attention to learning by doing. Lessons on theory should support the practical work.
In developing countries, a lot of money is invested in education. Nevertheless, the quality of education remains a problem. Since teachers prefer to live in cities, rural schools are at a disadvantage. Education is generally formative, and professional education, if present, is often too theoretical. In order to give practical education, training units are necessary, with facilities for housing broilers, laying hens, ducks, a hatchery, a feedmill and if relevant a processing plant. For integrated farming systems, other parts of the food chain should be used in the training process as well, such as fish ponds. Educational activities could include:

- practical courses for pupils of agricultural schools;
- education of specialists;
- short courses for extension officers, teachers etc.;
- training of farmers, including women;
- symposia.

Extension. Extension forms the link between research and practice. It is responsible for bringing new information to the farmers, as well as informing the researchers of bottlenecks in practice, which require a solution. Extension officers are not exclusively in government service; non-governmental organizations, representatives of supplying or processing industries and others can carry out this function as well. Extensionists are mostly generalists. In order to acquire skills in poultry extension, they have to be trained. They also need to be supported by specialists, who ought to be present in a poultry centre. One should be aware that successful extension needs a message, that is the technical/economical information, but also a good messenger, that is the person who

- knows how to reach the "hard-to-reach";
- has got a feeling for his "client’s" situation, and who knows how to adjust the advice to this situation;
- gives advice, or suggests alternative possibilities in dialogue or group sessions;
- reports actual developments back to the poultry-centre.

In order to disseminate advice successfully, trust is essential. Previous disappointments can adversely affect the level of trust in the extension officer or in new technologies. If high expectations are created from a new and recommended system - but it appears not to work, for instance through an outbreak of Newcastle disease - then the extension officer is often considered as the culprit and the relationship is disturbed. Therefore it is necessary to take into account these matters in advance, and to train the agents in these and other skills, which can be done centrally. Of course, the extensionists have to have good practical knowledge. Also, the technology package has to be complete, with after-care as an essential service. Two important items in extension are the quality of information, and the amount of people reaches; these items seem to contradict each other. Specialists in poultry centres can only reach a limited number
of farmers, if they advise them directly. An outreach programme involves various steps, for example:

- Poultry specialists;
- Poultry extension officers;
- General extensionists;
- Key farmers;
- Poultry farmers.

In this way, a high multiplication factor can be achieved. It may be possible to make short-cuts between the different steps mentioned before. Therefore, short training courses at the poultry centre for people mentioned in the steps above, might be very worthwhile.

Local organization. In many projects insufficient contact with local organizations has resulted in a disappointing outcome. In the setting up of a knowledge transfer system the importance of these local organizations can hardly be overestimated, because they know the answers to questions such as:

"How can we reach the hard-to-reach farmers?"
"What is the demand for on-the-spot training?"
"Which programme would be most effective?"
"Which farms can function as key farms?"

In the long run, they could take over the activities of the poultry centre and could support a durable knowledge-system. It is therefore important to make contact with the local organizations, and to encourage them to participate at an early stage. Non-governmental organizations do cooperate with local organizations, but often out of fear of government involvement, they limit themselves mostly to small projects. In larger projects, the government often neglects the need to consult local organizations, which dooms these projects to failure. If more than one organization is present, conflicting interests may arise. In these cases, choices have to be made in advance in accordance with the target group, policy etc. The function of local organizations is one of coordinating and directing the demand, resulting in a comprehensive and appropriate package which can help preventing disappointments. The role of negotiator, policy maker and sponsor will be of great benefit to the knowledge system to be set up. Of course, the existing local organizations will not always be strong enough, but nevertheless it is advisable to use them as a starting point.

Policy. Whatever the policy may be, the government should create an environment in which the poultry producer can live and survive. Governments have their own interests. In line with these interests, and with the budget available a policy will be formed. One essential factor for rural poultry development is a market- and price policy in which not only the urban consumer, but also the rural producer has his/her place. Big farms are founded by urban people, and produce for a top class of urban consumers. Interests between small- and large-scale producers do not always conflict, and in the past there have been examples of help. These have included a cockerel exchange programme, the dissemination of
specialist knowledge from bigger projects and the increased availability of vaccines. But the fact remains that free market competition will usually adversely affect the small-scale poultry producer, if he tries to market his product in the cities. Rural consumers, however, are less easily reached by the industrial units.

Linkage. Linkage functions are many, since many actors are involved. The linkage between extension and research is obvious, since it provides new information. As mentioned before, dissemination cannot be left to researchers alone, they can take part in liaison teams to keep the regional subject matter specialists up-to-date. Preferably, these teams would be located within the experimental stations, so that personal relationships can develop.

Linkage between extension and education will be of mutual benefit. The more theoretical and general approach of education needs to be in touch with day-to-day developments, enabling the education sector to adjust the curriculum to local conditions. On the other hand, short courses can supplement the extensionists' work. Extension officers can select candidates from the field for courses at the poultry centre. In order to achieve a better exchange of knowledge between the several actors within the knowledge system, good communication will be a "must".

Concerning the linkage between extension and policy, it will be clear that information from fieldworkers to politicians will make the policy more relevant to the existing problems in practice. For instance, stimulating activities or setting guidelines for developing poultry production in a particular direction result in a better achievement of government objectives. For this purpose, correct evaluation in the field will be essential.

Care should be taken that extensionists work only as informants from field to government, but not as controllers or executors of government agricultural policy. This would affect their image as an independent, trustworthy and reliable helper, and would inhibit their primary task.

WHAT MAKES THE KNOWLEDGE-SYSTEM WORK?

Information flows between the various factors in the system should be well-organized, in order to be efficient. The government has to invest in this linkage function, as an essential prerequisite for agricultural development. Investment in applied and practically oriented research and in education is costly, but has a high rate of return, and should be stimulated. Involvement of farmers through farmers organizations is necessary. Assuming that the farmer can afford to pay a contribution, the farmers' organization may charge them for their services. The organizations act as demand-coordinators, resulting in a complete, appropriate package of information and service. Furthermore, they can represent the farmers in negotiations with the government.

Integration of extension through government and private organizations will strongly reduce costs involved in this service for the government, and make it more effective as well.
POULTRY CENTRES

How can the above-mentioned system be started in an environment which does not yet have well-functioning actors within a knowledge-system? A good possibility might be the creation of poultry centres, as a basis for poultry education, research and extension.

Such a centre would serve as a base for extension officers coordinating the extension programme. Production of information material can be done in the centre, for example leaflets, handouts and demonstration sets. At the same time the poultry centre serves as a demonstration farm, illustrating new developments in poultry housing, feeding systems, breeds etc. In the same farm, applied research is possible, where direct links with education and extension are secured.

Education should be practice oriented, (learning by doing), and should be training medium-level workers and farmers directly. Since only a small number of farmers can be reached directly, it is vital to ensure that extensionists and teachers are well educated.

Furthermore, these centres can assist in supplying essential goods, such as vaccines, feed ingredients etc. The laboratory can carry out quality control on feeds and water, and do blood tests etc. In marketing and processing, these centres could have an intermediate function. "Internal" linkages, e.g. between extension, education and applied research are guaranteed in such centres. The centre itself should also ensure that contacts are maintained with international research institutes, the government, local as well as national, and other forms of education. As mentioned above, local organizations have to be involved, which will benefit the institution itself as well as the activities of the poultry centre.

The set-up as suggested above, would result in a complete knowledge system, backstopped by research, extension, education and local organizations. In situations where organizations are already present, as potential actors in the knowledge-system, they can (and should) be made use of in setting up the poultry centres.

SUMMARY AND CONCLUSIONS

Poultry production can contribute to welfare and food supply of rural farmers. An increase in production can be expected, if some essential factors are present, among which knowledge and skill of the farmers are very important. Although in many instances knowledge is available, it apparently often does not reach the target groups. Training and extension can contribute to the necessary improvement, but might best be incorporated into a knowledge-system, with the participation of some essential actors. This knowledge-system is described. It is suggested that the setting up of poultry centres is a way to start such a system in a developing country. Barneveld College works with this system, and cooperates with 5 similar projects abroad. Some of these projects are highlighted with slides and a video-film.
4. APPENDIX

OPENING ADDRESSES

The Secretary of State
Ministry of Agriculture
2, Acharnori Street, 1076 Athens, Greece

In the name of the Ministry of Agriculture I should like to bid you a hearty welcome to our country and wish you success in this seminar. As the Ministry of Agriculture we are the institution of the State responsible for the production and distribution of foods, as well as for the associated wellbeing of the farmers. Special problems for us include adequate food supply and subsidising farmers' incomes, problems with which the developing countries of the Third World are also confronted.

Our interest is concentrated on the family farm, the basic unit of agricultural development. Our constant care is therefore geared towards securing a satisfactory income, maintaining the ecological balance and adjusting the relations between town and country.

The problem of the drift of people from rural areas to urban centres and the resulting concentration of the population in the towns affects all countries which have either already gone through this development process, or else are still experiencing it. The rural exodus raises two problems: reduction of the production capacity in the rural regions and increase in the demand for non-traditional consumer goods in the towns.

Concomitantly the potential for active participation by farmers in development programmes and in environmental protection is limited. And yet the Lomé convention has given utmost priority to these points.

The development of poultry production - on a small scale first and later on a large scale - is of vital importance. However, the primary task must be to secure inexpensive protein-rich nutrition for rural families.

Unfortunately food supply still represents a major problem for a substantial part of our world population.

Parallel to this an improved transport system and an appropriate market for the surplus products of poultry breeding must be created, in order to cover the needs of the farmers' families. With the aid of these very efficient programmes which are simple to implement, we are in a position to stop the rural exodus and thus assure a balanced development.

The experience gained in Greece during the second half of this century has shown that poultry breeding in its simplest form, as
a family operation, has always been efficient and can thus develop into a dynamic branch of the economy. There is always potential for further development. In the field of poultry breeding we have gathered important knowledge and sufficient experience. We are particularly glad that this seminar is being held in Greece, since we believe that with our knowledge and experience we can contribute to the development of countries in Africa, the Caribbean and the Pacific Region and we believe that we shall also be able to profit from their experience. Thus the relations of Greece, as a Member of the European Community, with the countries which have signed the Lomé agreement will become closer.

Your presence here today bears witness to the fact that there is a will to apprehend the experience of all the countries participating in this seminar.

With these few words I should like to express the interest of the Ministry of Agriculture and my personal interest in the success of this seminar.

May I wish you every success in your work and a pleasant and fruitful stay in this historical place.
The poultry sector plays an important role in both industrialized and developing countries in satisfying the demand for animal protein from the rural and urban populations, as a source for income generation for farmers and as a means of increasing the gross domestic product.

Throughout the world, the poultry population has increased considerably over the last decade. However, the rate of growth turned out to be much higher in the developing world than in industrialized countries. According to the latest FAO statistics available, 52% of the chicken population worldwide was raised in the industrialized countries in 1979/81, whereas this percentage had decreased to 44% in 1988. Accordingly, the percentage of the chicken population raised in developing countries over the same period has increased from 48% to 56%. Similar developments can be observed in poultry meat production and egg production (see table).

Although the poultry sector holds such a prominent position for economic development and food supply for many countries in Africa, the Caribbean, the Pacific and other parts of the world, in development oriented literature the sector, its growth, its impact for the society and the economy is hardly mentioned. Also poultry projects financed by international organizations or bilateral donors in aid programmes are very limited. The reasons are obvious. It is felt that poultry production is in direct competition with food for human nutrition and that energy and protein losses as a result of the conversion of feedstuff are to the detriment of people already suffering from hunger and malnutrition.

Furthermore, it is assumed by these organizations that sufficient private capital is available in most developing countries for large-scale modern poultry enterprises, so there is no need for soft loans or grants under aid programmes.

Also technical assistance is considered not to be appropriate for this kind of activity.

All these arguments are certainly true for the large-scale poultry sector. And indeed a number of large-scale enterprises following the western model have been established in countries where fodder supply and equipment have to be ensured by imports against hard currency and where the benefits for the economy and the society may be doubtful.
However, in most rural areas small farmers and even landless people always keep a number of chickens or other poultry for which no, or very limited, costs for fodder and other inputs are involved. Such extensive poultry farming improves not only the diet of the rural family but provides also extra income for rural households in developing countries.

Furthermore, in many developing countries there are food industries producing by-products which cannot be shipped or otherwise utilized but which can provide the basis for the development of a small-scale poultry industry. By establishing a small-scale industry on this basis extra income can be generated by farmers and other rural people, from which not only the agricultural sector, but also handicraft, local industry and the service sector in rural areas may benefit. Through such a development even the exodus from rural areas to the large cities may be slowed down or stopped. Consequently, a poultry industry developed on a small-scale basis may be an excellent vehicle for rural development in many less developed countries, especially in Africa.

It was this kind of consideration that has lead the Technical Centre for Agriculture and Rural Cooperation, established in 1983 under the Lomé Convention between the member countries of the European Community and 69 ACP countries to encourage the German Agricultural Society to include workshops for problems of small-scale farmers in developing countries in two poultry symposia held 1985 and 1987. The very positive reactions from participants from ACP countries encouraged the CTA to organize this seminar here in Thessaloniki and to invite poultry specialists from ACP countries, the European Community and elsewhere have been invited to discuss problems and possibilities for the development of this sector in ACP countries. The aim is also to establish guidelines and recommendations which could be useful for governments in the countries concerned, bilateral and international organizations, including bank and credit institutions, in order to make full use of the existing intellectual and material capital for development.

The CTA is very grateful to the German Agricultural Society especially Dr. Riest that the offer to organize this workshop on our behalf has been accepted so that we can benefit from the results and the experiences of different international symposia implemented and executed by this Society during the last decade. In this respect I would also like to mention Professor Horst, Professor Sonaiya, Dr. Bessie, Dr. Chabouf and Dr. Viegas who advised us on scientific and development problems.

It is a special honour for me to express gratitude and appreciation to the Greek Government which has allowed and encouraged us to hold this Seminar in this wonderful country and this historic city of Thessaloniki. In organizing this Seminar we enjoyed not only the full assistance but also the enthusiasm of our colleagues in the different ministries and in the scientific institutions. This is, by the way, the second time the CTA has enjoyed this fine cooperation. During the Greek presidency of the European Community in 1988 the Greek Government, together with CTA,
prepared and implemented an International Forum "Agriculture in the Year 2000, the ACP countries", in which ministers, ambassadors, diplomats, administrators and other decision-makers as well as scientists from ACP countries, member countries of the European Community, the EC Commission and the Lomé Convention institutions participated. The results of this Forum and the excellent experiences in the implementation of this Forum were reflected in the preparation of this Seminar.

Let me mention among the many Greek colleagues to whom we have to express our gratitude, Mr. Georg Terzis, who organized not only the preparatory meeting in the Foreign Ministry in Athens, but who was also instrumental in the selection of the conference facilities. Furthermore, Mr. Efstathiadis, Mrs. Cosmidou and Mrs. Boulkou who assisted in the technical and organisational preparation. On the scientific side I may especially mention Professor Plytas from the Ministry of Agriculture.

I apologize that due to time limits I cannot mention all our Greek colleagues who have been so helpful in the preparation of the programme of this Seminar.

My special thanks go also to all the participants who sent the necessary documents and country reports in due time; they will be an excellent basis for the discussions and deliberations.

I hope that we shall have a fruitful week in Thessaloniki and I would like to express the expectation that the recommendations of the Seminar will benefit rural development in ACP countries.
Poultry population (no. of chickens, Mill.)*

<table>
<thead>
<tr>
<th></th>
<th>1979/81</th>
<th>%</th>
<th>1988</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>7,080</td>
<td>100</td>
<td>10,215</td>
<td>100</td>
</tr>
<tr>
<td>Developed countries</td>
<td>3,674</td>
<td>52</td>
<td>4,515</td>
<td>44</td>
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<tr>
<td>Developing countries</td>
<td>3,406</td>
<td>48</td>
<td>5,700</td>
<td>56</td>
</tr>
<tr>
<td>(Africa)</td>
<td>(593)</td>
<td>(8)</td>
<td>(828)</td>
<td>(8)</td>
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</tbody>
</table>

Poultry meat production (1,000 mt)*

<table>
<thead>
<tr>
<th></th>
<th>1979/81</th>
<th>%</th>
<th>1988</th>
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<tbody>
<tr>
<td>World</td>
<td>26,504</td>
<td>100</td>
<td>36,862</td>
<td>100</td>
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<td>Developed countries</td>
<td>18,307</td>
<td>69</td>
<td>24,028</td>
<td>64</td>
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<tr>
<td>Developing countries</td>
<td>8,197</td>
<td>31</td>
<td>12,833</td>
<td>35</td>
</tr>
<tr>
<td>(Africa)</td>
<td>(1,194)</td>
<td>(5)</td>
<td>(1,983)</td>
<td>(5)</td>
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</table>

Egg production (mt)*

<table>
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<th>1979/81</th>
<th>%</th>
<th>1988</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>World</td>
<td>446,274</td>
<td>100</td>
<td>573,817</td>
<td>100</td>
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<tr>
<td>Developed countries</td>
<td>133,559</td>
<td>30</td>
<td>159,056</td>
<td>28</td>
</tr>
<tr>
<td>Developing countries</td>
<td>312,715</td>
<td>70</td>
<td>414,761</td>
<td>72</td>
</tr>
<tr>
<td>(Africa)</td>
<td>(6,660)</td>
<td>(1.5)</td>
<td>(8,632)</td>
<td>(1.5)</td>
</tr>
</tbody>
</table>

Mme Isabelle Bassong
Ambassadeur du Cameroun auprès des Pays du BENELUX
et des Communautés Européennes
Présidente du Sous-Comité chargé du Développement Rural,
de la Coopération Agricole et des Produits de Base

C'est pour moi un Grand Honneur et un réel plaisir de prendre part au nom du
Comité des Ambassadeurs des Pays d'Afrique, des Caraïbes et du Pacifique dont
j'anime les Sous-Comité chargé du Développement Rural et la Coopération Agricole
et des Produits de Base, à ces importantes assises sur l'agriculture paysanne en
Afrique.

Je tiens à saluer d'emblée l'initiative du CTA qui a eu l'idée heureuse d'inscrire ce
thème majeur dans son Programme d'activités pour 1990.

Je voudrais ici au nom des ACP remercier le Gouvernement Grec qui a bien voulu
abriter ce symposium. Son implication dans la coopération ACP-CEE s'affirme
année après année par son exemplarité, son pragmatisme et sa qualité.

La Nouvelle Convention dite LOME IV signée le 15 décembre 1989 et qui lie
jusqu'en l'an 2000 les Pays ACP et la CEE, a confirmé la nécessité de mettre
l'accent prioritairement sur la sécurité alimentaire des populations, en favorisant
notamment leur auto-approvisionnement de manière à leur permettre de s'alimenter
en quantité et en qualité suffisantes afin d'atteindre un niveau nutritionnel satis-
faisant.

Force est de reconnaître, si l'on prend le cas spécifique de l'Afrique, que l'auto-
suffisance alimentaire reste un objectif. La crise qui secoue les économies afri-
caines est une conséquence directe de la détérioration des termes de l'échange; elle
a entraîné non seulement une baisse du pouvoir d'achat des populations y compris
les masses payannes, mais également une pénurie criarde des denrées étrangères, ce
qui empêche de combler le déficit alimentaire local par des importations. C'est
donc dire que pour nourrir un sous-continent de plus en plus peuplé, il convient de
maîtriser le mieux possible la production, en concentrant à court terme les efforts
dans le développement des espèces à croissance rapide.

C'est une nécessité impérieuse et absolue, et pour mener à bien cette stratégie,
l'agriculture apparaît être l'un des volets les plus fiables et les plus prometteurs.
Elle est partout reconnue comme une source de protéines animales facilement
accessible aux populations, même les plus pauvres.

Dans ce domaine particulier, force est également de constater que malgré la
développement de l'agriculture dite moderne - mais souvent basée sur des importa-
tions sans cesse croissantes de poussins, de matériel et même d'aliments ou de
composants - l'approvisionnement en viande de volaille est encore en grande partie
assurée par l'élevage traditionnel dans la plupart des pays africains. Il importe donc,
au moment où nous parlons tous de développement durable, d'améliorer avant tout
cela qui se trouve déjà à la portée de nos populations rurales en développant des
techniques basées sur leur capacités effectives et sur les réalités de nos pays.
C'est dans ce contexte que le choix de la Grèce pour abriter ce séminaire se
justifie pleinement.

En effet, malgré les progrès importants qu'elle a déjà accomplis dans la voie de son
développement industriel, la Grèce conserve encore pour bon nombre de ses unités
économiques une "taille humaine", ce qui pour nous rend son modèle de développe-
ment particulièrement attrayant.

L'honneur qui m'échoit en tant que Présidente ACP du Comité de Coopération
Agricole et Rurale ACP-CEE de participer aux discussions sur cet important sujet
rencontre opportunément des préoccupations naturelles de la Femme Africaine,
voire une expérience de terrain confirmée d'un pays à l'autre, car en Afrique, la
basse-cour a longtemps été et demeure par ailleurs, le Royaume des Femmes.

Ce sont en effet les Femmes rurales qui, en dehors de leurs corvées ménagères et
de leurs autres activités de production ou de commercialisation, tiennent le petit
élevage familial qui contribue pour une part significative dans le revenu des
ménages ruraux.

Dans le petit élevage avicole paysan comme dans bien d'autres domaines, le
stagnation qui prévaut et les nombreux obstacles qui persistent interpellent la
community des scientifiques et des techniciens pour apporter des solutions
réellement adaptées au contexte rural africain dans les domaines de la santé, de
l'hygiène, de l'alimentation et pour faire prendre par toutes les instances
concernées les mesures qui s'imposent en matière de formation, de vulgarisation et
de commercialisation.

Excellences, Mesdames et Messieurs, la persistance de la crise économique en
Afrique nous impose de nous écarter des approches trop spécialisées pour jeter un
regard global sur le développement. C'est pourquoi vous me permettrez de vous
dire que le développement réel de l'aviiculture passe également par l'allègement des
conditions de travail de la femme rurale.

La coopération ACP-CEE l'a si bien senti, que LOME IV a consacré un chapitre
spécial au rôle de la Femme dans le développement.

Je me félicite que le CTA ait convié à cette rencontre quelques cadres féminins
qui, en dehors de leur contributions scientifique et technique, nous aideront sans
doute à saisir davantage la dimension sociale du développement de l'aviiculture en
Afrique. Compte tenu de toutes les compétences ici réunies, je suis persuadée que
les femmes, les jeunes et les hommes ruraux d'Afrique bénéficieront des travaux de
ce séminaire.

Je vous souhaite plein succès. Vive la Coopération CEE-ACP.
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THE TECHNICAL CENTRE FOR AGRICULTURAL AND RURAL CO-OPERATION  
(CTA)

The Technical Centre for Agricultural and Rural Co-operation was established in 1983 at Ede/Wageningen. It operates under the Lomé Convention between Member States of the European Community and the ACP States. CTA is at the disposal of the ACP States to provide them with better access to information on research, training and innovation in the fields of agricultural and rural development and extension.

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(CTA)

Le Centre Technique de Coopération Agricole et Rurale (CTA) est installé depuis 1983 à Ede/Wageningen au titre de la Convention de Lomé entre les États Membres de la Communauté européenne et les États du groupe ACP.

Le CTA est à la disposition des États ACP pour leur permettre un meilleur accès à l'information, à la recherche, à la formation ainsi qu'aux innovations dans les secteurs du développement agricole et rural et de la vulgarisation.

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